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

OPERATING EXPERIENCE SUMMARY

Office of Environment, Safety and Health

Summary 2001-10

The 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.

Operating Experience Summary 2001-10

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EVENTS

1. HOLDING BRAKE FAILS ON 30-TON OVERHEAD CRANE

On November 1, 2001, at the Savannah River Site (SRS), personnel were operating a 30-ton crane in the 105-L Disassembly Transfer Bay when the holding brake on the crane failed. As the crane operator was raising the load block assembly toward the upper limit, an unusual noise was heard and the operator noticed the load block slowly descending toward the floor. A supervisor cleared personnel from the area and opened the main electrical crane disconnect, but the block continued its gradual descent. Within approximately one to two minutes, the load block settled to the floor. Wire rope continued to unspool from the load drum until the momentum of the drum rewound one and one-half wraps of rope in the opposite direction. There was no damage to other equipment in the Transfer Bay. However, if the holding brake had failed while the hoist was under load, the load could have been damaged. (ORPS Report SR--WSRC-REACL-2001-0011)

The affected crane was manufactured by the Whiting Corporation. The primary bridge crane consists of three hoists with lifting capacities of 85 tons, 30 tons, and 5 tons. The manufacturer for the crane brake components in this application is the Square D Company. Other brake manufacturers provide similar designs. In 1999, the Whiting Services Group provided major modifications and upgrades to the crane, including installation of the brake assembly.

A preliminary inspection of the crane brake system revealed that the 30-ton crane brake drum had become unfastened and slid off its shaft. An investigation to determine the causal factors concluded that a retaining nut installed on the outboard side of the holding brake drum backed off, allowing the brake drum to slide completely off the motor shaft. When the operator released the wireless control hoist button, the holding brake should have engaged. However, because the drum had fallen off the motor shaft there was no drum surface area with which the brake discs could make contact (Figure 1).

Figure 1. Crane Holding Brake after the failure

The crane manufacturer informed SRS Nuclear Material Management Division engineering that a typical holding brake nut-retaining feature would include a standard nut and a split-ring locking washer. However, no locking washer was installed in this application. Preparations for repair based on engineering and manufacturer recommendations are in progress.

No corrective maintenance had been performed on the holding brake since it was installed in 1999. Preventive maintenance (in the form of periodic inspections) and manufacturer's recommended maintenance procedures were performed and no findings were identified. The type of inspections currently performed would not be expected to discover a missing lock washer. Inspectors typically verify only that the nut is in place and appears secure. Recommendations have been made to evaluate and revise these inspection procedures.

The holding brake assemblies on most overhead and gantry cranes are generally typical in design, although differences in shaft mating tolerances and methods of securing the brake drum to the motor shaft may exist. While this incident of improper installation by the manufacturer is considered isolated, there are no assurances that a similar installation doesn't exist in another site facility. Hoisting and rigging organizations need to ensure that hoist and holding brakes are tested and inspected for proper installation and operation. An inspection and evaluation of the design and installation of holding brake

applications for all overhead and gantry (bridge) cranes at SRS facilities will be conducted. The SRS Site Rigging Authority issued a Special Safety Alert on this crane incident. For additional information on this event or the safety alert, contact the Site Rigging Authority at (803) 557-4657.

DOE-STD-1090-2001, *Hoisting and Rigging (*formerly *Hoisting and Rigging Manual)*, chapter 7, "Overhead and Gantry Cranes," and chapter 8, "Hoists," provide information and guidance for inspection and testing of hoist brakes. OSHA 29 CFR 1910.179, *Overhead and Gantry Cranes*, discusses the holding brakes in section (f) (2). The DOE Standard is available at http://tis.eh.doe.gov/techstds/standard/std1090_c/toc2001.htm, and the OSHA Regulation is available at http://www.osha-slc.gov/OshStd_data/1910_0179.html.

KEYWORDS: *Hoisting and rigging, crane, hoist, holding brake*

ISM CORE FUNCTION: *Analyze the Hazards*

2. CUT BREATHING AIR HOSE ENDANGERS WORKER

On August 29, 2001 at the Savannah River F-Area Analytical Laboratory, a radiological control operations inspector (RCI) mistakenly cut a fresh-air hose supplying breathing air to a construction worker in a fan room. The worker immediately exited the fan room. The individual was not injured or contaminated. The RCI was cutting breathing air hoses for bagging and disposal. This accidental cutting of the fresh-air hose had the potential for serious consequences to the worker due to the loss of breathing air. (ORPS Report SR--WSRC-ALABF-2001-0005)

Ten construction workers were using breathing air hoses attached to an air manifold while they performed duct installation and vibration tests on an off-gas exhaust fan in a Laboratory fan room. The workers began exiting the area, and one individual did not roll up his air hose as instructed during the pre-job briefing, causing the hoses to become entangled. The RCI at the fan room entry point decided to clear the airlock of potential tripping hazards caused by the entangled hoses by cutting two idle hoses into pieces and bagging them as waste for disposal. However, the RCI accidentally cut a hose supplying breathing air to the air hood being used by one of the workers in the fan room. The worker was quickly escorted from the fan room by radiological control operations personnel and monitored for radiological contamination. No contamination was detected on the worker. A count of the filter paper from the fan room air sampler indicated no radioactivity above background level. Health physics personnel verified that no smear or special bioassay was required. The shift manager suspended further work pending a full investigation to determine the cause of this occurrence.

The direct cause for this event was personnel error (inattention to detail). The workers were instructed to avoid tangling their hoses by rolling them up when exiting the work area. One individual did not roll up his air hose, thereby causing entanglement. Spent hoses would be cut at the air lock step-off pad. Workers would disconnect their hoses from the plastic suit hood and hand it over to the RCI, who would then pull on the hose to ensure he was cutting the correct one. While trying to clear the tangled hoses at the airlock, the RCI mistakenly cut a hose that was still in use because the idle hoses were not easily identifiable from the live hoses.

The root cause was a management problem (work organization/planning deficiency). It is not a standard practice of the central laboratory facility to cut idle breathing air hoses for bagging and disposal while other air hoses that are connected to the same manifold are still in use. The appropriate action would have been to forbid cutting any air hose while personnel are connected to the manifold. Positive controls need to be used to identify live breathing hoses and prevent them from being accidentally cut.

The following corrective actions were implemented.

- The pre-job briefing procedure was revised with a clear warning not to cut air hoses while personnel are connected to the manifold and instructions for handling tangled hoses.

- The personnel-related deficiency was addressed in accordance with the Westinghouse Savannah River Company Employee Development and Discipline Program.

- The contractor issued a Lessons Learned report for this occurrence, demonstrating proper air hose handling techniques.

A previous event occurred in September 1999, in which an operator inadvertently shut off the air supply to a welding inspector's plastic suit. The direct cause was personnel error because the manifold attendant did not verify the identity of the person still requiring air. Corrective actions included issuing a lessons learned document emphasizing the importance of communication before disconnecting the air supply and positively identifying the proper air hose is being disconnected. (ORPS Report SR--WSRC-LTA-1999-0031)

This event underscores the importance of proper work planning and communications for operations necessitating the supply of breathing air to personnel working in controlled areas. Pre-job briefings need to emphasize full implementation of the facility's standard practice of maintaining a continuous air supply as long as the working crew is connected to the manifold. Deviations from the work plan should be analyzed for potential safety hazards before the work activities are performed. Personnel should be encouraged to adopt a questioning attitude at pre-job planning meetings to prevent the potential for any negative safety impact in controlled areas. Unused air lines should be positively identified before they are disconnected.

KEYWORDS: *Pre-job planning, entanglement, positive controls, breathing air hose, airlock*

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

3. WORKER INJURED IN PARTIAL COLLAPSE OF TRENCH

On August 29, 2001, in an excavation near building C-3 at the DOE North Las Vegas Facility, a clod of compacted earth came loose from the trench sidewall, striking a contractor pipefitter on his hard hat. The impact caused the pipefitter's head to strike a pipe he was working on, causing contusions and one laceration near his right eye. At the time of the incident, the worker was wearing all the appropriate personal protective equipment (PPE); i.e., safety glasses, hard-toe boots, leather work gloves, and a hard hat. He was taken to a local hospital, where he was treated and released, returning to work the same day. (ORPS Report NVOO--BN-BNNLV-2001-0002)

A newly installed 10-inch PVC fire hydrant water line, located in an excavation near Building C-3, had undergone a pressure test and developed a leak where it joined the existing water main. The existing excavation in the area of the leak was enlarged to preclude confined space concerns. The sloping and benching characteristics of the enlarged trench were constrained by a natural gas line located approximately four feet from the centerline of the existing excavation, at a depth of approximately six feet. The workers wanted to remain as far from the gas line as was reasonable, while establishing a safe excavation.

Working in the excavated area, the pipefitter was in the process of installing a pipe joint repair clamp assembly, and his head was in close proximity to the 10-inch PVC water line. Without any indication of instability of the trench wall, a clod of earth broke away, slid down the embankment, and struck the back of the worker's hard hat. The force of the unexpected blow caused the worker's head to be accelerated

toward the pipe, and his face came in contact with either the pipe or the clamp assembly. His safety glasses were driven into his face by the impact, causing contusions and one laceration near his right eye.

The pipefitter removed himself from the excavation and was immediately escorted by a co-worker to the contractor's medical facility, where he was examined. Because the injury potentially involved an eye, the examining physician recommended that the pipefitter be taken to the University Medical Center Trauma Center for further evaluation and treatment. The worker was treated and released, returning to work the same day with a follow-up examination scheduled with an ophthalmologist.

The report on the contractor's critique of the incident cites a contractor directive on excavations which references the Occupational Safety and Health Administration (OSHA) requirements in 29 CFR 1926, Subpart P, "Excavations." Site contractors typically incorporate Subpart P in their health and safety plans and excavation procedures in lieu of specific DOE requirements and guidance.

Corrections issued to the initial Occurrence Report noted that the trench wall that partially collapsed was not, as initially reported, "stepped to meet the 4-foot rule," as required by the Job Hazard Analysis, nor was the trench wall sloped and benched in the immediate area of the work to provide material stabilization. (The 4-foot rule is from the Job Hazard Analysis – based on OSHA requirements – and states that if the trench depth exceeds four feet, shoring or sloped sides must be provided.) In addition, a 3-foot by 4-foot section of plywood, initially reported to have been installed with metal stakes to stabilize the wall in question, was in fact not installed until after the incident.

Two other examples of noncompliance with trench safety requirements in recent years have been identified. On April 25, 2000, at the Los Alamos National Laboratory, facility management stopped work being performed at Technical Area 55 because of improper trenching operations. Contractor personnel had been working in a trench that was more than 10 feet deep without shoring, benching, or other standard excavation safety measures. (ORPS Report ALO-LA-LANL-TA55-2000-0010) At Brookhaven National Laboratory, on May 16, 2000, an excavation was made to repair a storm drain manhole. A stop-work order was issued when a supervisor noticed a laboratory employee working in the 7½-foot deep excavation with walls that were not adequately stepped or shored up to prevent collapse. (ORPS Report CH-BH-BNL-PE-2000-0002)

This incident at the DOE North Las Vegas Facility could have resulted in a more serious injury. The U.S. Department of Labor, Bureau of Labor Statistics, has reported that 1,514 construction fatalities occurred in the year 2000, and that 40 of these were from cave-ins of excavations or trenches.

Two websites that contain information on excavation and trenching safety are:

- http://www.osha-slc.gov/SLTC/trenchingexcavation/index.html, for the Occupational Safety and Health Administration, U. S. Department of Labor, and

- http://www.trenchsafety.org, sponsored by the Building Science Department at Auburn University, Auburn, Alabama. This website also offers for sale a 10-lesson, 3-hour tutorial on trench safety on CD-ROM.

This incident emphasizes the importance of complying with excavation safety requirements, especially in cases where obstacles constrain one or more of the normal stepping, benching, sloping, and shoring practices. Individual workers and supervisors need to be knowledgeable enough to recognize hazardous conditions related to excavations, and safety-conscious enough to stop work when such conditions are encountered.

KEYWORDS: *Excavation safety, trench safety, cave-ins*

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

4. BULLDOZER SLIDES OFF FLATBED TRAILER

On October 18, 2001, at the Oak Ridge National Laboratory, a heavy equipment operator attempted to load a bulldozer onto a flatbed tractor-trailer when it skidded off the trailer and rolled onto its side (Figure 1). The metal bed of the trailer had become covered with heavy frost overnight, and the bulldozer's metal tracks slid off the slippery surface. The operator was uninjured, and the bulldozer sustained only minor damage. The contractor reported this as a near-miss occurrence. (ORPS Report ORO--ORNL-X10UTILITY-2001-0001)

Figure 1. Bulldozer rolled onto its side

The bulldozer and flatbed (lowboy) tractor-trailer had been parked overnight when the ground and equipment became covered with a heavy frost. At 8:25 AM, as the operator backed the bulldozer onto the trailer, the slippery contact of cold steel pressing on frost, coupled with a slight tilt of the trailer bed due to sloping ground, caused the bulldozer to slide off and roll. The closed cab of the bulldozer was equipped with a roll cage, and the operator was wearing safety glasses, hardhat, and his seat belt. He was unharmed. The bulldozer sustained only minor damage, and spilled a few gallons of crankcase oil.

This occurrence illustrates the hazards that weather changes can create. Heavy equipment operators should be cautious when loading steel-tracked machines onto steel beds covered with frost.

KEYWORDS: *Frost, bulldozer, flatbed trailer*

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

5. ELECTRICIAN SHOCKED BY UNANTICIPATED EDISON CIRCUIT

On September 4, 2001, an electrician in Building WMF-656 of the Idaho National Engineering and Environmental Laboratory (INEEL) received an electrical shock while replacing a 115-volt electrical receptacle. He followed a standard lockout/tagout procedure, and performed zero-energy checks with a voltmeter, but was shocked as he separated the neutral wires connected to the old receptacle. An investigation found this to be an Edison circuit, a wiring configuration that poses a shock hazard but is difficult to detect. A precautionary medical evaluation confirmed that the electrician was not injured. The contractor reported the occurrence as an electrical near miss. (ORPS Report ID--BBWI-RWMC-2001-0023)

Edison circuits are separate circuits that share a common neutral line. At INEEL, these circuits were commonly installed for lighting and non-industrial electrical receptacles. The electrician in this occurrence was familiar with Edison circuits and was trained to look for them, but did not notice any in this case. He

did not expect to encounter Edison circuits in Building WMF-656 because it was built during 1994, and site guidance warned only about wiring installed before 1994. The INEEL Architectural Engineering Standard was revised in November 1994 to prohibit installation of Edison circuits, but Edison circuits could have been installed earlier that year, as evidenced by this event.

The electrician followed a standard lockout/tagout procedure that requires zero-energy checks, but does not specifically require measuring voltage between neutral lines. He took off his gloves (part of his personal protective equipment) and began removing the receptacle. As he separated three neutral wires connected to the receptacle, he was startled by an electrical shock. He then measured the voltage between neutral wires to be 125 volts, rejoined the wires, and stopped work.

On May 29, 1997, a similar discovery of an Edison circuit in INEEL's CPP-605 led to a site lessons learned document warning about the hazards from such circuits. The document noted that facility wiring diagrams did not accurately show the installation of Edison circuits. It cautioned electricians to expect to encounter Edison circuits in non-industrial wiring installed "before 1994" and to check the voltage between neutral lines in older circuits. It warned that the ability to detect circuits with common neutrals is often impaired by open switches (such as thermostats) that may close unexpectedly. (ORPS Report ID--LITC-WASTEMNGT-1997-0013, DOE Lessons Learned Database: INEEL # 97283, OE Weekly Summary 98-03). On February 1, 2000, there was a similar electrical near miss involving Edison circuits at INEEL's TAN 677. (ORPS Report ID--BBWI-SMC-2000-0001)

Preliminary corrective actions planned in response to the September 4, 2001 occurrence include:

- Adding wording to electrical work packages: "Caution, if more neutrals are discovered than normally would be expected, an Edison circuit may exist. Ensure that neutral lines are checked for [electrical] potential before and after separation…"

- Correcting previous lessons learned documents to warn about Edison circuits installed at INEEL during 1994, as well as before 1994.

- Reviewing and correcting electrical drawings in WMF-655 and WMF-656, and labeling electrical panels to indicate the existence of Edison circuits.

- Developing clearer company work control policies on Edison circuits and updating appropriate training programs.

Work planners at sites and facilities that may have Edison circuits should be aware of the hazards they pose. Electricians working on such circuits should check for voltage between neutral wires after they are separated and before removing their personal protective equipment to work on the wires. Managers, supervisors, electricians, and other crafts personnel should note that the INEEL experience shows Edison circuits are difficult to detect.

KEYWORDS: *Electrical near miss, Edison circuit, wiring*

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