Department of Energy
Washington, DC 20585

July 25, 2001

The Honorable John T. Conway
Chairman
Defense Nuclear Facilities Safety Board
625 Indiana Avenue, NW, Suite 700
Washington, DC 20004

Dear Mr. Chairman:

I am pleased to announce that the Office of Environment, Safety and Health has resumed the publication of the Operating (OE) Summary. The OE summary promotes safety throughout the Department of Energy (DOE) complex by encouraging the exchange of lessons-learned information among DOE facilities. Please inform your staff that the OE Summary will be published on a bi-weekly schedule and accessible through our website at: http://tis.eh.doe.gov/oesummary.

Enclosed are copies of our first issue, and hardcopies of future issues will also be sent to your office. If you have any questions, please contact me at 202-586-6151, or your staff may contact Mr. Frank Russo at 301-903-1845.

Sincerely,

Steven V. Cary
Acting Assistant Secretary
Office of Environment, Safety and Health

Enclosure

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

OPERATING EXPERIENCE SUMMARY

Office of Environment, Safety and Health

Summary 2001-01

The Office of Environment, Safety and Health is pleased to announce the resumption of the Operating Experience (OE) Summary. The OE Summary promotes safety throughout the Department of Energy (DOE) complex by encouraging the exchange of lessons-learned information among DOE facilities. The OE Summary will be published on a biweekly schedule and accessible at the following URL: http://tis.eh.doe.gov/oesummary. We will also be providing more detailed lessons-learned analysis in the future.

This issue of the OE Summary provides operating experiences of six different events. Some of the events occurred earlier in this calendar year and we recognize that corrective actions may have already been completed. However, we feel that the lessons learned from these events are invaluable to promoting safety in the work environment.

Please check our Web site every two weeks for the latest OE Summary. 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.

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 2001-01

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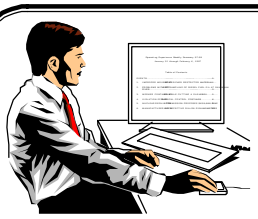

Visit Our Web Site

The Summary is available, with word search capability, via the Internet at http://tis.eh.doe.gov/oesummary. If you have difficulty accessing the Summary at this URL, please contact the ES&H Information Center, (800) 473-4375, for assistance. 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 e-mail address Frank.Russo@eh.doe.gov, so we may issue a correction.

EVENTS

1. ACCIDENT INVESTIGATION OF HEAD INJURY

On June 21, 2001, at FERMILAB, a subcontractor operator of a surface-drilling rig was struck on the right side of the head just below the hard hat by a recoiling tension cable. The tension cable recoiled due to a failed cable connector. The operator was knocked to the ground and became unconscious, and was transported to the hospital and admitted to intensive care. FERMILAB directed the subcontractor to cease all production activities until further notice. A formal investigation is being initiated, and further updates will be detailed in future issues of this publication. (ORPS Report CH-BA-FNAL-FERMILAB-2001-0006)

2. CRANE NEAR-MISS OCCURRENCE AT THE NEVADA TEST SITE

On February 1, 2001, at the Nevada Test Site, a crane inspector accidentally released the block hook of a 240-ton Manitowoc mobile crane after performing a scheduled monthly visual inspection. The crane block hook dropped about 70 feet to the ground, causing the 1,000-pound hook to separate from the auxiliary cable. On the following day, the same crane, having been left in an unsecured position after the inspection, was observed as having rotated to being in close proximity of de-energized power lines. There was no resulting personnel injury or major property damage in this near-miss event. (ORPS Report NVOO--BN-NTS-2001-0001)

On February 1, 2001, a crane inspector and crane mechanic were assigned to perform a monthly visual inspection of a 240-ton Manitowoc mobile crane. A Pre-Task Hazard Review and scope of work were reviewed and agreed to with the work supervisor, crane inspector, and crane mechanic. The monthly inspection is a *visual inspection only* and is considered non-contact work. However, following the visual inspection, the crane inspector started the crane's engine and operated the crane by manipulating the levers and controls. These out-of-scope inspection actions resulted in movement of the 200-foot boom and auxiliary ball and hook. The auxiliary ball and hook inadvertently dropped approximately 70 feet to the ground, causing the 1,000-pound hook to separate from the auxiliary line. The crane inspector then shut down the crane and engaged the dogs and brakes. Both the crane inspector and mechanic left the area without reporting the incident.

On February 2, 2001, an Environmental Restoration employee informed a Safety Officer that the 200-foot boom of the Manitowoc crane was located close (about two feet) to power lines. After verifying and reporting the crane's condition, the Safety Officer prepared a Pre-Task Hazard Review and conducted safety meetings with Utilities linemen and Construction crane operators to place the crane in a safe position and conduct visual checks. The power lines were verified as not energized, and the visual check determined that six of seven dogs and brakes of the crane were disengaged. The boom was raised and rotated back to its proper position and the crane placed in a secured condition.

Fact finding meetings were conducted on February 5 and 6, 2001, to determine the cause of the boom rotation. Interviews with individuals of an Asbestos Abatement crew working near the area of the crane revealed that the crane inspector failed to accurately relate certain events surrounding the crane activities. The inspector had exceeded his authority and failed to comply with the approved work package for non-contact work, resulting in the disengagement of the auxiliary ball and hook and subsequent boom rotation.

Workers must adhere to the defined work control limits and scope of work for the tasks they perform. Ignoring these controls can have serious consequences. In this instance, the approved work package was for a visual inspection that was categorized as non-contact work. However, the inspector conducted unauthorized operational inspections, which could have endangered personnel safety in the work area. The crane inspector also failed to properly secure the crane and report the dropping of the auxiliary ball

and hook. Consequently, the crane moved due to ground slope and weathervaned in the prevailing windy conditions.

This event illustrates the potential hazard to personnel and property when mandatory crane inspections are not performed per the specific work package. General guidance on crane inspection is available in DOE Standard, *Hoisting and Rigging,* (DOE-STD-1090-2001), which can be located at **http://tis.eh.doe.gov/techstds/standard/std1090/1090.html**.

KEYWORDS: *Hoisting and rigging, work planning, crane inspection*

ISM CORE FUNCTIONS: *Define the Scope of Work, Perform Work within Established Controls*

3. UNEXPECTED CHLORINE TRIFLUORIDE HAZARD FOUND

On December 19, 2000, at the East Tennessee Technology Park (ETTP) Building K-33, precautionary sampling of four large tanks in the Holding Drum Room revealed deadly concentrations of residual chlorine trifluoride (ClF_3) gas. The tanks were supposed to be empty; therefore, associated hazards and potential accidents posed by the gas were not addressed in the facility's authorization basis. The contractor declared a positive Unreviewed Safety Question Determination (USQD) on January 25, 2001, and issued an Unusual Occurrence Report on February 5, 2001. Precautionary sampling of the tanks prevented the potential for an uncontrolled release of the gas and any subsequent harm to workers when dismantling the tanks and associated piping. (ORPS Report ORO--BNFL-K33-2001-0001)

Project personnel were verifying the contents of four tanks in the Holding Drum Room in preparation for decontamination and decommissioning (D&D) operations. The workers opened the interconnecting piping between the four tanks to equalize gas concentrations and obtained air samples of the system. Analysis results of the samples indicated ClF_3 concentrations ranging from 1,000 to 4,000 parts per million (ppm). The Immediately Dangerous to Life and Health (IDLH) limit for the gas is only 20 ppm. No harm to workers occurred.

Chlorine trifluoride was used in the uranium enrichment process. This gas and other hazards in Buildings K-31 and K-33 were supposed to have been removed during earlier stages of facility shutdown in 1987. The current authorization basis for D&D operations assumed no significant quantities of ClF_3, and earlier verification samples of other ClF_3 containers in Building K-33 showed no evidence of the gas. However, because of the site's experience in finding other unexpected hazards during D&D operations (e.g., lubrication oil), the contractor uses verification sampling as a routine precaution. The precautionary sampling identified a significant risk to workers.

The contractor's immediate actions included isolating valves and vents, locking the Holding Drum Room, and posting danger signs. A USQD analysis document indicated that the contractor plans to remove the residual ClF_3 rather than updating the authorization basis, a Basis for Interim Operation.

A similar event occurred at ETTP on December 13, 2000. In this occurrence, fluorine leaked from the ETTP K-1302 Fluorine Storage Facility. This facility was in a deactivated state, and its fluorine tanks and piping were supposed to have been emptied and purged of the hazardous material. However, residual fluorine corroded and breached a weld joint, resulting in the release of fluorine. Two workers were hospitalized with nausea, and others had lesser effects. (ORPS Report ORO--BJC-K25GENLAN-2000-0028)

The discovery of unexpected ClF_3 in Building K-33 demonstrates the benefits of precautionary verification sampling before dismantling tanks and other containers during D&D.

KEYWORDS: *Conduct of operations, safety analysis/USQ, OSHA industrial hygiene, near miss other*

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

4. ELECTRICAL SHOCK FROM POWER SUPPLY CAPACITOR

On April 9, 2001, at the Argonne National Laboratory (ANL), a scientist performing operational checks on a power supply believed to be de-energized received an electrical shock from the power supply's capacitor. The shock caused temporary numbing and discoloration of the scientist's hand. The capacitor's stored energy was later calculated as sufficient for the shock to have been fatal if the pathway had included his torso. The scientist recovered full use of his hand within one to two hours. (ORPS Report CH-AA-ANLE-ANLEET-2001-0002)

The scientist was conducting operational checks of an electron beam evaporator when he observed arcing in the evaporator's 4-kV, 3-kW power supply that he had installed in an equipment rack. After switching the power supply off and unplugging it from the 240-volt line circuit, the scientist removed the cover and noticed that a portion of a recently installed internal power cable was covered with soot. While examining the cable and looking for the source of the arcing, his left thumb inadvertently contacted the "hot" terminal of the power supply's capacitor while his left ring finger contacted another component, resulting in a shock.

Prior to the incident, the scientist had made several modifications to the power supply, including the installation of a new internal power cable by a supervised undergraduate student. The student had inadvertently routed the power cable against insulated 4-kV terminals that were protruding from the power supply's transformer. This cable routing caused distortion of the terminal's insulation and allowed arcing to occur between a large bleed-down resistor in the power supply and an adjacent aluminum plate. The resistor is designed to safely discharge the power supply's capacitor after the external source of electrical energy is removed; however, the resistor failed to function as designed. Consequently, the power supply's 2-microfarad capacitor contained stored energy when the scientist touched it.

Under normal operating conditions, the capacitor has more than 30 Joules of stored energy; the DOE Electrical Safety Manual indicates 10 Joules as potentially lethal. The scientist regained full function in his hand within one to two hours.

The accident's direct cause was personnel error (inattention to detail). Contributing causes included both an equipment/material problem (the failed resistor) and a management problem in which policies regarding work on electrical equipment were not adequately defined, disseminated, or enforced. However, the root cause was lack of a procedure. While the Laboratory formally required each division director to designate "qualified persons" authorized to perform electrical work, the term "qualified persons" had not been formally identified. Safe electrical work at the site depended on personal preference, experience, and knowledge, unsupported by an institutionalized process.

As a result of the incident, the divisions participating in this research program are developing procedures to designate and authorize "qualified persons" to perform electrical work and recommending development of site-wide management processes to better support division directors in ensuring adequate training and qualification of persons performing electrical work. They are also examining all similar power supplies to verify the operability of the bleed-down resistor circuit.

Four similar capacitor shock events have previously been noted in the Operating Experience Summary. One technician received a shock and damaged equipment by inadvertently completing a circuit to ground from a partially charged capacitor. Failure to update procedures and provide a method of discharging capacitors resulted in the occurrence (Weekly Summary 97-45). Los Alamos National Laboratory also reported three different occurrences where personnel were shocked by failure to discharge capacitors prior to working on electrical equipment (Weekly Summary 97-17).

It is essential that workers assume that capacitors are always charged until the absence of energy has been safely verified with an appropriate instrument and a temporary shorting conductor has been installed

to preclude unexpected re-accumulation of energy. Neither disconnection of electrical equipment from the main line circuit nor equipment designs that provide for rapid dissipation of the energy when the main power is disconnected precludes the need for these practices. These practices implement the intent of NFPA 70E, an electrical safety code defined in DOE Order 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees,* as a contractor requirement. Requirements and guidance are also contained in 29 CFR 1910.333, *Selection and Use of Work Practices*; 29 CFR 1910 (subpart S), *Occupational Safety and Health Standards;* DOE/ID-10600, *Electrical Safety Guidelines;* and DOE-HDBK-1092-98, *Electrical Safety*.

KEYWORDS: *Electrical safety, electrical shock, capacitor*

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

5. ELECTRICAL SHOCK WHILE REPAIRING FUME HOOD ACTUATOR

On February 14, 2001, at Sandia National Laboratory, a subcontractor employee trouble-shooting a fume hood reached into an actuator control box, touched exposed wires, and received an electrical shock. He did not sustain a permanent injury. The worker had de-energized major equipment when beginning work. He did not lock out an exposed circuit in the actuator control box because he thought repairs could be performed without contacting the related wires. The wires carried an unanticipated 120 volts associated with older installations of the actuators. The worker was on a ladder when the electrical shock occurred. (ORPS Report ALO-KO-SNL-7000-2001-0001)

The worker's initial evaluation of the fume hood led him to believe the problem was in the actuator/damper control system located above the hood. He used a ladder to access the actuator control box, opened the box, and saw exposed electrical wiring in the bottom right side. The actuator/damper control system normally only contains exposed electrical components energized at 24 volts. The worker verified the 24-volt power of the actuator motor and began to check the mechanical coupling between the motor and damper rod. He reached inside the control box to hold the head of a bolt when his left thumb brushed an energized connector that not only had the 24-volt wire exposed but also a 120-volt supply line, resulting in the electrical shock. The worker subsequently stopped to de-energize the actuator/damper control system, completed repairs, and reported to the Sandia medical facility.

The worker was trained and qualified on the work being performing as well as lockout/tagout procedures, and had previously repaired hoods with similar actuators. The root and direct causes were personnel error. The worker lost track of the electrical hazard when he was focusing on a mechanical problem that would not normally require reaching inside the actuator control box. The contractor's policy prohibiting working on energized equipment was not in writing and this was a contributing cause.

The contractor initiated a stand-down to discuss the incident to correct the problem. The contractor revised the procedure on troubleshooting fume hoods with actuators to note required safety precautions as a direct result of this occurrence. Sandia is publishing a "lessons learned" report about subtle differences in seemingly repetitive tasks that may lead to additional and unexpected hazards. This article may be updated if significant new information is presented.

The ORPS and Operating Experience databases contain numerous occurrences where work was performed in the vicinity of unrecognized energized wiring. For example, on March 23, 1999, an industrial hygiene and safety inspector at the Los Alamos National Laboratory Accelerator Complex noted that a recently wired 240/120-V ac disconnect box did not have a lock or tag on or near the box. Subsequent investigation revealed that subcontractor electricians had wired to the load side, unaware that the lead terminals in the box were energized. (ORPS Report ALO-LA-LANL-ACCCOMPLEX-1999-0009)

Also, on January 6, 1999, a DOE facility representative at the Idaho Chemical Processing Plant Waste Management Activities Facility observed an electrical engineer and two electricians handling wires inside a power panel. A disconnect switch on the panel was open, but 480-volt ac power remained available at the line side of the switch. The individuals were not wearing personal protective equipment, no lockout was installed, and zero-energy verifications were not performed. The approved work package allowed for visual inspection, but the engineer and electricians incorrectly assumed that the work scope permitted handling wires. (ORPS Report ID--LITC-WASTEMNGT-1999-0001)

These occurrences underscore the importance of strict adherence to hazardous energy control and related safety procedures. Working on potentially hazardous systems or components without a safety lockout is the most dangerous of all forms of lockout violations because such work bypasses administrative barriers intended to prevent personnel injury. Additional hazards may be present in seemingly repetitive tasks. A worker may have performed a similar task by working on a similar piece of equipment; however, differences may exist that could change potential hazards of the job. Workers should evaluate each task individually for potential hazards and make necessary changes in each task to adequately control them. Workers must remain aware of all hazards and not lose track of an already recognized hazard once work proceeds to a new phase. Workers should particularly perform thorough and complete zero-energy checks as a final barrier against electrical shock.

KEYWORDS: *Electrical maintenance, work planning, stop work, electrical safety*

ISM CORE FUNCTIONS: *Define the Scope of Work, Perform Work within Controls*

6. INEFFECTIVE CORRECTIVE ACTIONS CAUSE LOCKOUT/TAGOUT STAND-DOWN

On January 31, 2001, at the Hanford River Protection Project, an electrical near miss occurred when a severed electrical cable was encountered while work was being performed in a pump pit. The cable was later determined to be de-energized. The contractor performed a field walkdown and identified a 480-v severed electrical cable attached to the load side of an “Off” breaker that did not have a lock and tag. Conflicting sets of drawings showed the absence of an electrical cable and the presence of an electrical cable, respectively. Five other lock and tag incidents have been identified over the past six months. (ORPS Report RP--CHG-TANKFARM-2001-0005)

Corrective actions, including lock and tag training and issuance of a lock and tag lessons learned, were completed by December 15, 2000, as a result of events that occurred on August 28, September 26, and September 27, 2000, respectively. Since completion of these corrective actions, there have been three other lock and tag events—December 28, 2000, the January 31, 2001 event discussed above, and February 21, 2001. Consequently, a contractor-imposed stand-down was initiated. Following the stand-down, the contractor assembled a team of managers, technical support personnel, and Tank Farm workers to perform a more thorough root cause analysis of all the events. Nearly two-thirds of the 22 causal factors pointed to inadequate implementation of the existing program, while almost one-third of the factors pointed to the lockout/tagout procedure itself. Short-term corrective actions involved minor procedure improvements, re-training, and increased oversight of program implementation. Long-term corrective actions include more significant procedure and training improvements.

In the August 28, 2000, event, an operations engineer released a maintenance work package for a compressor glycol flow indicator. On August 29, 2000, the shift operations manager was preparing to authorize removal of the lockout when the lock and tag independent verification signature blocks were observed to be blank. A critique of the event determined the root cause as failure to follow the lockout/tagout procedure. (ORPS Report RP--CHG-TANKFARM-2000-0061)

On September 26, 2000, a lock and tag to support a pressure test was observed to be improperly hung. The lock and tag were placed through the administrative lock that was on the disconnect instead of

separately on the disconnect. The direct cause was personnel error for failure to follow the procedural requirements for lock and tag location. The root cause was inattention to detail because the lock and tag were inadvertently attached to the wrong place. (ORPS Report RP--CHG-TANKFARM-2000-0067)

On September 27, 2000, a shift manager observed that independent verification had not been signed on a lock and tag being removed following repair of a lighting transformer. The manager also discovered that the August and September monthly surveillances of this lock and tag failed to detect the missing signature. The direct and root causes of this event were personnel error. An electrician had performed the verification, but neglected to sign the tag. (ORPS Report RP--CHG-TANKFARM-2000-0065)

On December 28, 2000, during a safety meeting, the locks and tags for a transfer pump and an annulus pump were determined to be inadequate because the safe condition checks had not been performed in accordance with the lock and tag procedure. The locks and tags had been installed previously to prevent waste transfer during a manned pit entry. (ORPS Report RP--CHG-TANKFARM-2000-0086)

On February 21, 2001, a lock and tag were inappropriately applied to a valve. The error was identified during a management walkdown. Again, the lock and tag procedure was not completely followed. (ORPS Report RP--CHG-TANKFARM-2001-0012)

These events underscore the need to thoroughly follow lockout/tagout procedures. Adequate work package preparation and execution are important for worker safety. Operations should be monitored following the implementation of corrective actions to determine if the corrective actions were effective in preventing recurrences. Further action, as in this case, should be required when corrective actions are found to be ineffective.

KEYWORDS: *Inadequate procedure, lockout/tagout electrical, lockout/tagout other*

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

Note: *Three of the occurrences contained in this Summary involve electrical safety, including electrical shocks and a near-miss on April 9, 2001. The Defense Nuclear Facilities Safety Board (DNFSB) sent a letter to the Department of Energy (DOE) expressing concerns with electrical safety programs and performance. Concerns were expressed in areas such as defective or improperly installed electrical equipment; electrical safety during excavation; implementation of the authority having jurisdiction (AHJ) over electrical equipment; and functions of electrical safety committees (ESCs).*

The DNFSB is urging the Department and its contractors to utilize the guidance contained in DOE's Electrical Safety Handbook (DOE-HDBK-1092-98) and to take a proactive stance to ensure adequate electrical safety programs are in place. The DOE handbook on electrical safety can be located at http://tis.eh.doe.gov/techstds/standard/standard.html.