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

OPERATING EXPERIENCE SUMMARY

Office of Environment, Safety and Health

Summary 2002-05
March 11, 2002

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.

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Operating Experience Summary 2002-05

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EVENTS

1. SUBCONTRACTOR WORKER VIOLATES FALL PROTECTION PLAN

On January 8, 2002, at the Hanford Site, a worker was using a JLG Industries man-lift to inspect the integrity of roof guardrails and ladders at the deactivated 105-DR Reactor building when the speed of the wind increased. Because of the unstable condition of the man-lift the worker tied off to a non-approved roof guardrail and then later to a nearby crane hook of an operating crane to return to the ground. Neither the use of the guardrail or an operating crane as a tie-off point was allowable per the subcontractor's fall protection plan. No injuries occurred as a result of these violations. (ORPS Report: RL--BHI-DND-2002-0001; final report issued February 8, 2002)

The subcontractor worker was using the man-lift to inspect the integrity of roof guardrails and ladders at the 72-foot 9-inch elevation level of the reactor building. The worker wore the required fall protection harness and lanyard and used the man-lift fall protection eye while he moved from the man-lift to the roof. During the course of the work, wind speed increased to the point where the man-lift basket was swaying. Because of the unstable condition of the man-lift, the worker tied off to the roof guardrail while moving from the roof to the man-lift to determine if it could be safely lowered to the ground. In accordance with the subcontractor fall protection plan, the guardrail was designated as a fall restraint barrier, which means it had been tested to the 200-pound horizontal stress test, but was not tested to the 5,000-pound fall arrest limit. The railing was not an approved tie-off point, which was a violation of the fall protection plan. The worker opted to tie off on the guardrail, believing that it was safer at that time, while he entered and exited the man-lift in the wind.

The worker and subcontractor management, concerned that the man-lift might get caught in a gust of wind and topple, decided it would be safer to tie off the worker's fall protection lanyard to the hook of a nearby crane, rather than to the man-lift. The subcontractor's fall protection plan allows the use of the crane hook if the crane is shutdown with the operator in the cab and not operating any of the controls. However, because the worker used a 50-foot retractable lanyard, which was not long enough to reach the ground from 72 feet, the crane operator had to follow the worker to the ground with the crane hook. This violated the fall protection plan. At the time of the incident, subcontractor management stopped the work until the weather conditions were more favorable. In addition, the man-lift was swaying with the wind and the worker did not feel it was sufficiently safe to be lowered in it without additional fall protection. As a side note, the subcontractor's fall protection plan requirement to have the crane operator and protected worker in constant communication via radio was also not followed. Although they were able to adequately communicate verbally, the use of the radios would have made communication much easier and subject to less misinterpretation.

Although the subcontractor violated the approved fall protection plan, the sudden change in weather conditions placed the worker in a situation where he felt there was substantial risk in using the man-lift. Subcontractor personnel performed the right steps by involving supervision and safety in determining the safest way to extract the worker from roof. The use of the crane as an anchor point was determined by knowledgeable personnel to be the most acceptable solution.

The following corrective actions were put in place as a result of this incident.

- Established a wind speed limit of 30 mph for operations of the JLG Industries man-lift in accordance with the manufacturer's recommendations.
- Subcontractor management established a practice to monitor meteorological data from the Hanford weather station for daily wind conditions.
- The subcontractor purchased portable, two-way radios and will fully implement their use.
- The subcontractor purchased and implemented the use of hand-held wind meters.

- Advised site workers to strictly follow the Fall Protection Plan, and specifically never to tie off at a handrail. Also, installed a stair tower so that the workers could use the stairs instead of having to use a man-lift.

The following lessons were learned from the investigation of this incident.

- The manufacturer of man lifts or similar lifting devices should be contacted to determine the maximum safe operating wind speed for the equipment.
- Meteorological data should be consulted at the start of each day to determine the forecasted wind speed if work is to be performed outside at elevated heights.
- Administrative controls should be developed to suspend work if meteorological data suggest wind speed will reach or exceed the safe operating limit, or when sudden unexpected windy conditions develop.
- Hand-held wind meters should be used to quickly gauge wind speed during quickly developing weather conditions.

KEYWORDS: *guardrail, manlift, fall protection, subcontractor, wind*

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

2. NEAR MISS PERSONAL INJURY INVOLVING A LATHE

On January 11, 2002, at the Kansas City Plant, an associate, who was standing on top of a lathe, was knocked backwards onto the lathe bed when he was struck by a large metal part that was suspended from an overhead hoist. The associate was standing on the smooth, oily metal rails of the lathe while attempting to remove a 100-pound end cap from the suspended part. While holding the end cap in his hands, the part came free and swung into him, causing him to fall with the heavy end cap on his legs. The associate was not injured, but the facility representative indicated that had the associate not fallen just perfectly he could have been sliced by the cutting tool, broken a leg or ankle if he fell into the cavities cast into the lathe housing, or punctured by the sharply pointed lathe spindle (see Figure 1). (ORPS Report ALO-KC-AS-KCP-2002-0002)

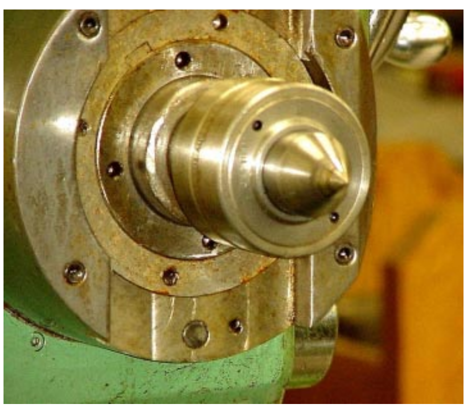

Figure 1. Lathe spindle

Two Honeywell Federal Manufacturing & Technologies (FM&T) Kansas City associates were removing a large metal part (a cylinder weighing more than 1,000 pounds) from the lathe with an overhead hoist. In order for the associates to remove the part from the lathe, they had to attach nylon slings that were connected to the part from the overhead hoist. The hoist trolley was off-centered above the part, creating a static pulling force. Another requirement during the removal process was to remove the heavy end cap from the part. One of the associates stood on the lathe rails to remove the end cap (see Figure 2). When the part separated from the cap, it swung into the associate and hit the end cap he was holding, knocking him backwards. The associate stumbled back and fell on the lathe bed.

At this time, the contractor has yet to develop formal lessons learned and corrective actions. However, two immediate lessons can be learned involves human lifting and the other pertains to traction control. Because the end cap weighed approximately 100 pounds, no one should have tried to remove it by hand without external support. This weight alone exceeds Honeywell's allowable human lift load of 40 pounds. In addition, the operator was standing on the oily rails of the lathe. These rails have a pointed ridge, which gives the operator very little standing surface. The operator had almost no means of shoe traction control even if the part had not moved.

The causal analysis cited personnel error (inattention to detail) as the root cause for this occurrence because the associate focused on completion of the work to meet production schedules rather than working safely. The lesson learned from the occurrence report is that employees must place safety first above completion of work processes. An essential step is to identify hazards before attempting tasks. In this case, there were two hazards to address. The first hazard involved human lifting. Because the end cap weighed approximately 100 pounds, no one should have tried to remove it by hand without external support.

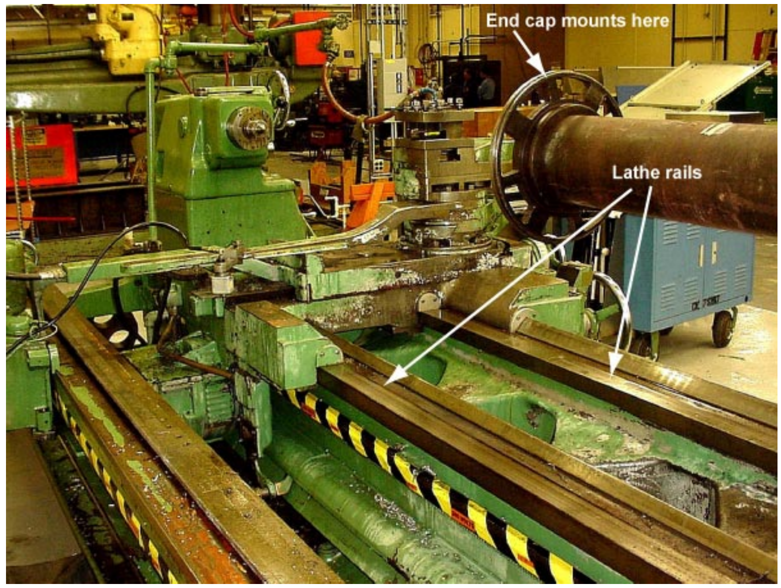

Figure 2. Close-up of lathe rails and mounting fixture

This event underscores the importance of analyzing all potential hazards associated with performing a job safely. It also highlights the fact that individual workers must also be responsible for ensuring their safety is not placed at risk. In this event the worker should have recognized that standing on a slippery work surface while attempting to remove a heavy object from a suspended load could be hazardous.

KEYWORDS: *Hoisting and rigging, lathe, near miss*

ISM CORE FUNCTION: *Analyze the Hazards*

3. FORKLIFT PIERCES ELECTRICAL TRANSFORMER

On January 31, 2002, at Building 9714 of the Oak Ridge Y-12 Site, a forklift driver pierced and damaged an energized electrical transformer with the left tine of his forklift. This tripped the circuit breakers for the transformer, and the driver was uninjured. The contractor reported this as a near-miss occurrence because of the electrical hazard. (ORPS Report ORO--BWXT-Y12SITE-2002-0003)

Building 9714 is a multi-bay vehicle maintenance facility with several roll-up garage doors. The 480-240-120-volt transformer was located between two garage doors, in an area used daily to load and unload supplies using forklifts. Although this is a high-traffic area, there were no barriers around the transformer to protect it from collisions from forklifts and other vehicles.

The forklift driver was attempting to maneuver the forklift out of a garage door and inadvertently ran the left forklift tine into the electrical transformer. The tine pierced a hole approximately 1.5 by 6 inches into the transformer housing. The transformer emitted a puff of blue smoke, and later electrical arc marks were noted on the forklift tine; however; there were no apparent flames or fire. The transformer supply breaker tripped during the collision, de-energizing all electrical loads supplied by the transformer. The driver backed his forklift out of the transformer, informed his supervisor, and the electrical power circuits supplied by the transformer were locked and tagged out. Fortunately the driver was not injured, but the transformer was ruined and later replaced.

At this time, the contractor has not formalized lessons learned and corrective actions. A preliminary causal analysis alleges the driver and his inattention caused the event. His forklift license has been revoked, and he is scheduled for retraining. However, the need for installing barriers around the new transformer is also recognized, and barriers are now recommended as a corrective action. Occupational Safety and Health Association (OSHA) Standard 1910.303 (g)(2)(ii) (http://www.osha.gov/OshStd_data/1910_0303.html) requires that enclosures or guards protect electric equipment that could be exposed to physical damage.

Accidents and near misses caused by forklift operations occur frequently at DOE sites. OE Summaries 1999-17, 1999-23, and 2001-02 discuss a variety of forklift events. Personnel installing equipment and planning operations in areas where forklifts are used should recognize and address the hazards they pose.

KEYWORDS: *Forklift, electrical transformer, near miss*

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

4. WORKER SPRAYED WITH GASOLINE WHILE CHANGING FUEL FILTER

On December 18, 2001, at the Oak Ridge National Laboratory (ORNL), a worker was sprayed with gasoline while he was changing a filter on a filling station fuel dispenser. Ten to fifteen gallons of gasoline leaked from the filter. Emergency crews responded quickly and cleaned up the spill. The worker sprayed by gasoline and another who assisted him later suffered the effects of gasoline vapor inhalation. They both reported to ORNL Health Services the next day. The contractor reported this as a near-miss occurrence. (ORPS Report ORO--ORNL-X10EAST-2002-0003)

Figure 1: ORNL fuel distribution center, Building 7069

A pipefitter and electrician were assigned the task of changing the filters on three fuel dispensers at ORNL Building 7069, a fuel distribution center (Figure 1). The task was considered skill-of-the-craft routine work. The workers were unaware that the two dispensers for unleaded gasoline shared a common pump, and that turning on one of these dispensers would pressurize the gasoline supplies to both. They did not lock and tag out the dispensers before working on them. The regular fuel center attendant, who was familiar with the pumping system alignment, was out sick that day.

While the pipefitter was changing one of the filters on an unleaded gasoline dispenser, an ORNL employee drove into the fuel center and began refueling his vehicle from the other unleaded gasoline dispenser. This pressurized supplies to both dispensers, causing gasoline to spray from the loosened filter and onto the pipefitter. He attempted to re-tighten the filter, but the filter gasket was ruptured. After one or two minutes, the electrician shut off gasoline flow to the two dispensers by entering a cancellation command into the fuel center computer. The workers called for assistance, which led to the arrival of the fire department and a spill response team. The emergency crews cordoned off the area, established a fire watch, monitored gasoline fume concentrations, and cleaned up the spill.

Although the pipefitter's shirt, pants, and shoes were soaked in gasoline and the electrician had gasoline on his hands, they did not immediately go to their change house because their vehicle was blocked during the cleanup. Two hours after the pipefitter was sprayed, the Complex Facility manager arrived and ordered him to change his clothes at the General Stores across the street. The pipefitter returned to the fuel center and finished the filter change. Nearly three hours after being sprayed, the pipefitter showered and changed his clothes again. Later in the day he felt dizzy and lightheaded. He reported to ORNL Health Services the next morning. The electrician awoke during the night with headaches and nausea. These symptoms persisted during the next day and so he also reported to ORNL Health Services. Both the pipefitter and electrician were diagnosed as having been exposed to gasoline vapors. Neither received treatment, and both returned to work.

The contractor's preliminary causal analysis identified the lack of a procedure for fuel filter replacement as the direct cause of the occurrence. The root cause was a work planning deficiency in treating this as a skill-of-the-craft job. That was an incorrect task level assignment, particularly because the pipefitter had only performed one fuel filter change before and was unfamiliar with the system alignment for the gasoline pumps and dispensers. The contractor has developed instructions for fuel filter changes and will issue a memorandum stressing the importance of task-level assignment and its relationship with the determination of hazards and controls.

A similar event occurred on December 22, 1999, at a refueling station at the Argonne National Laboratory – East. A truck driver offloading diesel fuel overfilled an underground tank, and was sprayed with diesel fuel as he closed connections to stop the spray. The driver showered after being exposed to the diesel fuel and was treated at a local hospital. Between 50 and 100 gallons of fuel were spilled. The causal analysis identified the lack of a fuel loading procedure as the root cause of the event. (ORPS Report CH-AA-ANLE-ANLEPFS-1999-0011)

These occurrences demonstrate that controls need be formalized when hazards are significant. In the past at the ORNL fuel center, filter changeouts had informally relied on the knowledge and assistance of the fuel center attendant. His absence the day of the occurrence, coupled with the lack of a hazard evaluation and formal procedures, led to the gasoline spill, worker illness, and the near miss of a fire or other greater consequences.

KEYWORDS: *Gasoline, filling station, fuel filter, near miss, spill*

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

5. INADEQUATE SPACING OF FISSILE MATERIAL RAISES NUCLEAR SAFETY CONCERNS

On January 23, 2002, during facility rounds at the Savannah River Site FB-Line, a shift nuclear safety specialist found two fissile material containers that were spaced closer than the minimum 3-feet apart permitted by the Nuclear Safety Control specified in the standard operating procedure. Although calculations proved that the fissile mass did not exceed the limits in the facility authorization basis, the inadequate spacing between the containers violated the double contingency requirement for fissile materials stored outside of reactors. Inattention to detail could have resulted in a criticality event, compromising personnel safety and causing property damage. (ORPS Report SR--WSRC-FBLINE-2002-0002; final report filed February 21, 2002)

On January 18, FB-Line facility personnel were removing deposits from inside of a precipitator to improve its efficiency. They collected the deposits into a number of filter boats that could be moved up and down the mechanical line. All of the fissile deposits were collected in a single 1-liter container and moved to a maintenance cabinet in the Mechanical Line Operating Room. On January 20, operators were requested to transfer the material in the 1-liter container into another filter boat at the same maintenance cabinet.

The subsequent investigation concluded that the operators were aware of a container of unprocessed sweepings in the vicinity and that efforts were being made to maintain a 3-foot minimum separation between the two containers. It was further known that the container was moved east of the maintenance cabinet, and a caution tag was placed on the maintenance cabinet to indicate that the container of sweepings was present. On January 23, the nuclear safety specialist discovered that the spacing between the east filter boat and the sweepings container was approximately 6 inches, a violation of spacing requirements for fissile material. The specialist informed the Operations Command Center of this infraction. Because the fissile mass was within authorization basis limits, the items could be safely separated. The investigation could not, however, conclusively identify when the filter boat was moved closer to the sweepings container.

The direct and root causes of this event are personnel error (inattention to detail). Although the location of the fissile material in the sweepings container was properly identified, an operator's inattention to detail before moving the filter boat caused the spacing violation.

The contributing cause for this occurrence is personnel error (procedure not used or used incorrectly) because the procedures that were in place for moving floor sweepings were not used. In addition, investigators found that a status board used for maintaining updated locations of containers of floor sweepings was not being kept current.

The following corrective actions were recommended.

- Issue a lessons learned on this event to all operations personnel.
- Emphasize the importance of maintaining the minimum distance of 3 feet between any two fissile material masses.
- Discuss process controls and procedures for movement of fissile materials in the lessons learned.
- Require the facility to maintain process status control in the shift orders and ensure that the appropriate procedures are initiated for movement of fissile materials.

The Office of Environment, Safety and Health reported on a similar event involving nuclear criticality safety infractions in OE Summary 2001-02, issued July 30, 2001. On March 14, 2001, solid waste rigging personnel at Savannah River moved a metal container from transuranic (TRU) Pad 3 to TRU Pad 7. During an inspection tour of Pad 7 the next day, the TRU shift manager noticed that the container was placed approximately 16 inches from FB-Line containers instead of the 3-foot-minimum spacing required for nuclear criticality safety. This inadvertent violation of a nuclear criticality control and technical safety requirement placed the facility in an unsafe configuration. (ORPS Report SR--WSRC-SLDHZD-2001-0004)

Such events highlight the importance of operator knowledge of adequate status control and the correct use of established procedures during handling of nuclear materials. Workers must pay full attention to operational details and ensure that nuclear criticality safety limits of mass and spacing are not violated.

DOE Order 420.1, *Facility Safety*, provides guidance on nuclear safety controls for operations at DOE facilities. The order refers to the American Nuclear Society (ANSI/ANS) Standards and regulations to avoid double contingency violations. DOE Standard DOE-STD-1039-93, *Guide to Good Practices for Control of Equipment and System Status,* provides general guidance about equipment control and system status. These documents are accessible at http://www.directives.doe.gov/serieslist.html.

KEYWORDS: *Filter boat, nuclear safety, double contingency, criticality safety*

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

6. LOOSE CONNECTIONS CAUSE UNANTICIPATED TRITIUM RELEASE

On January 30, 2002, an estimated 170 curies of elemental tritium (HT) and 1.5 curies of tritium oxide (HTO) were released to the environment from the Weapons Engineering Tritium Facility at the Los Alamos National Laboratory. Operations personnel were transferring a mixture of deuterium and tritium from a storage container to process piping inside a glovebox, when a loose fitting allowed gas to leak. The dose to a member of the public at the site boundary was estimated to be much less than 1 mrem and bioassay results indicated operator exposures were less than 1 mrem. (ORPS Report ALO-LA-LANL-TRITFACILS-2002-0001)

Shortly after the operators initiated the transfer, tritium levels in the glovebox increased to full-scale on the glovebox monitor and the tritium levels in the room began to increase. The operators then reversed the transfer by pumping the gas back into the product container from the process piping. Upon completion of the reverse transfer, in order to measure the tritium levels inside the glovebox, the operators attached a portable tritium monitor to the glovebox using quick-disconnects on the side of the glovebox. The portable tritium monitor was employed because it is a higher-range instrument than the internal glovebox tritium monitors, which indicated an off-scale high measurement. During this measurement process, the high alarm on the room tritium monitor activated, and the operators evacuated the room. Facility personnel decided to release the tritium to the environment through the stack based on the tritium levels present in the room at that time. The release was conducted in accordance with approved procedures.

The cause of the high tritium level in the room was a leak in the portable tritium monitor tubing, which allowed higher than normal concentrations of tritium to escape from the monitor loop into the room air. A separate leak in the process piping inside the glovebox resulted in the higher than normal tritium concentration inside the glovebox. Both leaks were caused by loose Swagelok® connections (see Figure 1). The cause of the loose monitor connection has not been determined at this time; however, facility personnel believe the loose connection inside the glovebox is attributable to vibration from a nearby pump. Facility personnel are considering a locking device that will prevent the loosening of these types of fittings in critical applications. One such device is shown in Figure 2. It is positioned such that the male nut of the connection fits within the parallel tabs of the collar and the female nut fits inside the wing tabs.

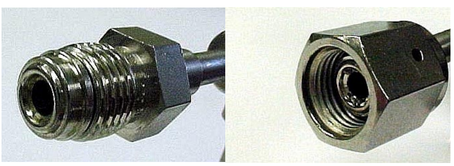

Figure 1. Swagelok® male and female vacuum coupling ring connections

This event serves as a reminder that even small leaks in fittings and valves in tritium applications are readily detected. Precautionary testing measures and mechanical devices may lessen the probability of an undesirable event scenario developing. Recommended practices to reduce the probability of these events can be found in DOE-HDBK-1129-99, *Tritium Handling and Safe Storage* (http://tis.eh.doe.gov/techstds/standard/hdbk1129/hdbk1129.pdf). Additional information on recommended practices on tritium valves and fittings can be found in Technical Notice 94-01, *Guidelines for Valves in Tritium Service,* published by the Office of Nuclear Safety in September 1994 (http://tis.eh.doe.gov/docs/tn/eh-0417.pdf).

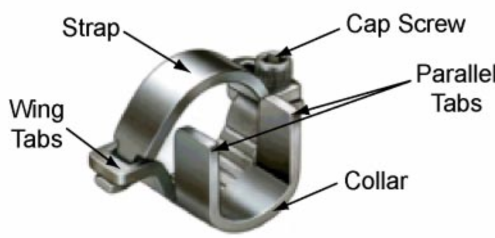

Figure 2. A Swagelok® locking device

It would also be desirable from a response perspective to have full-range tritium instrumentation capability inside gloveboxes to preclude the necessity of hooking up portable instrumentation after the fact. As was the case with this event, the use of portable instrumentation introduces a potential pathway for tritium release to the room.

KEYWORDS: *Tritium release, fitting leak, fitting locking devices*

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