OPERATING EXPERIENCE SUMMARY

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The Office of 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 conversations with cognizant facility or DOE field office staff. If you have additional pertinent information or identify inaccurate statements in the Summary, please bring this to the attention of Frank Russo, 301-903-8008, or Internet address Frank.Russo@eh.doe.gov, so we may issue a correction.

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EVENTS

1. TANK FALLS ON ELECTRICAL AND STEAM LINES

On December 10, 2002, at the Fernald Environmental Management Project, a 14-ton stainless steel tank fell onto an energized 480-volt electrical line and an elevated steam pipe bridge during demolition work. The tank damaged the electrical line, causing a circuit breaker trip that resulted in loss of power to a building and two trailers. A 150-psig steam line ruptured, dislodging a small amount of asbestos insulation. The tank also struck and damaged several abandoned steam lines on the pipe bridge. No one was injured in this event, but it was categorized as a near miss because of the potential for serious injury. (ORPS Report OH-FN-FFI-FEMP-2002-0041)

A subcontractor excavator operator was using a hydraulic shear mounted on the excavator boom to pull down the tank. He grasped the 39-foot-high, 12-foot-diameter tank with the shears and began to back up the excavator to pull the tank down. However, the tank began to lean in a different direction, pulling the boom with it, and rotating the excavator cab. The operator was unable to halt the motion of the tank because of its weight, so it continued to slowly fall until it struck the pipe bridge. The operator saw sparks and immediately released the bite on the tank while it was leaning against the pipe bridge (Figure 1-1).

The excavator operator remained in the cab while emergency personnel responded to the area. After ensuring there was zero energy on the 480-volt electrical line, the emergency duty officer directed the operator to exit the cab of the excavator. Facility personnel reduced steam pressure to the damaged steam line and isolated it.

Hoisting and rigging personnel removed the tank from its leaning position and stabilized it. Another operator, using a different hydraulic shear, safely raised the tank off the pipe bridge and lowered it to the ground. During this process, more asbestos-containing pipe insulation (approximately 7 linear feet) broke off the steam pipe and fell to the ground.

Investigators determined that none of the subcontractor personnel who participated in the work area pre-job walkthrough was involved in the removal of the tank. Investigators also determined that the pipe insulation that fell to the ground held approximately 8.4 pounds of asbestos-containing material. Because the reportable quantity for released asbestos is 1 pound, notifications were made to the appropriate regulatory agencies, including the federal interagency National Response Center. It is unlikely that any asbestos was inhaled by personnel because the asbestos-containing material was sprayed with an encapsulant.

Figure 1-1. Tank leaning against pipe bridge

Investigators identified six event-specific causal factors and three generic causal factors that contributed to this occurrence. (All of these causal factors are described in detail in the Fluor Fernald, Inc. Investigation Team Report, *Tank Falls on Energized Line and Steam Highlines During Demolition Resulting in a Release of Asbestos-Containing Material,* dated December 30, 2002.) Event-specific causal factors included the following.

- The equipment operator violated safety warnings provided by the manufacturer of the excavator/shear equipment (and posted

in the cab) warning against pulling objects toward you.

- Work planners failed to evaluate hazards (e.g., the pipe bridge within the fall-radius of the tank).

- Work planners failed to determine the weight of the tank and the load capacity of the excavator/shear equipment.

The three generic causal factors are briefly described below.

1. *There were multiple indications of a lack of formality/detail in the work authorization process.*

A more complete hazard analysis and more comprehensive description of the work in the Work Authorization Request might have prevented the event. Workers who attend the briefings and walkthroughs are sometimes not the same people as those who perform the work.

2. *Project roles, responsibilities, and authorities with respect to safety and quality issues were not followed.*

The prime contractor project team failed to fulfill its responsibilities to "assure that the [sub]contractor's work is performed in a safe manner and in compliance with the regulations and contractual requirements."

3. *Assessments of decontamination and decommissioning (D&D) projects have focused on subcontractor operations. Few (if any) focused on prime contractor oversight.*

Had the contractor provided adequate oversight and performed the appropriate assessments, many of the causal factors identified could have been eliminated before this event occurred (e.g., not evaluating the hazards within the fall radius and not following the excavator manufacturer's safety warnings).

Investigators identified corrective actions related to this event in three categories: those actions to be completed before resumption of D&D work; long-term actions specific to D&D projects; and site-wide actions. Corrective actions included the following.

- Evaluate and document the operation of shearing equipment.

- Develop formal work control, management, and functional roles responsibilities, as well as accountability documents and procedures.

- Develop a detailed, proceduralized work control process.

- Evaluate the use of heavy equipment to ensure that it is operated in accordance with the appropriate operation and safety manuals.

This event underscores the need for developing and implementing formal work planning and authorization processes for potentially hazardous tasks. Contractor and subcontractor roles, responsibilities, accountabilities, and authorities need to be documented, understood by all involved, and implemented effectively. Project managers should ensure that personnel performing work are involved in the work planning and pre-task walkthroughs. Personnel who operate heavy equipment, as well as their supervisors, should review and understand safety warnings provided by heavy equipment manufacturers and comply with them.

KEYWORDS: *Demolition, tank removal, electrical safety, steam line damage*

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

2. *FORKLIFT NARROWLY MISSES WORKER*

On January 9, 2003, at the Rocky Flats Environmental Technology Site, an operator working in a remediation tent was maneuvering a forklift loaded with an empty intermodal container and nearly struck a waste technician. A health and safety specialist saw the forklift and pushed the technician out of its path. (ORPS Report RFO--KHLL-ENVOPS-2003-0001)

Figure 2-1 shows the remediation tent after it had been mostly cleared out. Intermodal waste containers can be seen in the background.

Figure 2-1. Empty remediation tent

The waste technician, who was decontaminating a filled intermodal container, had his back to the forklift operator. Because the tent was crowded with about 14 people and various types of equipment, it was difficult for the forklift operator to maneuver safely.

Project management held a fact-finding meeting to determine the cause and identify corrective actions. Waste management personnel will clean the intermodal containers before they are moved into the tent, thus reducing the number of activities within the tight confines of the tent. The job hazard analysis was modified to require establishing a clear path before heavy equipment operators move loads in or out of the tent. In areas where space and visibility are limited, an alternate spotter will be assigned to assist in maneuvering. Project management discussed the event with the entire crew to demonstrate the lessons learned.

A near-miss event involving a forklift operation occurred at the Fernald Environmental Management Project on June 5, 2002. A contractor operator was driving a forklift with a single skid of four drums through a building when a hazardous waste technician stepped in the forklift's path. The operator did not see the waste technician, and the waste technician was unaware that the forklift was operating in the area. Before either of them could react, one of the drums on the forklift skid struck the hazardous waste technician in the right arm, causing an abrasion and contusion. (ORPS Report OH-FN-FFI-FEMP-2002-0017)

These events illustrate the necessity of personnel establishing a clear path for forklifts, including stopping work if necessary, to prevent the possibility of serious injury. It is essential for project managers to control the work environment at construction and demolition sites where there are many workers performing different activities. A number of injuries involving forklifts have been reported in ORPS, including one fatality in 1991.

KEYWORDS: *Near miss, forklift, spotter*

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

3. OPERATOR ERRORS RESULT IN BAGLESS CAN WELD FAILURES

On January 20, 2003, at the Savannah River Site, facility personnel welding a plug on a bagless transfer can (Figure 3-1) missed a step in the procedure, and the weld failed. The operators were using the "reader-worker" method of relaying procedure steps, but the operator designated as the worker did not complete one of the steps. (ORPS Report SRS--WSRC-FBLINE-2003-0001)

The operators were welding cans of plutonium-bearing materials for storage and were wearing personal protective equipment and respirators.

The first step in the welding process is to turn the helium backfill valve to the vent position. The operator functioning as the reader instructed his co-operator to turn the valve to the correct position, but the second operator apparently failed to do so, and instead skipped to the next step. When the operators had completed the welding process, system indicators displayed two error messages advising that the weld had failed.

An evaluation of the event revealed that both workers were well experienced in performing the welding operation, and had successfully performed this operation many times before. Investigators attributed the failure to position the valve correctly to inattention on the part of the operator performing the worker role. They also determined that the workers had difficulty communicating because they were wearing respirators.

A similar event involving a bagless transfer can weld failure occurred on November 12, 2002, at the Hanford Site. Operators did not perform several procedure steps and began welding operations before installing the plug (lid). A hole developed in the side of the container because the plug had not been installed. The workers immediately stopped work so that they could recover the container and properly weld the lid. (ORPS Report RL--PHMC-PFP-2002-0050; final report filed January 29, 2003)

The workers, team lead, and support engineering staff held a critique immediately following the event. The critique members concluded that the operators did not perform all four sequential steps before welding the container. Initially, an operator-in-training assisted the two operators by reading the step-by-step procedure. When one of the operators was unable to secure a knurl knob, the other operator took over the glovebox work and secured the knob. At this point the operators switched roles. While the operator was reading the procedure steps, the operator-in-training distracted him by asking a number of questions. After answering the questions, the operator resumed reading the step-by-step procedure at the start weld step, assuming that the other operator had already placed the lid into position for welding.

Figure 3-1. Bagless transfer can

Management counseled the personnel involved in the event and distributed an internal lessons-learned transmittal throughout the site. Team leads will assign roles for each operator and operator-in-training during pre-job briefings. They will advise operators to encourage observers hold questions until after a task has been completed, unless they are raising a safety concern, to avoid distractions.

These events demonstrate the importance of remaining focused on tasks even if they are routine in nature. Procedural compliance is essential to safe operation. Whenever possible, distractions should be removed or kept to a minimum. Workers should follow the task assignments they are given to prevent confusion and error during the work evolution.

Many events have occurred during work operations because of the lack of good communication between personnel performing a task and those directing the task (e.g., worker-reader method). In situations where respirators are worn, it is even more important for operators/workers to follow good communication practices, such as repeating back and confirming messages. DOE-STD-1031-92, Guide to Good Practices for Communications (URL http://tis.eh.doe.gov/techstds/standard/std1031/s1031cn.pdf), *discusses the need for clear, formal,*

and disciplined communications and provides guides for improving communications.

KEYWORDS: *Bagless transfer container, plug, failed weld, operator*

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

4. SHOCK-SENSITIVE CHEMICALS DISCOVERED IN WASTE DRUMS

On February 3, 2003, at the Savannah River Site, during sampling and characterization activities, workers found a 55-gallon drum that contained bottles of p-Dioxane, a chemical that can form explosive peroxide when exposed to air. (ORPS Report SR--WSRC-SLDHZD-2003-0002)

Workers were sampling drums of legacy waste bottles that had been shipped to the hazardous waste facility in 1985. Several bottles bore p-Dioxane labels in poor condition (Figure 4-1). However, the waste characterization form did not indicate that the drums contained p-Dioxane. When workers found the bottles labeled p-Dioxane, they stopped work. The contents of the bottles appeared to have crystallized.

Figure 4-1. Bottles of p-Dioxane

An investigation revealed that a portion of the material inside the bottles was probably ice, as p-Dioxane freezes at 53° F (11.7° C). However, because the bottles had been in storage for such a long time, further evaluation will be needed to determine if peroxides have formed, and a hazardous waste vendor will test and stabilize the contents of the bottles.

From January 28 through January 30, 2003, DOE's Office of the Inspector General conducted an inspection of Ames Laboratory's management of shock-sensitive chemicals. The investigation revealed that the proper requirements were in place, the training seemed adequate, and the research staff understood the special precautions that must be taken for handling and storing shock-sensitive chemicals. There was, however, evidence that some chemicals were being kept past their recommended shelf lives. In addition, the inspectors found two bottles of peroxide-forming chemicals. These were immediately labeled with Do Not Disturb warnings so others will not handle or disturb them. The research group leaders responsible for the chemicals were informed of the significance of the warning labels and the need to inform all personnel in the laboratories where the chemicals are stored. Any peroxide-forming or shock-sensitive chemicals that have exceeded their shelf lives will be identified and removed. (ORPS Report CH--AMES-AMES-2003-0001)

Another event involving improper storage of potentially explosive materials was reported at Hanford on January 23, 2001. Facility management discovered approximately 75 ml of Collodion, a mixture of pyroxylin, ether, and alcohol with a very low flash point, in a flammable cabinet. The Collodion, which also forms explosive peroxides over time, was estimated to have been in the cabinet for about 5 years. The chemical was not listed on the facility chemical inventory or on the list of chemicals routinely tested for peroxides. (ORPS Report RL--PHMC-WSCF-2001-0002)

At the Oak Ridge East Tennessee Environmental Technology Park, a subject matter expert identified two chemicals, perchloric acid and methyl ethyl ketone (MEK) peroxide that had started to crystallize, causing a potentially shock-sensitive hazard. Because the facility authorization basis did not evaluate storage of this type of chemical, facility management declared an Unreviewed Safety Question (USQ) and took compensatory measures. (ORPS Report ORO--BJC-K25WASTMAN-1999-0022) A Yellow Alert on this issue was submitted to the Lessons Learned database and can be found at the following URL http://www.eh.doe.gov/ll/lldb/detail.CFM?Lessons IdentifierIntern=Y%2D2000%2DOR%2DBJCETTP%2D0701. Six months later, another USQ was declared during a quality assurance audit, when two pint-size cans of tetrahydrofuran were discovered inside a plastic container in a flammable storage cabinet. Tetrahydrofuran becomes potentially shock-sensitive after 1 year; the two cans were dated 1993. An explosives expert inspected the facility to ensure that it was in a safe configuration before the cans were removed for disposal. (ORPS Report ORO--BJC-K25WASTMAN-2000-0020)

These events illustrate the importance of maintaining a complete inventory of all chemicals on site. Any chemicals with the potential to become shock-sensitive should be removed and properly disposed of before the expiration of their shelf lives. Periodic inspections should be conducted to identify degrading chemicals.

KEYWORDS: *Shock-sensitive chemical, explosive, hazardous material, peroxide-forming*

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