OPERATING EXPERIENCE SUMMARY

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OE Summary 2002-17
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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, 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.

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EVENTS

1. GLOVEBOX BAGOUT OPERATION RELEASES AIRBORNE RADIOACTIVE MATERIAL

On June 27, 2002, at the Los Alamos National Laboratory (LANL), continuous air monitors (CAMs) alarmed, indicating airborne contamination in two rooms of a LANL facility. A release of airborne contamination resulted from a problem during glovebox bagout operations in one of the rooms and migrated to another room, which was occupied by eight personnel. They immediately exited the room and submitted nasal smears. Two of them had positive readings, but the readings were below the reporting threshold. There was no impact on the environment. (ORPS Report ALO-LA-LANL-TA55-2002-0011)

Two workers, assisted by a radiation control technician, were performing the bagout operation in accordance with established work instructions. They wore anti-contamination clothing with full-face respirators, and red-lighted the room to restrict access. The workers prepared a 4-inch glovebox port by placing a bagout bag on the port. While lowering a can of Pu-239 oxide into the bagout bag, the can fell through the bag and hit the floor. The can did not break open, but radioactive material on the outside of the can became airborne. The radiation control technician immediately put the can in a plastic bag and placed it in an open-front hood. Shortly thereafter, a CAM alarm occurred in the room, and the employees evacuated. They were surveyed by five radiation control technicians who responded to the alarm. Approximately 10 minutes later, a CAM alarmed in the room nearby that was occupied by eight personnel.

All ten personnel involved and the five responding radiation control technicians were placed on diagnostic bioassay. The radiation control technician who had assisted in the bagout operation had not removed his respirator during the entire incident, and so was not placed on bioassay. All 61 fixed-head air sampler filters in the room nearby where the bagout was performed were removed and analyzed, and 9 of them indicated contamination above 40 Derived Air Concentration-hours (DAC-hours), ranging from 42 to 62.5 DAC-hours. Based on the filter analysis and a conservative exposure time of 15 minutes, Health Physics Operations personnel calculated that the likely worst-case exposure to the employees was 2.9 DAC-hours.

During a critique of the event, the workers stated that they had inspected the bagout bag and verified that it was whole and airtight before they attached it to the port. However, inspection of the bag after the incident revealed that the heat seal on the bag was cut off; that is, it had no bottom. The contractor has not finished developing formal corrective actions, a root cause analysis, or lessons learned. However, a preliminary evaluation by DOE facility representatives indicates some accountability issues regarding the procedure that requires those performing bagout operations to verify the integrity of the bagout bag. If the integrity of the can had been breached when it hit the floor, the potential existed for significant internal exposures to the workers given the type of radioactive material inside the can. Hence, it is essential that workers pay close attention to detail and follow procedures rigorously during glovebox bagout operations.

A search of the Occurrence Reporting and Processing System database found 20 other radiological events at this facility over the past year. One of these involved a minimal Pu-238 uptake to two workers. In another, two workers received small uptakes of airborne alpha-emitting radioactive materials. Seven events, as well as the event in this article, involved airborne releases greater than 40 DAC-hours, and eleven events involved radiation contaminations; eight on the skin and three on clothing.

KEYWORDS: *Airborne release, uptake, radioactive contamination, bagout, glovebox*

ISM CORE FUNCTION: *Develop and Implement Hazard Controls, Perform Work within Controls*

2. UNSECURED FORKLIFT LOADS RESULT IN PROPERTY DAMAGE AND SPREAD OF CONTAMINATION

On July 2, 2002, at the Savannah River Site, a forklift operator was moving miscellaneous items from one building to another. Office supplies and two boxes of EXIT signs containing tritiated gas had been loaded and secured on a pallet. Because space remained on the pallet, two unboxed EXIT signs were added, but not secured. (ORPS Report SR--WSRC-SRDD-2002-0004)

As the forklift operator approached a stop sign, he heard something breaking behind him. He stopped the forklift, lowered the forks, and looked behind the forklift to find a crushed EXIT sign lying in the roadway.

The operator placed the largest pieces of the broken sign on the pallet and transported them to a storage facility, where he placed them in secured plastic bags. He returned to the roadway, cleaned up the remaining debris, and placed the debris and his cleanup tools into plastic bags. A barricade was erected around the location of the crushed sign.

Radiological control personnel took tritium smears of the sign, the gloves, the forklift, and the roadway. The smears of the roadway were 93,802 disintegrations per minute (dpm) and 125, 884 dpm tritium. The smears on the gloves were 337,066 dpm, 515,935 dpm on the sign, and 557,808 dpm on the broom and dustpan.

The forklift operator and two radiological control inspectors submitted bioassay samples for analysis. The results of the analysis for all involved workers were below the reportable levels. No further action was required.

As of this writing, the root cause analysis has not been completed. Corrective actions include evaluating the methods for loading pallets and securing their contents, and determining the existence of a site procedure for handling signs containing tritiated gas. The site plans to develop and disseminate a lessons learned to alert others of the potential for tritium contamination if the signs are broken.

DOE Standard DOE-STD-1090-96 (URL http://tis.eh.doe.gov/whs/bookshelf/std1090.pdf), *Hoisting and Rigging*, Section 10.5.5, "Moving the Load," states that a designated person "…shall ensure that the load is well secured and properly balanced before it is lifted." Figure 2-1 illustrates this principle. The Occupational Safety and Health Standards, 29 CFR 1910, *General* (URL http://www.access.gpo.gov/nara/cfr/waisidx_01/29cfr1910a_01.html) and 29 CFR 1926, *Construction* (URL http://www.access.gpo.gov/nara/cfr/waisidx_01/29cfrv8_01.html) also provide guidance on securing objects on forklifts.

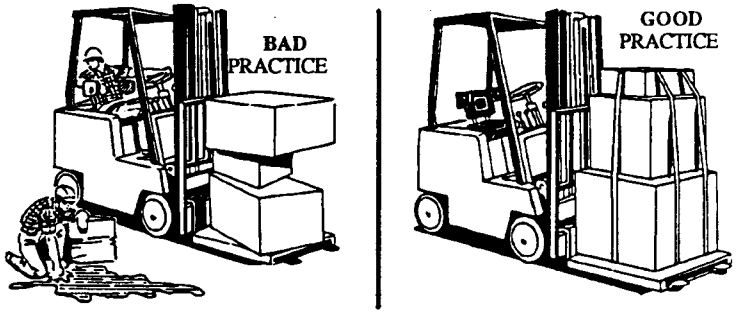

Figure 2-1. Bad and good practices for forklift operations

A similar event took place on July 24, 2002 at Idaho, where a warehouse delivery driver was transporting a gamma ray spectrometer that had been placed on top of a loaded pallet but not secured. When the load shifted the unsecured spectrometer fell onto the road where the forklift ran over it, damaging it beyond repair (Figure 2-2). No one was injured. (ORPS Report ID--BBWI-CFA-2002-0007)

Another similar event occurred on August 8, 2001, at the Oak Ridge K-25 Site. A forklift operator was moving a multi-drawer air sampler counter to a flatbed truck. When the load shifted, the lead-shielded detector assembly, which was not secured, fell and broke apart upon impact with the pavement. There were no injuries or environmental impacts as a result of this incident. (ORPS Report ORO--BJC-K25GENLAN-2001-0009)

Figure 2-2. The damaged spectrometer

These events illustrate the importance of properly securing all forklift loads, no matter how small the loads or how briefly they will be transported.

KEYWORDS: *Forklift, unsecured, pallet, tritium, contamination*

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

3. IMPROPER PACKAGING OF RADIOACTIVE MATERIAL FOR OFFSITE SHIPMENT

On July 10, 2002, at the Hanford Site, a worker at a shipping building discovered instruments, which had been marked as containing radioactive material, inside a shipping package that did not have appropriate shipping documentation for transport of radioactive materials. The worker immediately notified radiological control personnel of the finding. The worker had opened the package to verify proper packaging of the high-value equipment prior to shipment offsite. (ORPS Report RL--PHMC-GENSERVICE-2002-0002)

The package contained four individual radiation detectors that were being shipped to the manufacturer in New Mexico for repair or credit. Each detector contained a sealed radioactive source used for functional testing. Each source contained 1.0 microcuries of strontium-90. The outside package did not meet Department of Transportation (DOT) packaging requirements for a limited-quantity shipment off-site, in that the package was not strong-tight. All packages used to transport radioactive material must be strong, tight containers that will not leak under normal transportation conditions such as dropping, jarring, or temperature extremes. Experienced transportation and packaging personnel repackaged the detectors into a DOT-compliant package.

A critique of the event was conducted, and it was learned that the package containing radioactive material was sent to the shipping building by a waste management project materials coordinator who was not trained or authorized to ship radioactive or hazardous material/waste. The procedure the coordinator used called for involvement of the transportation and packaging organization to inspect and approve packaging of the material. This was not done. Therefore, the root cause for this non-compliant shipment of radioactive material was a lack of training. Procedure not used or used incorrectly was the direct cause.

There have been a number of events across the DOE complex involving shipping non-compliances. A search of the ORPS database from January 2002 to the present found 13 events involving incorrect labeling and markings, improper packaging, inadequate shipping documents, and exceedance of material quantity or weight limits. Two of these events involved non-DOE shippers. Personnel error (inattention to detail) was cited as the root cause in the majority of the events that contained causal analyses.

These occurrences illustrate the importance of ensuring that personnel involved in packaging and shipping of radioactive and hazardous materials/waste have requisite knowledge and training on DOT requirements. Transportation and packaging personnel need to verify that shipments are properly packaged, marked, and documented to ensure compliance with DOT regulations.

Federal regulations are delineated in 49 CFR 100-177, *Transportation*. Information on packaging and transportation safety can be found in the following DOE Orders.

- DOE O 460.1, *Packaging and Transportation Safety*, establishes the requirements for packaging and transportation of off-site shipments from DOE and on-site transfers of hazardous materials.

- DOE O 460.2, *Departmental Materials Transportation and Packaging Management*, establishes DOE policies and requirements to supplement applicable laws, rules, regulations, and other DOE Orders for materials transportation and packaging operations.

KEYWORDS: *Transportation, shipping, packaging, labels, radioactive sources, hazardous materials*

ISM CORE FUNCTION: *Perform Work within Controls*

4. INCORRECT INSTALLATION RESULTS IN HIGH-PRESSURE REGULATOR FAILURE

On August 9, 2002, at the Sandia National Laboratory, a pressure regulator connected to a P-10 gas cylinder failed, propelling the plastic lens off of a pressure gauge approximately 30 feet to strike an adjacent wall. The low-pressure side of the regulator had been incorrectly connected to the high-pressure cylinder. No one was injured; however, because of the potential for injury, the contractor reported this event as a near miss. (ORPS Report ALO-KO-SNL-6000-2002-0007)

To support the operation of a radiation portal monitor, Facility Operations installed the cylinders, regulators, and manifold. After installation was completed, calibration technicians began connecting the P-10 gas system to calibrate the monitor. The system comprises two gas cylinders, as shown in Figure 4-1. Each cylinder has a pressure regulator that contains two gauges; a high-pressure gauge (0 – 3,000 pounds per square inch, gauge (psig)), and a low-pressure gauge (0 – 30 psig). When the isolation valve on the first cylinder was opened, the low-pressure gauge lens blew off. Following the event, technicians disconnected the cylinders from the monitor and tagged the system out of service.

Figure 4-1. Configuration of gas cylinders

Figure 4-2 shows the damaged pressure regulator with the lens blown off the low-pressure gauge.

At the event critique, it was learned that the installer had incorrectly connected the low-pressure side of the regulator to the cylinders, thus exposing the low-pressure side to the full cylinder pressure of 2,000 psig. There were no injuries because the calibration technicians followed their training and positioned themselves away from the regulators in case of failure.

The installation was performed without a procedure or verification that the configuration was correct. However, even without a procedure there are ways to distinguish the low-pressure side of the regulator from the high-pressure side when connecting to it. First, the body of the regulator is stamped "LP" and "HP," and second, the range on the pressure gauges and their orientation on the regulator indicate whether they are on the high-pressure or low-pressure side.

Figure 4-2. Damaged regulator (picture rotated 90 degrees)

The contractor has not completed a causal analysis or determined corrective actions.

Another near-miss event involving compressed gas cylinders occurred at Hanford on February 22, 2002, when a flow regulator connected to a bottle of compressed argon gas failed. A pipefitter had installed a distribution manifold containing the flow regulator directly to the cylinder without a pressure regulator. When he opened the isolation valve on the cylinder, full pressure caused the flow regulator to break. The pipefitter was not injured. (ORPS Report RL--PHMC-SNF-2002-0010)

These occurrences underscore the importance of maintaining attention to detail when working with compressed gas cylinders and associated regulators and manifolds because of the potential for high-energy hazards. Compressed gas cylinders must be connected only to regulators and equipment designed for gas cylinders and the operating pressure. Personnel should always stand away from the face and back of the gauge and regulator when opening the cylinder valve and should always open the valve slowly.

DOE/EH-0527, *Compressed Gas Cylinder Safety*, provides recommendations and lessons learned from compressed gas cylinder events that occurred at DOE facilities. It also identifies applicable regulations and guidelines for safe use, handling, and storage of compressed gas cylinders.

KEYWORDS: *Pressure regulator, gas cylinder, compressed gas, equipment failure, near miss*

ISM CORE FUNCTION: *Perform Work within Controls*