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OPERATING EXPERIENCE SUMMARY

Office of Environment, Safety and Health

Summary 2001-04

The Office of Environment, Safety and Health (EH) 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 2001-04

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EVENTS

1. LACK OF WORK AREA CONTROL CAUSES PERSONNEL CONTAMINATION

On May 1, 2001 at the Nevada Test Site, while unloading dimethyl methylphosphonate (DMMP) drums, a Defense Threat Reduction Agency (DTRA) employee came in contact with a small amount of the potentially hazardous chemical. Failure to identify changes in the scope of work and off-loading the DMMP drums without an approved work package could have compromised personnel safety. (ORPS Report NVOO--DTRA-NTS4-2001-0001).

The volatility of DMMP is similar to that of many non-persistent nerve agents; i.e., chemicals that affect the central nervous system. Because of this physical property, DMMP has been used as a nerve agent simulant to study vulnerability of military vehicles, shelters, protective masks, and filters.

The DTRA, in consultation with the Hazardous Spill Test Facility (HSC), requested that the 55-gallon drums be palletized and delivered on a flatbed truck. This request would permit easy forklift handling by HSC personnel and was included in the approved work package. However, when the shipment was received, it was not palletized and was in an enclosed container. DTRA personnel accompanied the shipment, and were to observe the offloading of the drums. Bechtel Nevada (BN) personnel informed the Facility Manager about the arrival condition of the shipment. The HSC personnel told DTRA personnel that the forklift would be available for unloading the drums after changing a flat tire. In an attempt to facilitate the offloading of the drums, DTRA personnel began moving loose drums by hand from the front of the container to the rear to facilitate easy pickup by a drum clamp attached to the forklift. DTRA personnel had not attended the pre-job briefing and did not utilize the identified personal protective equipment (PPE) for handling DMMP.

While moving the fourth drum, a DTRA employee came in contact with a small amount (approximately 5 to 8 tablespoons) of DMMP that had apparently escaped through a leak in a bung seal. At this time, the DTRA Supervisor arrived at the site and was informed about the contamination of one of his men. The Supervisor placed the individual under a chemical shower to wash his exposed hands, forearms and clothes for about 10 minutes. He then verified, by phone from the shipper, that no other substance could have contaminated the drums and the contents were in fact DMMP.

Several minutes later, the DTRA and BN Safety personnel arrived at the scene. DTRA Safety Representative ordered the work to stop and assessed the situation. It was determined that the shower rinse removed all the DMMP from the DTRA worker. As a precaution, the DTRA Safety Representative released all his personnel to go home and change their uniforms. After further assessment and using proper PPE, the DTRA Supervisor and DTRA Safety personnel observed the offloading of the remaining drums.

HSC and DTRA personnel failed to follow established work control procedures. DTRA personnel performed work without an approved work package, did not attend the pre-job briefing, and failed to use proper PPE. HSC personnel failed to exercise work area control by instructing DTRA personnel in site safety requirements prior to the start of work.

This incident is attributable to a Personnel Error-Communication Problem. All personnel at the site failed to identify the change in the scope of work resulting from the arrival of improperly shipped drums. The direct cause is Management Problem-Work Organization/Planning Deficiency. DTRA personnel performed work without an approved work package. HSC personnel failed to control their work area by allowing the work by DTRA personnel to proceed without an approved work package.

DTRA has conducted an internal "lessons learned" briefing for their personnel. DTRA has also provided a refresher Integrated Safety Management (ISM) training and refresher Hazardous Material Communications training to their personnel involved in this event.

This occurrence demonstrates the importance of adequate work planning, hazard analysis, and proper communication to ensure appropriate PPE and safety during the handling of toxic chemicals. The work planning process should include a detailed work package, a pre-job briefing with all involved personnel, and a well-defined work area control process. It is essential that work be stopped when unusual or unexpected conditions are encountered and reanalyzed prior to proceeding.

KEYWORDS: *Industrial Safety, work planning, work package, chemical safety, toxic chemicals*

ISM CORE FUNCTIONS: *Define the Scope of Work, Develop and Implement Hazard Controls, Perform Work Within Controls*

2. BATTERY FAILURES IN POWERED AIR-PURIFYING RESPIRATORS

In two separate incidents on March 21, 2001, contractor workers at the Hanford Site experienced failures of their powered air purifying respirators (PAPRs). These PAPR failures have been attributed to the failure of the approximately six-year-old batteries used in the PAPR blower units. Neither worker was found to have received a measurable hazardous materials exposure. (ORPS Report RL--BHI-GENAREAS-2001-0003)

In the first incident, a Decontamination and Decommissioning worker was removing transite panels containing asbestos when the PAPR face piece fogged up. A check of the PAPR blower unit indicated that it was barely operational, resulting in a significantly reduced air flow. The worker immediately exited the area. In the second incident, another worker, also wearing a PAPR, was removing electrical conduit in a High Contamination Area/Airborne Radiation Area when the PAPR face piece began fogging up. A check of the PAPR blower unit revealed that it had shut down, and cycling the battery switch did not restart the blower. The worker was directed to exit the area. Both workers were checked for possible exposure to the inhalation hazards.

In both incidents, the workers and their supervisors performed emergency actions quickly and efficiently, in accordance with their procedures and training, to avoid exposure to a potentially hazardous environment.

Both PAPR units were kept intact and transported to the contractor's Industrial Hygiene (IH) facility for inspection, testing, and evaluation. Tests conducted by the contractor on the two PAPR units indicated the hoods, tubes, blowers, and filters were functioning normally; however, the battery in each unit had failed.

Replacement batteries for PAPR units are purchased new from the PAPR manufacturer. The contractor's procedures require that before initial use, each new battery be charged and tested under load. Those batteries that indicate an output of 4.4 volts or above, while under load, are recharged and put into service. Additionally, after each use, the batteries are recharged and retested for open circuit voltage, voltage output under load, and charging amps. Contractor procedures require a minimum open circuit voltage of 4.8 volts, and the minimum acceptable output under load is 4.4 volts. Each time a battery is recharged and tested, the appropriate testing information is recorded in a database.

Because specific information on PAPR battery shelf and service life is not available, the contractor has investigated mandating removal/replacement of any battery that has reached 5 years of age. Testing completed by the contractor's Respiratory Protection Program Manager indicated that the likelihood of battery failure increases significantly in older batteries and that batteries that reach 5 years of age fall below the acceptable risk level. As a result, the contractor has removed from service all batteries older than 5 years and implemented additional testing criteria.

The contractor has performed the following corrective actions:

- Revised the IH procedures to require the removal from service of any battery that tests at 4.4 volts under load twice during its service life or reaches 5 years from the date of purchase.
- The IH group will closely monitor battery testing and service life. These actions should allow early detection of potential battery problems and reduce the probability of in-use battery failures.
- The contractor has issued "Powered Air-Purifying Respirator Battery Failures Lessons Learned," ERC-01-0014, to provide others with information and suggestions for corrective actions. This document was added to the website of the Society for Effective Lessons Learned Sharing (SELLS). (URL http://tis.eh.doe.gov/ll/sells/index.html)

Because the service life of batteries depends on the type of battery, the nature of the equipment that the battery is used in, the type of application, and the operational environment, it may be practical to establish a company/site standard based on the specific uses of the different types of batteries. This would be most important for batteries that operate equipment designed to keep workers safe in hazardous environments. Such a standard would address the careful documentation of testing and monitoring methods and results and the shelf and service life of specific types of batteries.

KEYWORDS: *Respirator, battery failure*

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

3. NUCLEAR CRITICALITY VIOLATIONS AT ETTP K-33 BUILDING

On April 23, 2001, the contractor for the K-33 Building of the East Tennessee Technical Park (ETTP) reported that its workers had mischaracterized and compacted process gas piping with significant deposits of low enriched uranium. On May 16, 2001, nuclear criticality engineers found several violations of nuclear criticality requirements involving spacing, securing, and labeling of process gas piping stored on the K-33 Building floor. On June 12, 2001, in two separate occurrences, DOE facility representatives and contractor personnel found sections of dismantled process gas piping on the building's floor that should have been stored in a fissile array, but were not. These four recently issued occurrence reports show a trend of nuclear criticality violations at the facility. (ORPS Reports ORO--BNFL-K33-2001-0003, ORO--BNFL-K33-2001-0004, ORO--BNFL-K33-2001-0008, and ORO--BNFL-K33-2001-0009)

Seal exhaust piping in the K-33 Building are from the gaseous diffusion process and contain deposits of low enriched uranium (equal to or less than 2.5% U-235). In the first occurrence, workers failed to characterize small-bore (less than 3.5 inches in diameter) seal exhaust piping as "process gas piping." This mischaracterization resulted in a loss of control of fissile material and the placement of the piping in the wrong material stream — as feed material for the Supercompactor. Workers processed an amount of the process gas piping through the site's Supercompactor sufficient to fill seven large shipping containers without determining the amount of U-235 present, as required for process gas piping. A new work shift discovered the mistaken characterization on April 23, 2001, and subsequent surveys found one of the seven shipping containers to have 630 grams of U-235. This exceeded the contractor's shipping limit of 350 grams, based on the Department of Transportation's upper limit for U-235 shipments considered "Fissile Exempt."

The contractor's immediate actions included initiating an investigation of the occurrence and suspending all compaction of piping less than 3.5 inches in diameter. On June 11, 2001, the contractor re-categorized the incident from an off-normal occurrence to an unusual occurrence after recognizing that an operational safety limit had been violated. At this time, the contractor has not formalized corrective actions or lessons learned. However, the contractor is considering the implementation of two independent checks in categorizing piping as "process gas" or "non-process gas." The contractor has extended the date for a final ORPS report to September 3, 2001.

In the second occurrence, nuclear criticality safety engineers found criticality control deficiencies during a regularly scheduled walkdown of fissile arrays of seal exhaust piping in the K-33 Building. Between May 16 and May 21, 2001, the engineers identified several spacing and labeling violations, as well as improperly constrained sections of piping. The contractor issued a stop work order, forbidding the establishment or change of temporary piping arrays without the approval of a nuclear criticality safety engineer, and developed additional criticality safety training for work crews. The contractor also issued a Noncompliance Tracking System report (NTS-ORO-BNFL-K33-2001-001), and is conducting a formal investigation.

The third and fourth occurrences, both on June 12, 2001, involved the discoveries of process piping sections that, because they contained uranium deposits, should have been stored in fissile arrays but were not. The first discovery that day was two sections of seal exhaust piping that a previous contractor had dismantled and not stored in a fissile array, as appropriate. The second discovery was a section of process piping with uranium deposits mixed in with sections of piping that did not contain deposits. The contractor's immediate actions were to place those sections of piping with uranium deposits back into appropriate fissile arrays. The next day, the contractor held a stand-down to address criticality concerns in the K-33 area where pipe removal was ongoing.

As with the first occurrence, the contractor has not yet formalized corrective actions or lessons learned for the latter three occurrences involving nuclear criticality violations.

A search of the ORPS database found only one other criticality control violation reported at the K-33 Building during the two years prior to the May 16, 2001 occurrence. This violation involved the stacking of coolers (ORPS Report ORO--BNFL-K33-2000-0004). These events indicate a need to maintain a high level of sensitivity to criticality safety level and adherence to associated controls during decontamination and decommissioning activities.

KEYWORDS: *Conduct of operations – criticality procedures, configuration management*

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

4. FIRE SYSTEM SPRINKLER SPRAY PATTERNS OBSTRUCTED

On August 13, 2001 at Rocky Flats, three sprinkler heads were found to have deficient spray patterns during the annual fire sprinkler inspection. Obstructions such as hanging lights, ducting, and a beam impaired the flow pattern of three sprinklers, but did not prevent the sprinklers from activating. However, the obstruction of the fire system sprinkler heads reduced their effectiveness in combating a fire, which could result in excessive damage to the facility or endangering the lives of its occupants. The contractor imposed Limiting Conditions for Operation in two areas where the obstructions could not immediately be removed. (ORPS Number RFO--KHLL-371OPS-2001-0070)

The hanging lights were removed, which restored the spray pattern for one sprinkler. A duct located approximately five inches from the sprinkler head obstructs the second sprinkler, preventing the full spray pattern. The third sprinkler's spray pattern is blocked horizontally by a beam that is located a few inches from the sprinkler.

The two sprinklers whose spray patterns could not immediately be corrected are scheduled for modification during a scheduled shutdown of the sprinkler systems for replacement of sprinkler heads identified as defective. The connectors for these two partially blocked sprinkler heads will be lengthened so that their spray patterns will no longer be obstructed.

EH reported on a similar occurrence in Operating Experience Summary 99-35. On August 24, 1999, at the Pantex Plant, fire protection engineers identified sprinkler heads that did not comply with the obstruction distance requirements of National Fire Protection Association (NFPA) Standard 13. The fire protection engineers were performing a risk management assessment in a building when they discovered that fluorescent light fixtures obstructed the spray patterns of several sprinkler heads in Bays 1 through 6. Based on this information and the guidance of the fire protection engineers, the facility manager restricted access to the bays pending investigation of the full extent of the NFPA 13 requirements. He also declared the fire suppression system impaired, placed the bays in a repair mode, and directed operators to remove materials from the bays. (ORPS Report ALO-AO-MHSM-PANTEX-1999-0061)

The NFPA Fire Protection Handbook, Section 6, *Care and Maintenance of Water-based Extinguishing Systems*, contains information on maintaining sprinkler system piping and identifying obstructions. The handbook identifies eight categories, of which the following four pertain to this occurrence:

- *Improper location of sprinklers* – observe whether there are sprinklers under air ducts, shelves, benches, tables, overhead storage racks, platforms, or similar obstructions.
- *Proper sprinkler clearance* – ensure that sprinklers are not obstructed by piled-high stock, walls, or partitions (there must be a clear space of 18 inches below the sprinkler deflectors) and that installation guidelines have not been violated (refer to NFPA 13).
- *Proper position of deflectors* – determine that the distance of the deflectors from the ceiling or bottom of beams or joists conforms to NFPA 13.
- *Proper sprinkler installation* –- observe whether the sprinklers are installed in the positions for which they were intended. Note the type, design, year of manufacture, and date installed; check for proper temperature rating; check for corrosion and blockage; and check for coatings of paint.

Facility managers responsible for fire safety should ensure that systems are installed, inspected, and maintained using NFPA standards. NFPA 13, *Installation of Sprinkler Systems*, is the fundamental document that governs the design and installation criteria for installing sprinkler systems. NFPA 25, *Inspection, Testing, and Maintenance of Water-based Fire Protection Systems*, is another reference that facility managers should consult when performing acceptance testing, periodic testing, and maintenance.

Ordering information for NFPA documents can be found at the NFPA Web site at http://www.nfpa.org. DOE implementation of NFPA 25 can be found at the DOE Fire Protection home page at http://tis.eh.doe.gov/fire/fire.html.

KEYWORDS: *Fire suppression, inspection, sprinkler, surveillance*

ISM CORE FUNCTION: *Provide Feedback and Continuous Improvement*

5. BWXTO RECEIVES PRICE-ANDERSON ACTION AT MOUND

On July 11, 2001, DOE issued a Preliminary Notice of Violation (PNOV) and a proposed civil penalty of $137,500 against BWX Technologies of Ohio (BWXTO), the contractor of the Mound Plant in Miamisburg, Ohio. The DOE action is a result of a series of procedural nuclear safety violations including one that led to a plutonium intake. (ORPS Reports OH-MB-BWO-BWO02-2001-0001; OH-MB-BWO-BWO01-2000-0009).

The PNOV identified procedural deficiencies associated with a chain of events in Building 38, where a worker received a plutonium intake and plutonium contamination was spread into an involved room. The event was initiated on January 24, 2001, when personnel performed characterization surveys inside a glovebox line. The next morning, they performed passbox operations to bag the survey wipes for counting in a nearby fumehood. During both of these activities, personnel were wearing appropriate anti-contamination clothing and respirators, and exited the room without incident. However, later that day one individual re-entered the room without respiratory protection to count the wipes. The individual transferred highly radioactively contaminated wipes and a contaminated meter from the passbox to a nearby fumehood, a posted High Contamination Area. Due to background interference, the individual moved the items to another fumehood posted for a lower level of contamination (Contamination Area) and surveyed the 45 wipes. A continuous air monitor (CAM) was in operation during the counting evolution and gooseneck air samplers were placed on each side of the fumehood. On January 29, 2001, the same individual re-entered the room without respiratory protection to retrieve instrumentation. Since no counting was to be performed, air sampling was not initiated; however, the CAM was still operating. The air sample results from January 25 became available later that day and indicated an airborne activity of 3.8 derived air concentration (DAC), prompting a nose swipe of the individual. The nose swipe measured 52.7 counts per minute, which was above the threshold level for initiation of an Internal Dosimetery investigation of the incident. Additionally, contamination was spread throughout the room.

The individual had signed a radiation work permit (RWP) that specifically prohibited work or entry into a High Contamination Area and which did not cover fumehood counting. However, the Radiological Point of Contact had given the individual permission to access the area without a RWP task breakdown sheet, which was in violation of procedural requirements. The planned activity had not been coordinated with the Plan of the Day, also a procedural violation. As corrective actions, all Radiological Points of Contact were briefed on the lessons learned, the Radiological Control Manager issued a letter to all radiological control personnel discussing balancing priorities, and the Site Manager issued a letter to all employees emphasizing the importance of properly planned hazardous activities. Additionally, a working-level meeting was held among the various radiological control personnel to reinforce that RWPs are not work planning documents. These personnel also received conduct of operations training using this event and its lessons learned. DOE considers the corrective actions as comprehensive; however, the corrective actions from a previous enforcement action in February 1998 (98-12) at Mound had not been properly implemented. Proper implementation of those corrective actions, which included an enhanced work control process to meet Integrated Safety Management System objectives, could have precluded the January 2001 event. Therefore, full mitigation of the fine was not granted (25% mitigation was granted for the extensiveness of the current corrective action).

The PNOV also cited violations related to failure to properly validate a computer software change associated with managing the timely turnaround time for bioassay analyses. As a result of this failure, 33 bioassay samples exceeded administrative analytical turnaround times without procedurally required work restrictions being issued**.** There was no actual safety significance arising from this failure, and the problem was self-identified, resulting in 25% mitigation of the civil penalty. However, full mitigation for identification was not given since this issue was raised in a prior enforcement action (98-12) for similar problems involving failure to conduct software validation following software modifications. Comprehensive corrective actions at that time could have precluded the current problem.

There were also violations cited in the PNOV that involved multiple examples of inadequate RWPs that were generated during calendar years 1999 and 2000. During that time, BWXTO personnel issued 28 RWPs that did not identify all the radioisotopes for bioassay that were potential exposure hazards for the work activity, as required by procedure. Consequently, personnel who performed work under the deficient RWPs were not monitored for all potential radiological exposures. Since BWXTO considered the potential for an undetected exposure to be a serious problem, a stop work order for all work involving bioassay except tritium was issued. Short-term corrective actions included changes in radiological characterization, bioassay determinations and RWP roster control. Long-term corrective actions included establishing an accountability process for radiological control personnel, revising the Radiological Point of Contact training, revising and communicating the radiological control Quality Assurance Plan, and developing a Radiological Control Program Improvement Plan. The entire monetary penalty was waived since this problem was identified by BWXTO in a self-assessment activity and reported on a timely basis, and due to the comprehensive and timely corrective actions. However, DOE cited this issue due to the long-standing programmatic problems in the bioassay program at Mound. (The previous contractor was cited in 1997 and BWXTO was cited in 1998 for bioassay program issues.)

The PNOV also included violations involving multiple failures to fully implement and comply with procedures that govern the review of proposed changes for potential unreviewed safety questions (USQs). A DOE assessment identified these deficiencies, which included a failure to: properly implement USQ screening as required by procedure, develop USQ process forms per procedure, complete USQ evaluations as required, and accomplish the Mound annual review of the USQ program. These issues are being addressed by various corrective actions including administering a site-wide USQ training course, developing a qualification standard for USQ evaluators, and conducting inter-departmental USQ assessments. The civil penalty includes no mitigation for identification of the problems since these were identified by DOE assessments. However, 50% mitigation was granted for the comprehensive and timely corrective actions that were taken.

The Price-Anderson Amendments Act of 1988 requires the Energy Department to undertake regulatory enforcement actions against contractors for violations of its nuclear safety requirements. The program is implemented by the Office of Price-Anderson Enforcement. This action was taken with the support and participation of the Department's Ohio Field Office, which will ensure that the corrective actions are fully implemented.

Additional details can be found on the Internet at http://tis.eh.doe.gov/enforce.

KEYWORDS: *Enforcement, Price-Anderson Amendments Act*

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

6. WORKER INJURY RESULTS FROM LOOSE ELECTRICAL CONDUIT

On July 18, 2001, a subcontractor construction employee at the Pantex Plant suffered an electrical burn on the back of his right shoulder while installing fire-barrier board. He was taken to a local hospital for treatment and was released. (ORPS Report ALO-AO-BWXP-PANTEX-2001-0072)

The employee was on an elevated platform, approximately 13 feet above the finished floor, when the event occurred. While installing the fire barrier, the employee apparently contacted a length of electrical conduit, which became separated at a tee condulet (joint). The insulation on the 277/480-volt wiring inside the conduit was damaged, resulting in an electrical arc. The contractor immediately suspended construction work in the facility, and the site initiated an accident investigation. The facility manager reported this as a near miss, unusual occurrence.

A search of ORPS reports from the past two years found one similar occurrence, also at the Pantex Plant. On March 27, 2000, a contractor employee was cleaning under a conduit containing an energized 110-volt electrical power cable. Using a wooden-handled shovel, the worker moved the conduit to clean under it. The conduit separated at a tee condulet fitting and pinched or nicked the insulation. This caused direct electrical contact with the sidewall of the conduit, resulting in an electrical arc. (ORPS Report ALO-AO-MHC-PANTEX-2000-0028)

This occurrence underscores the importance of checking for mechanical integrity when working around electrical conduit. Most electrical conduits are put together with compression-type fittings, which are prone to come loose over time.

KEYWORDS: *Electrical near miss*

ISM CORE FUNCTION: *Analyze the Hazards*