The Office of Environment, Safety and Health and its Office of Nuclear and Facility Safety (NFS) publishes the Operating Experience Weekly Summary to promote safety throughout the Department of Energy (DOE) complex by encouraging feedback of operating experience and encouraging the exchange of information among DOE nuclear facilities.

The Weekly Summary should be processed as an external source of lessons-learned information as described in DOE-STD-7501-96, *Development of DOE Lessons Learned Programs*.

To issue the Weekly Summary in a timely manner, the Office of Operating Experience Analysis and Feedback (OEAF) 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 Jim Snell, 301-903-4094, or Internet address jim.snell@hq.doe.gov, so we may issue a correction.

Readers are cautioned that review of the Weekly Summary should not be a substitute for a thorough review of the interim and final occurrence reports.

Operating Experience Weekly Summary 97-20

May 9 through May 15, 1997

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EVENTS

1. RADIOLOGICAL CONTROLS NOT FOLLOWED DURING CONSTRUCTION WORK

On May 6, 1997, at the Sandia National Laboratory, the facility manager designee for construction reported that subcontract construction workers excavated in a radiological soil contamination area without following the required radiological work controls. Radiological control technicians took surface probe readings of the area on May 6 and detected 100 to 400 dpm/probe for the disturbed soil and 100 to 4,000 dpm/probe for the soil within a 50-foot radius of the excavation. The hazard assessment for the work required a radiological work permit for excavations deeper than 6 inches and required notification of Radiation Protection Operations personnel before starting. The assessment also required general radiological training and radiological worker training for some activities. Preliminary investigation indicates that elements of the hazard assessment that addressed the radiological hazards had not been implemented. Further review will be necessary to determine how this occurred. This breakdown in work planning and control could have resulted in personnel and equipment contamination. (ORPS Report ALO-KO-SNL-NMFAC-1997-0005)

The construction workers were working on a power systems modernization project. The workers excavated the ground and installed a concrete transformer pad in mid-March. In mid-April, they dug four holes over 6 inches deep and installed traffic bollards. The work area was posted as a radiological soil contamination area, and personnel were required to contact Radiation Protection Operations staff before entering. The workers saw the posting but thought the work package authorized them to enter the area and start work. Entry into this area also requires general radiological training and radiological worker training. Health physics coverage is required if workers are excavating deeper than 6 inches.

A team from Sandia National Laboratory and DOE debriefed the construction workers and surveyed the subcontractor's facility, tools, trucks, and work areas. They found no contamination. Bio-assay testing on all workers involved in the project is underway. An investigation continues to determine the causal factors and identify corrective actions to prevent recurrence.

NFS reported a similar event in Weekly Summary 97-16. On April 8, 1997, at the Mound plant, workers contaminated their gloves and boots while taking core samples from an asphalt paved area with known sub-surface contamination. The workers were not wearing anti-contamination clothing. The boots of five workers had alpha contamination of 325 dpm to 4,200 dpm and the gloves of two workers had 450 dpm and 350 dpm. Investigators determined that planners failed to specify wearing protective clothing while working in the contaminated soil. (ORPS Report OH-MB-EGGM-EGGMAT04-1997-0003)

This event illustrates how the lack of effective oversight and work planning could affect worker safety. The responsibility for ensuring adequate planning and control of work activities resides with line management. Managers should ensure that work control processes are followed and contamination mechanisms are planned for and evaluated. Management and integrating contractors need to closely supervise subcontractors that perform construction and maintenance work at DOE facilities. They should ensure that subcontractor personnel have completed the required training and understand all hazards associated with the job and work place. Management and integrating contractors should

also provide safety oversight of subcontractor administrative controls, safety programs, and work plans to ensure subcontractor personnel perform work safely and in a safe working environment. Management and integrating contractors should review DOE 4330.4B, *Maintenance Management Program,* chapter II, section 8.3.6, "Control of Non-Facility Contractor and Subcontractor Personnel."

KEYWORDS: personnel safety, construction, contractor controls, radiation protection

FUNCTIONAL AREAS: construction, radiation protection

2. PROCEDURE VIOLATIONS RESULT IN ELECTRICAL SHOCK HAZARD

On May 8, 1997, at the Fernald Environmental Management Project, the facility manager reported that an electrical subcontractor was exposed to a 480-volt electrical shock hazard when he violated procedures. A subcontract electrician connected wiring in a repaired conduit for parking lot lighting to a 480-volt source without authorization and outside his job scope. There were no locks or tags on the equipment when he performed the work. The wires were not energized because a photo-eye control sensed sufficient outdoor illumination and was in the de-energized position. However, the photo-eye control could have energized the circuit in twilight or heavy cloud cover. To ensure positive isolation of energized circuits and minimize electrical shock hazards to personnel, lockouts and tagouts must be thoroughly planned and procedures must be strictly followed. (ORPS Report OH-FN-FDF-FEMP-1997-0032)

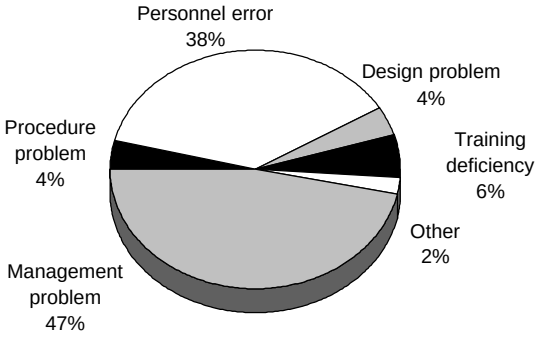
When a subcontract worker hit and broke a 480-volt conduit buried in the parking lot on April 30, 1997, the construction coordinator tasked the subcontractor with the repairing it, However, he did not assign anyone to reconnect the line after the repair. Electricians placed locks and tags on the supply breaker to prepare the line for repair. While the line was de-energized and tagged, electricians disconnected the wires contained in the broken conduit. This allowed the electrician to remove the locks and tags from the circuit breaker and provided power to other parking lot lights.

While the subcontractor electrician was repairing and wiring the conduit, maintenance and electrical personnel planned the task of reconnecting the wires. When the electrician pulled on the wire to make repairs, one came completely out of the junction box, causing the electrician to think he had pulled it loose. He tested the circuit and determined it was de-energized; so he re-attached the loose wire, reconnecting the circuit.

Investigators determined that no one wrote a work plan stating that the subcontractor would make the repairs or indicating how the repairs would be made. No one checked the system boundary or walked down the area before starting work. Investigators also determined the electrician did not know the configuration of the system or the location of the disconnected wires. When he tested the circuit, it was de-energized, so he assumed it was disconnected at another location. No one hung tags at the junction box to identify the disconnected wires, and no one placed locks or tags on the circuit breaker before the worker rewired it.

Operating Experience and Feedback (OEAF) engineers reviewed the Occurrence Reporting and Processing System (ORPS) database for electrical shock hazards with the direct cause of inadequate work planning or procedure violations and found 186 reports. Personnel errors and management problems were cited as the root cause for 85 percent of the reports. This indicates that most electrical shock hazards are preventable. Figure

2-1 shows the root causes of the electrical shock hazards related to procedure violations or work planning issues DOE-wide from 1990 to present.



Management Problem	Percent
Policy not communicated or enforced	34
Inadequate administrative control	24
Work organization/Planning deficiency	22
Other management problem	11
Inadequate supervision	9

Figure 2-1. Root Causes of Electrical Shock Hazards Related to Procedure Violations or Work Planning Issues DOE-wide[1]

This event illustrates the need for work planners and coordinators to ensure that plans accurately describe the work activity and specifically identify tasks and equipment or components. Work plans should be made for the entire job before it starts and should not be completed piecemeal as the job progresses. DOE-STD-1050-93, *Guideline to Good Practices for Planning, Scheduling and Coordination of Maintenance at DOE Nuclear Facilities,* section 3.1.1.3, provides the key elements of an effective planning program. The standard includes guidance recommending that experienced individuals conduct thorough reviews of work plans to eliminate any errors or confusion. Managers at DOE facilities should review their programs to ensure that planners, craftsmen, and engineers understand their responsibilities and obligations.

KEYWORDS: electrical, shock hazard, work planning

FUNCTIONAL AREAS: electrical maintenance, construction, work planning

3. HOT WORK ACTIVITIES RESULT IN CLOTHING FIRES

This week, Operating Experience and Feedback engineers reviewed two events where craft workers' clothing caught fire. Both individuals were wearing flame-resistant clothing and anti-contamination clothing. One fire occurred at Hanford; the other, at a commercial nuclear power plant. Investigators determined that the Hanford fire was caused by a piece of hot slag caught in the folds of the worker's anti-contamination clothing. The other fire was caused by a damaged hose from an acetylene-oxygen torch. Neither employee was burned. Clothing fires can be fatal, as demonstrated by the recent event at Oak Ridge, where a welder was fatally burned when his clothing caught fire. (ORPS Report RL--BHI-REMACT-1997-0005)

[1]OEAF engineers reviewed the ORPS GUI database for the nature of occurrence codes 3 (personnel safety) OR 10 (cross-category items) AND direct cause codes 6b (work organization/planning deficiency) OR 3b (procedure not used or used incorrectly) AND all narrative "electric*" for the period 1/1/90 to 5/15/97 and found 186 reports. A random review of 30 reports indicates that each slice of the pie is accurate to within ± 5.6 percent.

On May 7, 1997, two laborers at Hanford were cutting contaminated retention basin steel into 4-foot by 15-foot plates. Each laborer wore a single pair of anti-contamination coveralls, flame-resistant boot covers, leather leg coverings, and jacket. A radiological control technician in the area surveyed the plates before they were cut. When one of the laborers noticed a smell inconsistent with his cutting operation, he stopped cutting, looked around, and noticed the leg of his coveralls was on fire. The laborer put out the flame by patting it with his gloved hand.

The fire occurred at ankle level on the laborer's anti-contamination coveralls and burned a hole approximately 8 inches in diameter. The flame-resistant boot covers he wore under the anti-contamination coveralls were also burned. There was also minor burn damage to his jeans under the protective clothing. Managers at the Hanford Remedial Action Project have suspended all hot work until they can identify safer hot work practices.

On March 24, at a commercial nuclear power plant, pipefitters were pre-heating weld lugs with an oxygen-acetylene torch inside the reactor containment building. The pipefitters worked in the area for approximately 4 hours before the fire occurred. A pipefitter torch operator finished pre-heating a plate, shut off the acetylene torch, and laid it on the concrete platform behind him. When a pipefitter welder struck an arc with his weld rod, a flash occurred and his flame-resistant welding jacket caught fire. He immediately moved the weld rod away from the plate, stopping the arc. He descended a 5-foot platform, and a firewatch immediately removed his welding hood and jacket. This action extinguished the fire. The welder was not burned, but he did receive a mild contusion on his right knee when he brushed a steel structure while descending the platform.

Investigators determined that the March 24 fire was caused by a damaged acetylene hose. The inner neoprene elastomer on the hose was degraded to the extent that gas leaked through small cracks. Investigators also determined the event was minimized by the following.

- Workers performed the hot work in accordance with the approved hot work permit. Properly trained firewatch personnel were stationed at the hot work activity and responded appropriately.

- The pipefitter welder was wearing 100 percent cotton protective clothing and an approved fire-retardant welding jacket.

- The acetylene gas pressure was regulated to less than 15 psi for safety reasons.

Managers suspended all hot work in the containment building. Inspectors removed all acetylene-oxygen hoses from the containment to conduct visual inspections and snoop-testing. They removed four hoses from service based upon their visual examination.

These events illustrate the potential hazards when clothing, including flame-resistant clothing, comes in contact with flames or hot objects. DOE O 440.1, *Worker Protection Management for DOE Federal and Contractor Workers,* requires DOE site organizations to implement a written worker protection program that provides a place of employment free from recognized hazards that are causing or are likely to cause death or serious physical harm. The Order also requires facilities to implement a hazard prevention and abatement process to ensure identified hazards are managed through final abatement and control.

When a serious hazard is identified, management must assess the process and take appropriate steps to prevent, abate, or mitigate the hazard.

The power plant event also demonstrates the importance of having hoses in good condition, especially if they are attached to cylinders containing flammable gases. OSHA Regulation 29 CFR 1917.152 *Welding, cutting and heating (hot work)*, section (d)(2)(v) states that hoses shall be inspected before use. Hoses subjected to flashback or showing evidence of severe wear or damage shall be tested to twice-the-normal working pressure but not less than 200 psi. The Regulation also states that defective hoses shall not be used. U.S. National Research Council publication ISBN 0-309-05229-7, *Prudent Practices in the Laboratory: Handling and Disposal of Chemicals,* 1995, recommends that all pressure equipment and assembled apparatus be tested and inspected periodically. The frequency of the inspection should be dependent on the frequency of use, nature of use, and the corrosive properties of the stored material. Testing assemblies with soap solution and air or nitrogen pressure to the maximum working pressure can usually detect leaks at critical points. Managers at DOE facilities should review their cylinder and hose inspection program to ensure that damaged or degraded hoses are identified and removed from service before they can cause a personnel hazard.

KEYWORDS: fire, combustible materials, anti-c clothing

FUNCTIONAL AREAS: industrial safety, fire protection

4. CHLORINE EMISSIONS EXCEED LIMIT DURING INCINERATOR TRIAL BURN

On May 12, 1997, at the Idaho National Engineering Laboratory Waste Experimental Reduction Facility, the facility manager reported that, during a trial burn of a new incinerator, the chlorine emissions exceeded the administrative limit. Operators performed the Resource Conservation and Recovery Act (RCRA) trial burn to establish permit conditions for the incinerator. During a low temperature trial burn on May 9, 1997, a continuous emissions monitor indicated that excessive hydrogen chloride was being burned. Operators believed the indications were invalid and did not abort the test. However, subsequent analysis proved the indications were valid. Failure to act upon unexpected indications resulted in chlorine emissions in excess of administrative limits. (ORPS Report ID--LITC-WERF-1997-0005)

In order to simulate actual operating conditions, operators used water extracted from low-level mixed waste. The primary ingredients of the mixed waste were trichloronaphthalene (TCA) and water. Operators poured the low-level mixed waste into a 55-gallon drum and allowed the waste to separate into TCA and water. Operators then pumped the water out of the drum, ensuring the inlet hose did not penetrate the TCA (see figure 4-1). Operators used this method successfully during a preliminary burn in January and an initial trial burn on May 8.

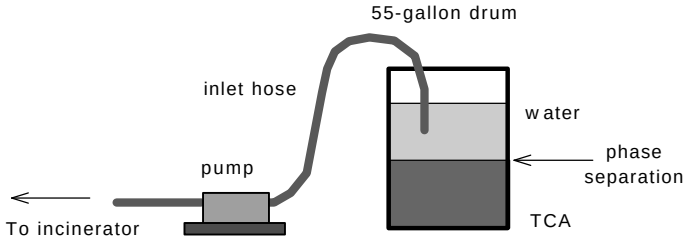


Figure 4-1. Method Used to Pump Water from Mixed Waste to Incinerator

Before the May 9 trial burn, operators failed to observe phase separation in the drum and assumed there was no TCA present. They placed the inlet hose deep enough into the drum to penetrate the TCA area. When they ran the incinerator, the indicated concentration on the continuous emissions monitor rose rapidly and continued to spike high periodically for about 2 hours. Operators inspected the monitor and found high levels of condensation in some sample lines. Because they believed the waste fed to the incinerator was not the cause of the high hydrogen chloride levels, they assumed that the condensate in the sample lines had an adverse effect on the monitor. After the trial burn was completed, they sent a sample from an off-gas sample train to a laboratory for analysis. Laboratory technicians confirmed that the monitor indications were accurate.

Investigators determined that the administrative limit for emissions at the interim status facility had been exceeded. They immediately informed representatives of the Idaho Department of Environmental Quality and the Idaho Environmental Protection Agency who were at the facility to witness the trial burn. Operators isolated the suspect waste from the test and completed the last two low-temperature trial burns without incident.

NFS reported on events where employees failed to believe indications in Weekly Summaries 96-52, 95-49, 95-23, 94-36, 94-25, 93-46, and 93-39. Weekly Summary 93-39 reported on an event at Paducah, where 13 workers were exposed to uranium hexafluoride. The workers responded to a uranium hexafluoride alarm they thought was false and failed to wear proper respiratory protection. Nine of the workers received uptakes.

This event illustrates the importance of accepting instrument readings and making conservative decisions when confronted with unexplained indications. In this event, if the operators had suspended the test until they received the results of the sample analysis, the violation would never have occurred. DOE 5480.19, *Conduct of Operations Requirements for DOE Facilities,* chapter III, section b.6, states: “Operators should believe instrument readings and treat them as accurate unless proven otherwise. Ignoring an unusual reading because an operator believes an instrument is faulty can cause abnormal conditions to be undetected. In general, operators should check other indications, if possible, when unexpected readings are observed.” Managers at DOE facilities should ensure their personnel make conservative decisions and trust their instruments until proven otherwise.

KEYWORDS: incinerator, instrumentation, violation

FUNCTIONAL AREAS: environmental protection, chemistry, operations

5. UNAUTHORIZED ACCESS TO POSTED AREA

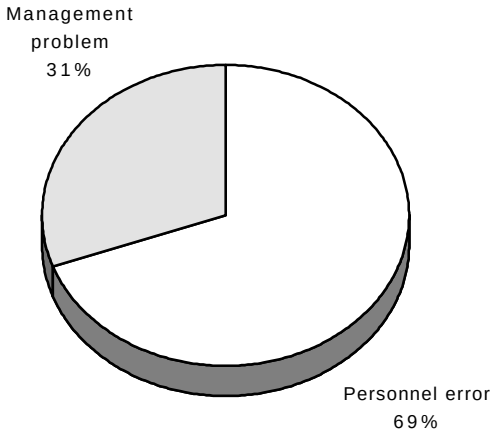
On May 12, 1997, at the Oak Ridge Y-12 Site, a utility operator accessed a building roof without wearing a personal radiation detection device as directed by a posting on the doorway leading to the roof. The doorway was posted because of audibility deficiencies associated with the building criticality accident alarm system. In addition to the requirement for radiation detection devices, the posting also required approval from the building operations manager before access. Failure to comply with access postings can result in personnel radiation exposures, and failure to obtain access approval can hinder accountability of personnel within posted areas. (ORPS Report ORO--LMES-Y12NUCLEAR-1997-0018)

Operations personnel, performing a building walk-through, summoned the utility operator on the roof and informed him of the requirement for a personal radiation detection device. The utility operator stated that the door had been propped open for at least 2 months and the posting was not visible with the door open. Operations personnel immediately shut the door to make the posting visible. The Y-12 plant shift superintendent directed operators to check other postings in the building for legibility and to add additional postings to ensure visibility whether the door was open or shut. Managers briefed utility operators on the existence of areas with criticality accident alarm system audibility deficiencies and on the associated access requirements.

A similar event occurred on July 8, 1996, at another Y-12 Site building. In this event an operator accessed a stairwell that had inadequate criticality accident alarm system coverage. The operator did not have the required radiation detection device. Investigators determined that the posting, which required hand-held radiation detection devices, was not visible because the door was propped open. Operators relocated the posting to ensure it was visible with the door open. Investigators determined the direct cause of the event to be personnel error because the sign was not posted where it would always be visible. The contributing cause was training deficiency because personnel were not specifically trained on postings for the criticality accident alarm system. Investigators determined the root cause was management problem because management's policy on posting signs about inaudibility of criticality accident alarm systems was not adequately disseminated.

NFS reported other events where postings were violated in Weekly Summaries 97-18, 97-06, 96-37, 96-26, 96-25, 96-05, and 95-18. Weekly Summary 96-05 reported on January 24, 1996, at Savannah River Site, a laundry worker violated radiological control postings and procedures when he entered a shed posted as a contamination area without reading the radiological postings. The laundry worker did not wear protective clothing, did not sign on the radiological work permit, and did not have the proper level of Rad Worker training. Investigators determined that the posting was obscured when the worker's helper opened the doors to the shed. (ORPS Report SR--WSRC-REACP-1996-0002)

Operating Experience Analysis and Feedback (OEAF) engineers reviewed the Occurrence Reporting and Processing System (ORPS) database for reports involving violations of postings and found 36 occurrences. Figure 5-1 shows the distribution of root causes reported by facility managers for these events. Personnel error represented 69 percent of the root causes and management problems, 31 percent. Inattention to detail accounted for 56 percent of the personnel errors and inadequate administrative control accounted for 46 percent of the management problems.



Personnel Error	Percent
Inattention to detail	56
Procedure not used or used incorrectly	36
Communication problem	8

Management Problem	Percent
Inadequate administrative control	46
Policy not adequately defined or enforced	27
Inadequate supervision	18
Work organization/Planning deficiency	9

Figure 5-1. Distribution of Root Causes for Posting Violations[1]

These events underscore the importance of reading, understanding, and following the requirements of posted signs before opening doors or entering areas. Facility managers should ensure that access control signs are clearly worded, conspicuously posted, and always visible before entry. Personnel should be cautioned about propping open doors that can obscure postings. Surveillances should be conducted to verify that required postings are present and legible. Signs are important to facility residents and visitors because they provide information on (1) entry requirements, (2) notification requirements, (3) storage limits, and (4) health hazards, like chemicals, explosives, and radioactivity. DOE/EH-0256T, *Radiological Control Manual*, part 3, "Posting," contains requirements for posting of radiological areas. In addition, parts 601 through 603 of 10 CFR 835 establish requirements for posting radiological areas.

KEYWORDS: posting, signs, access control, criticality alarm

FUNCTIONAL AREAS: operations, nuclear/criticality safety, radiation protection

OEAF FOLLOWUP ACTIVITIES

1. CORRECTION TO WEEKLY SUMMARY 97-17, ARTICLE 3

The title and the first paragraph of Article 3 in Weekly Summary 97-17 incorrectly stated that a visiting engineer received an electrical shock. The engineer was not injured or

[1] OEAF engineers searched the ORPS database for final reports during the period 01/01/96 through 05/15/97 and all narrative "violat@ AND posting@" and found 82 occurrence reports. A 100 percent review of these reports yielded 36 events.

shocked when he reached into the damaged capacitor case he was inspecting. However, an electrical discharge from the stored energy of the capacitor elements occurred on two occasions when he reached inside the case. The energy stored within the capacitor and the electrical discharges provided the potential for electrical shock.

KEYWORDS: electrical shock, visitor, capacitor, permit

FUNCTIONAL AREAS: industrial safety, operations

2. CLARIFICATION TO OEWS 97-18, ARTICLE 1, "CRITICALITY SAFETY POSTING NOT FOLLOWED FOR GLOVEBOX"

A reader contacted OEAF engineers and requested the dates for the search criteria used to produce the figure in the article. The dates were inadvertently left out of the article. The data range was 1988 to May 1, 1997.