OPERATING EXPERIENCE SUMMARY

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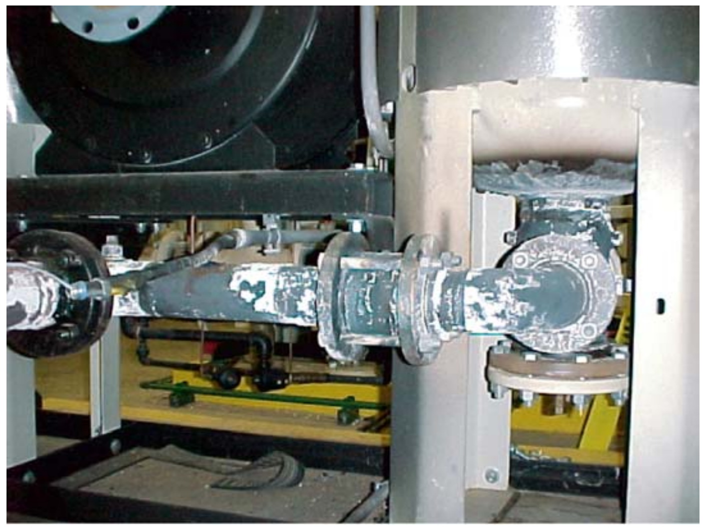

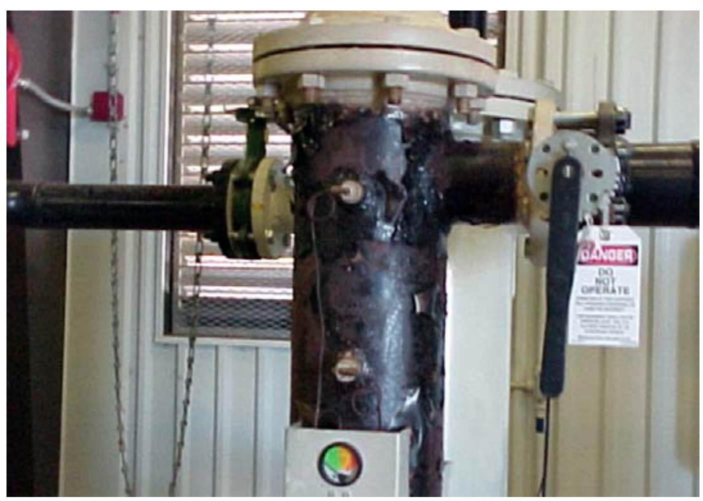

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The Office of Environment, Safety and Health, Office of Corporate Performance Assessment publishes the Operating Experience Summary to promote safety throughout the Department of Energy complex by encouraging the exchange of lessons-learned information 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. If you have difficulty accessing the Summary on the Web (URL http://www.eh.doe.gov/paa), please contact the ES&H Information Center, (800) 473-4375, for assistance. We would like to hear from you regarding how we can make our products better and more useful. Please forward any comments to Frank.Russo@eh.doe.gov.

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EH Publishes "Just-In-Time" Reports

The Office of Environment, Safety and Health recently began publishing a series of "Just-In-Time" reports. These two-page reports inform work planners and workers about specific safety issues related to work they are about to perform. The format of the Just-In-Time reports was adapted from the highly successful format used by the Institute of Nuclear Power Operations (INPO). Each report presents brief examples of problems and mistakes actually encountered in reported cases, then presents points to consider to help avoid such pitfalls.

1. Deficiencies in identification and control of electrical hazards during excavation have resulted in hazardous working conditions.
2. Deficiencies in work planning and hazards identification have resulted in electrical near misses when performing blind penetrations and core drilling.
3. Working near energized circuits has resulted in electrical near misses.
4. Deficiencies in control and identification of electrical hazards during facility demolition have resulted in hazardous working conditions.
5. Electrical wiring mistakes have resulted in electrical shocks and near misses.
6. Deficiencies in planning and use of spotters contributed to vehicles striking overhead power lines.

The first six Just-in-Time reports were prepared as part of the 2004 Electrical Safety Campaign. In April, the Office of Environment, Safety and Health published a Special Report on Electrical Safety. The purpose of this report is to describe commonly made electrical safety errors and to identify lessons learned and specific actions that should be taken to prevent similar occurrences. This report can be accessed at http://www.eh.doe.gov/paa/reports/Electrical_Safety_Report-Final.pdf

EH plans to issue more Just-in-Times soon on other safety issues, such as lockout and tagout, fall protection, and freeze protection. All of the Just-in-Times can be accessed at http://www.eh.doe.gov/paa/reports.html.

EVENTS

1. UNUSUAL VALVE HANDLE CONFIGURATION LEADS TO VALVE POSITION ERRORS

On April 21, 2004, at the Hanford Spent Nuclear Fuels Project, an incorrect valve line-up resulted in the unexpected operation of a pressure relief valve. When the event occurred, operators were attempting to swap ion exchange modules. Based on their understanding of valve operation and handle configuration, the operators believed the system valves were open; however, the valves were actually closed. (ORPS Report RL--PHMC-SNF-2004-0016)

The inlet valves to the ion exchange modules are ball valves, which typically rotate 90 degrees from full closed to full open. The valves installed in this system have an unusual configuration in that the valve handle is in-line with the pipe when the valve is closed. This is the opposite of normal convention, so when the operators looked at the valves, they appeared to be open.

The operators checked the valve positions in accordance with their operating procedure, which only directed them to verify that the valves were open. However, because the inlet valves were actually closed, the pressure at the discharge of a pump increased to the relief valve setpoint, causing the valve to lift. With the relief valve open, fluid was recirculated to the basin from which it was drawn.

The handle on the ball valves has a position indicator, but it must be viewed up close to be seen clearly. Investigators believe that the operators looked down at the valves from a catwalk and assumed the valves were in the open position based on normal valve convention. The operators involved in this event had not performed this operation in some time and were not familiar with the valve handle configuration on these modules.

Although facility managers continue to review this event, the operating procedure for the ion exchange system will be revised to include a "Caution" that will ensure operators understand the valve operation and handle configuration. Also, operators will attend refresher training that will stress this issue.

DOE-HDBK-1018/2-93, *DOE Fundamentals Handbook, Mechanical Science, Volume 2 of 2*, states that most ball valves are equipped with stops that permit only a 90-degree rotation because that is all that is required to fully close or open the valve. The handle indicates valve position. When the handle lies along the axis of the valve, the valve is closed. Figure 1-1 is a graphic from the handbook showing ball valve operation with a normally configured operating handle. Some ball valve stems have a groove machined in the top face of the stem that indicates the flow path through the ball. Observation of the groove indicates the position of the port through the ball. The handbook can be accessed at http://www.eh.doe.gov/techstds/standard/appframe.html.

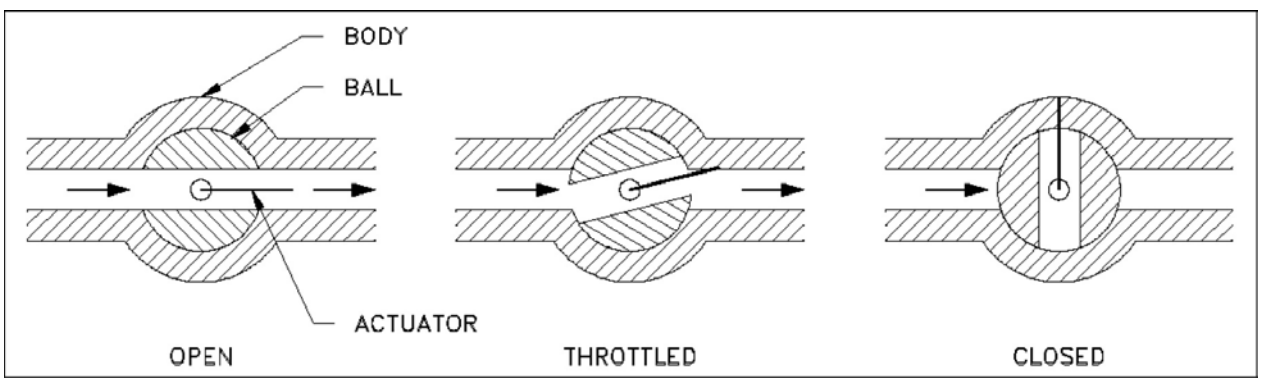

Figure 1-1. Graphic of ball valve operation showing position of handle (actuator)

Valve position errors have resulted in spills and inadvertent transfers. At the Hanford Tank Farms, operators inadvertently drained 2,450 gallons of water into a tank because a valve and reach rod were not configured according to expected facility convention and were not labeled to indicate the difference. In the closed position, the valve handle was in line with the piping instead of perpendicular to the piping. (ORPS Report RL--PHMC-TANKFARM-1997-0025)

Facility operators need to properly identify the correct position of valves, including performing a hands-on verification (if practical). The need to perform a hands-on verification was made clear in an event at Fernald where a newly installed ball valve was not fully closed, resulting in the release of 500 gallons of water. Operators had verified the valve closed visually, checking to ensure that the handle was perpendicular to the piping; however, the valve was installed such that the handle had to be slightly past the perpendicular position to be fully closed. (ORPS Report OH-FN-FFI-FEMP-1994-0103)

These events emphasize the importance of ensuring that operating procedures include precautions and notes on operational or equipment limitations, including configurations that run contrary to normal convention. DOE-STD-1029-92, Writer's Guide for Technical Procedures, *provides guidance on including warnings, notes, and cautions in procedures. Operator training programs, both initial and refresher, need to include important information on equipment configuration and address any associated idiosyncrasies to ensure this information is not left to "tribal knowledge." This is particularly necessary for operations that may be performed infrequently. Operators should be encouraged to perform hands-on verification of valve positions where feasible rather than relying on visual checks. A physical check (by movement) is the most reliable way to ensure correct positioning.*

KEYWORDS: *Valve, handle, miss position, procedure, inadvertent transfer, precautions, training*

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

2. OSHA STANDARD FOR TRENCH SHORING/SLOPING NOT FOLLOWED

On February 5, 2004, at the Stanford Linear Accelerator Center, a construction inspector spotted a subcontractor worker standing in an open trench that was inadequately shored and too steeply sloped. The spoil pile of dirt was also too close to the edge of the trench. The construction inspector stopped work and ordered an investigation. (ORPS Report OAK--SU-SLAC-2004-0001)

The trench was about 13 feet deep on one end and 7 feet deep on the other. The slope was estimated to be 1 foot horizontal for every 3 feet vertical (1:3), although Appendix B, *Sloping and Benching,* to OSHA standard 29 CFR 1926, Subpart P, states that the maximum allowable slope for Type C soil is 1.5 feet horizontal to 1 foot vertical (1.5:1). An onsite competent person had previously determined that the soil was Type C.

Table 1 shows the definition for each soil type, as defined in Appendix A to 29 CFR 1926, Subpart P. Table 2 lists the OSHA-required sloping for each type of soil. The allowable slope for Type C soil in trenches 5 feet and deeper is depicted in Figure 2-1. A representation of the 1:3 slope at the Stanford construction site is shown in Figure 2-2 for contrast.

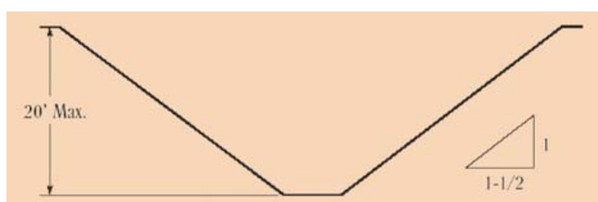

Figure 2-1. A 1.5:1 slope (34 degrees)

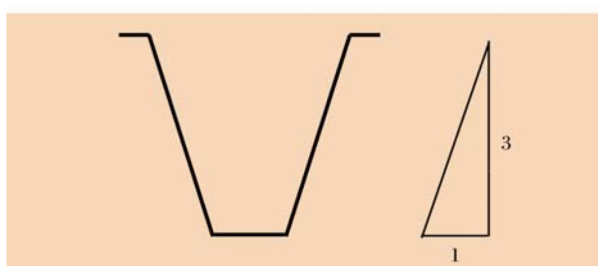

Figure 2-2. A 1:3 slope

The safety plan recommended performing the work from above, and the subcontractor's work plan stated that no workers were allowed in the trench. After the inspector stopped work, safety barriers were placed around the trench and a safety review ensued.

The ORPS database contains other examples of inadequate shoring and sloping in trenches. At Brookhaven National Laboratory on October 21, 2003, a facility support technician observed a trench that workers had excavated to access and disconnect water pipes. The technician saw that the trench, measuring approximately 10 feet wide, 18 feet long, and 5½ feet deep, was inadequately sloped or shored. There were no workers in the trench at the time. The technician told the workers of her concern, and they agreed to slope the trench before entering it to resume work. (ORPS Report CH-BH-BNL-PE-2003-0004)

Table 1. Soil types

Type A	• Cohesive soils • Clay, silty clay, sandy clay, clay loam
Type B	• Dry rock that is not stable • Previously disturbed Type A soil • Angular gravel. Silt, loam, silt loam, sand loam
Type C	• Granular soils • Submerged or unstable rock

The east side of the excavation was sloped at a 34-degree angle, appropriate for the Type C soil at the laboratory. The south side of the excavation, however, had a 45-degree slope; therefore, it should have been cut back about 2 feet to comply with the 34-degree slope requirement. The north side was sloped at nearly a 90-degree angle with a 2-foot bench at a height of 4 feet from the bottom of the trench. However, since no credit is given for benching in Type C soil, the north side needed to be cut back 4½ feet to achieve the 34-degree slope. An investigation revealed that the workers were unaware that they had dug deep enough to require shoring or cave-in protection. In addition, the job supervisor failed to assign a competent person to inspect excavation work, as required by OSHA in 29 CFR 1926.651(k).

On August 13, 2003, at the Test Area North facility at Idaho National Environmental and

Table 2. Slope requirements

SOIL TYPE	SLOPE	DEGREES
Stable Rock	Vertical	90
Type A	0.75:1	53
Type B	1:1	45
Type C	1.5:1	34

Engineering Laboratory, a worker walking past an excavation noticed that its north face appeared to be steeper than 1.5:1. A fact-finding investigation determined that the north slope of the excavation did exceed 34 degrees. In addition, management discovered that radiological control personnel had entered the excavation 2 weeks earlier to survey. (ORPS Report ID--BBWI-TAN-2003-0007)

Investigators found that a safety professional, who was not qualified as a competent person, had evaluated the soil on the excavation's north face on July 23 and determined it to be Class B. The OSHA standard states that Class B soil can have a 1:1 slope (45 degrees). The safety professional failed to document this designation and did not inform the radiological control technician who entered 2 feet into the trench to perform surveys. Management had previously issued a directive stating that all soil at Idaho is considered to be Type C soil and may not be reclassified except by a professional engineer. The facility issued a lessons learned document on the need to follow site procedures for soil classification and to document excavation inspections. Managers of excavation sites will keep in daily contact with industrial safety experts, who will increase their oversight of existing excavation sites.

Trenching accidents are among the leading causes of serious injuries or fatalities at construction sites. Bureau of Labor Statistics for the period 1992 through 2001 show fatalities from trench collapses averaged 54 per year and 102 injuries per month. Excavations, even in soil that appears to be well-compacted and stable, can unexpectedly cave in if improperly shored or too steeply sloped. Workers can become trapped and crushed or asphyxiated. Workers, management, and safety personnel involved in excavation work should be fully familiar with 29 CFR 1926

*Subpart P (*URL http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10930). *These three events, in particular, illustrate the necessity of having only competent persons perform thorough onsite inspections. Planning is also an essential component of working safely.*

KEYWORDS: *Trench, shoring, sloping, excavation, OSHA, near miss*

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

3. ACCUMULATION OF OIL IN COMPRESSED AIR SYSTEM RESULTS IN FIRE

On August 28, 2003, at the Pantex Plant, vapors from accumulated oil in a compressed air system dryer ignited causing a fire inside the piping system. The fire self-extinguished when the oil was consumed. A utilities operator and his supervisor discovered the problem while responding to a low air pressure alarm in the compressed air facility. The supervisor, who heard air leaking and smelled hot paint, immediately called the fire department. Firefighters found no smoke or fire but several components of the compressed air system showed signs of extreme heat, such as burning paint from the lower section of the dryer, a filter housing, and connecting piping. A combination of no preventive maintenance and inattentive maintenance contributed to this incident. (ORPS Report ALO-AO-BWXP-PANTEX-2003-0043; final report filed January 12, 2004)

The fire, fueled by oil from the primary air compressor, started within the piping between a heater and the west drying tower of dryer No. 2 (Figure 3-1) during its desiccant regeneration cycle.

The fire burned from the lower portion of the tower in one direction and traveled through a check valve into the compressed air stream flowing from the east tower. The fire continued to burn through several gaskets in pipe joints and also traveled downstream into a particulate filter (Figure 3-2).

The fire self-extinguished when the oil was consumed, and the fire remained confined to the dryer. The compressed air system, by design and with the appropriate maintenance, should not allow oil to enter the drying towers.

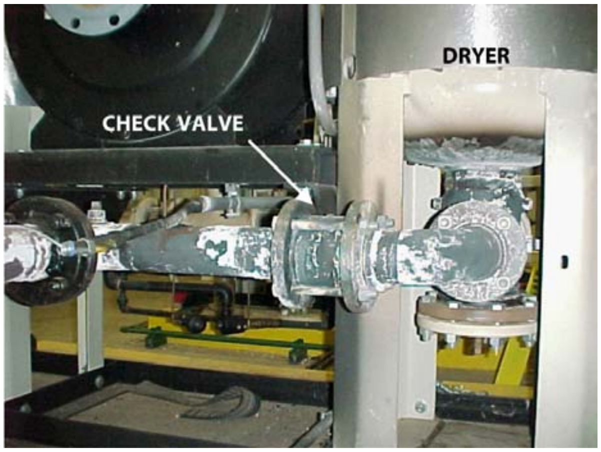

Figure 3-1. Fire-damaged bottom of dryer and piping

Investigators determined that an equipment problem was the direct cause of this event. Excessive oil traveled from the air compressor and accumulated downstream of the filter, receiver, and separator, which is designed to remove oil from the compressed air. Forced hot air (400°F to 425°F) was sufficient to ignite oil vapors in the piping near the downstream exit of the drying tower, resulting in a brief but hot fire. Investigators identified the following three contributing causes for this event.

1. A lack of procedure resulted in no preventive maintenance being prescribed or performed on the dryers or their associated filters during 3 years of operation. This allowed oil to buildup in the dryer filters, piping, and desiccant tower to go undetected.

2. Inattention to detail by utilities operators resulted in warning signs of problems not being investigated and resolved in a timely manner. These signs included excessive oil consumption by the compressor and dew point temperature alarms. In addition, the filter and separator differential pressure instrumentation never indicated a pressure drop.

3. Defective or inadequate procedures for post-installation testing and commissioning of the equipment in the year 2000 failed to detect quality problems with system instrumentation. For example, on both dryers, the pressure differential gauge for the particulate filter was installed "backwards," and an air saver temperature sensor was wired incorrectly. Although this sensor did not directly contribute to the accident, it indicates the ineffective startup testing.

Figure 3-2. Fire-damaged filter housing

Investigators determined that the root cause of the incident was inadequate administrative control. There was a lack of formality in the commissioning process necessary to place the equipment in a stable condition for plant operations. As a result, the equipment was not thoroughly checked out or adequately maintained.

The following corrective actions have been implemented to address the causal factors and the judgments of need that resulted from the accident investigation.

- The separator element in the compressor and the filter in dryer No. 1 were replaced.
- Regular preventive maintenance has been established.
- Guidelines for preventing and dealing with utility system problems have been established and distributed to utilities supervisors and system engineers/owners.
- The route sheets for the utilities operators were revised to include the manufacturer's requirements for system operation and inspection.
- Utilities personnel will lead a management assessment of the commissioning process for new and/or modified utility systems and facilities.

Air compressor fires and explosions can occur in both lubricated reciprocating and oil-flooded rotary air compressors. Although this is a fairly uncommon event, without effective preventive maintenance, a system or equipment can easily fall into disrepair; reducing its reliability, operational efficiency, and safety.

This event underscores the importance of maintaining a safe and functional infrastructure by ensuring that preventive maintenance programs include all equipment and systems that support the operation and function of the facility infrastructure. In addition, this event emphasizes the importance of conducting proper installation verification and testing when commissioning new equipment and systems. It also highlights the importance of performing routine operational checks in accordance with sound operating practices and a questioning attitude. Manufacturer's recommendations should be followed during installation and, operation and should be included in preventive maintenance scheduling.

KEYWORDS: *Fire, preventive maintenance, compressed air, dryer, filter, oil, installation, testing, startup, infrastructure*

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

Commonly Used Acronyms and Initialisms

Agencies/Organizations	
ACGIH	American Conference of Governmental Industrial Hygienists
ANSI	American National Standards Institute
DOE	Department of Energy
DOT	Department of Transportation
EPA	Environmental Protection Agency
INPO	Institute for Nuclear Power Operations
NIOSH	National Institute for Occupational Safety and Health
NNSA	National Nuclear Security Administration
NRC	Nuclear Regulatory Commission
OSHA	Occupational Safety and Health Administration
SELLS	Society for Effective Lessons Learned

Units of Measure	
AC	alternating current
DC	direct current
psi (a)(d)(g)	pounds per square inch (absolute) (differential) (gauge)
RAD	Radiation Absorbed Dose
REM	Roentgen Equivalent Man
v/kv	volt/kilovolt

Job Titles/Positions	
RCT	Radiological Control Technician

Authorization Basis/Documents	
JHA	Job Hazards Analysis
NOV	Notice of Violation
SAR	Safety Analysis Report
TSR	Technical Safety Requirement
USQ	Unreviewed Safety Question

Regulations/Acts	
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
RCRA	Resource Conservation and Recovery Act
D&D	Decontamination and Decommissioning
DD&D	Decontamination, Decommissioning, and Dismantlement

Miscellaneous	
ALARA	As low as reasonably achievable
HVAC	Heating, Ventilation, and Air Conditioning
ISM	Integrated Safety Management
ORPS	Occurrence Reporting and Processing System
PPE	Personal Protective Equipment
QA/QC	Quality Assurance/Quality Control