U.S. Department of Energy
Office of Environment, Safety and Health
July 25, 2005

OPERATING EXPERIENCE SUMMARY

OE SUMMARY 2005-11

Supervisory Errors Result in Occupational Exposure

1

On June 30, 2005, Los Alamos National Laboratory (LANL) issued a final report to ORPS detailing an October 2003 occupational exposure to hydrochloric acid (HCl) that occurred when two maintenance technicians were cleaning an etcher with the acid while wearing HEPA filter cartridges instead of acid gas cartridges on their air-purifying respirators. One of the technicians was later diagnosed with an occupational injury as a result of the exposure. (ORPS Report ALO-LA-LANL-FIRNGHELAB-2005-0005)

Investigators determined that, among other causal factors, poor supervision contributed to this event. Although the technicians left the room twice and reported smelling acid while wearing their respirators, the supervisor told them to keep working. The LANL web-based respirator training, which both technicians had taken, directs workers to exit the work area *immediately* if they smell an unusual odor or notice irritation. Because the technicians were relatively new to this task, they apparently were reluctant to override the supervisor and stop work.

The first time the workers smelled the acid and noticed a burning sensation in their throats, they left the area and reported to the supervisor. However, the supervisor was not familiar with the task and assumed that their respirators were not strapped tightly enough. The technicians checked the seals, re-entered the room, quickly finished pouring the acid, and came back out. Another technician, also wearing a HEPA filter cartridge on his respirator, entered the room just long enough to cap the empty acid bottles and left.

Upon hearing of the event, line management directed the technicians to report to the LANL occupational medicine unit for evaluation, where they were examined and released without restrictions. The next day, industrial hygiene staff informed the technicians that they had used the wrong cartridges. A critique was convened, during which the technicians described their activities. Site industrial hygienists concluded at that time that the technicians were not overexposed to HCl.

Several weeks later, one of the technicians reported to the occupational medicine unit complaining of respiratory problems. He underwent a series of examinations and finally in February 2005 was diagnosed with an occupational exposure. Facility personnel attempted to reconstruct the event to determine an estimated level of exposure. Their results yielded less than half of the short-term exposure limit for HCl, but the technician may have had pre-existing health conditions that were aggravated by the exposure. The technician has been reassigned to other work that accommodates his limitations.

OSHA Standard 1910.134(d) requires employers to evaluate workplace respiratory hazards, furnish the appropriate respiratory protection, and ensure that it is used properly. At LANL, supervisors are responsible for specifying the respirator and cartridge needed for a particular work package and for making sure that workers wear the respiratory protection specified in the package. However, in this case, the supervisor was unfamiliar with the task of etcher maintenance and did not know what respiratory protection would be needed.

Corrective actions included reinforcing the importance of stopping work when an unexpected hazardous condition arises, improving facility on-the-job training and procedures, and placing a qualified supervisor in the facility to oversee maintenance work.

Two events were reported in ORPS over the past month where one of the contributing causes was inadequate supervision. These are summarized below.

- On July 20, 2005, at the Idaho Advanced Test Reactor, facility management discovered that while workers were performing maintenance on a shim rod, they did not lock and tag out the rod drive and isolate seal water, although it was required in the work order. The shift supervisor had reviewed the work order and thought that "and" and "or" statements gave him the flexibility to determine that the power could be controlled without locking and tagging out the rod drive. This event was reported as a near miss because of the potential for workers to be exposed to the seal water (pressurized contaminated liquid). (ORPS Report ID--BEA-ATR-2005-0006)
- On June 6, 2005, at Sandia National Laboratory, a recently hired technologist received an electrical shock while changing out a 7-amp fuse in a variable power supply unit during a pre-burn inspection check. The lead technologist (who was supervising him) assumed that the fuse compartment was not energized when the power switch was off. However, he was unaware that the fuse was designed to be live when the switch was off, and told the technologist to turn off the power switch before removing the blown fuse. (ORPS Report ALO-KO-SNL-2000-2005-0004)

The U.S. Chemical Safety and Hazard Investigation Board (CSB) reported on a February 2001 accident at Bethlehem Steel's Burns Harbor mill in Chesterton, Indiana, that resulted in several injuries and fatalities. Two people were killed and four were injured in a blast and fire that occurred in the plate mill. Millwrights were loosening a flange to a cracked valve they were preparing to replace. As they did so, coke oven gas condensate leaked out and soaked the millwrights. A nearby electric space heater most likely caused the condensate to ignite and spread to the valve, causing a blast that sprayed the burning condensate all over the room. (CSB Report No. 2001-02-I-IN)

Root causes included inadequate supervision, planning, and execution of maintenance work. For example, CSB investigators found that maintenance workers often bypassed lockout/tagout procedures when performing maintenance on the coke oven gas lines, apparently without oversight. Also, managers and supervisors were aware that the flammable condensate was accumulating faster than expected, but failed to take action to control it or to plan the task of replacing the valve to mitigate the hazard.

These events illustrate the importance of competent supervision. A supervisor's role is to ensure that those who work for him or her successfully and safely get the job done. Managers and supervisors must understand the complete scope of a work evolution, provide the necessary guidance and oversight, and be aware of what their workers are doing so that they can stop work if they see a potentially unsafe condition.

KEYWORDS: *Supervisor, supervision, respirator, occupational exposure, stop work*

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

Lack of Maintenance Contributes to Fire in Welder/Generator

2

On May 12, 2005, at the Yucca Mountain Site, a fire started in a gasoline-powered welder/generator being used by a work crew. One of the crew members used a hand-held fire extinguisher to put out the fire. None of the workers was injured during this near-miss event, and damage was limited to the welder/generator. Investigators determined that preventive maintenance on the welder/generator was less than adequate. (ORPS Report HQ--BSYM-YMSGD-2005-0006; final report filed July 5, 2005)

A Bechtel-SAIC Company crew was using the welder/generator to power a drill while working on a mainline track switch. They saw smoke coming from the welder/generator, which was on the back of a mechanic truck (Figure 2-1). One of the crew reported the fire on his radio while another crew member turned off the welder/generator and unplugged the drill. They observed flames through the smoke and quickly extinguished the fire. Pending an investigation of the cause of the equipment failure, the battery cables were disconnected to prevent the welder/generator from being started.

The welder/generator, a Trailblazer model manufactured by Miller, was originally purchased in October 1997. In February 2003, preventive maintenance on welding machines was cancelled. Based on an inspection of the equipment, it appears that an electrical short from damaged low-voltage wires started the fire. The age of the welder/generator and the lack of maintenance were contributing factors.

Figure 2-1. Welder/generator (blue) on bed of mechanic truck

Investigators found several bare, small-gauge wires that appeared to have been abraded through normal use and equipment transportation. The insulation on the heavy-gauge power leads was severely cracked and flaked off when the cable was handled (Figure 2-2). The damage appeared to be from exposure and use over the lifetime of the equipment. It is unlikely that anyone would have discovered the damaged wiring during normal use, which underscores the importance of performing regular maintenance and equipment inspections.

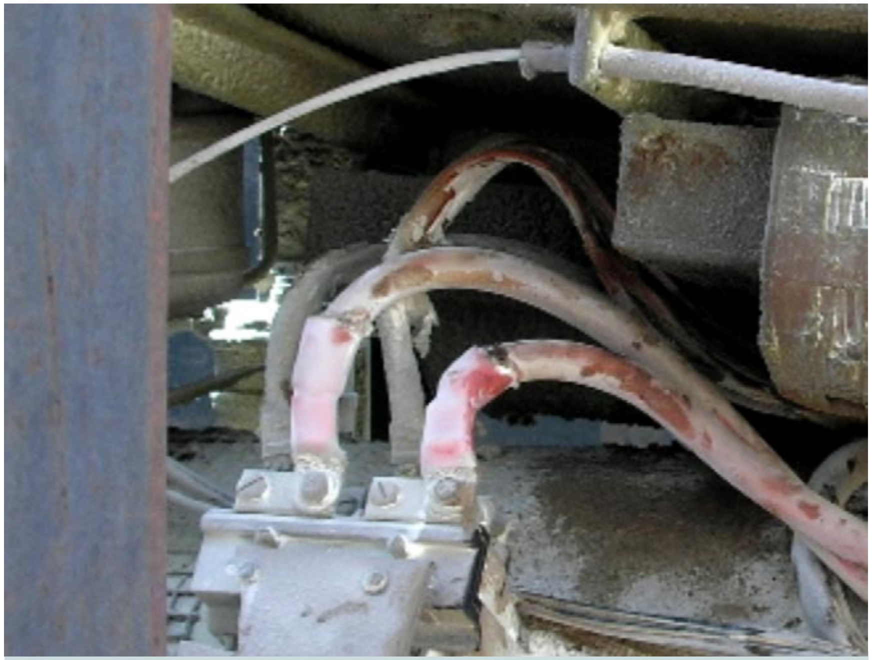

Figure 2-2. Cracked insulation on cables

Investigators also found an excessive buildup of diesel fuel and dust on the welder/generator. The fuel buildup appeared to have come from filling the fuel tank. Fuel on the electrical insulation would have contributed to degradation of the insulation. The accumulation of dust could have caused the buildup of excessive heat in the electrical components.

Paragraphs 5.11 and 6.3.2 of American Welding Society code D1.1, *Structural Welding Code—Steel*, require maintaining welding equipment in good working condition. To meet this requirement, the manufacturer's maintenance guidelines should be followed. As a corrective action, facility management will re-establish preventive maintenance programs for all electric arc-welding equipment based on manufacturer recommendations. This effort should be completed in the near term for existing in-service welding equipment and will be applied to new welders added in the future.

The following three near-miss events also cited a lack of or inadequate preventive maintenance as a causal factor.

- On January 9, 2004, at the Rocky Flats Environmental Technology Site, a rollup door at an industrial building dropped 10 feet to the floor when the drive chain for the operating mechanism separated. Investigators determined that the door had been cycled (open/close) in excess of its normal expected life cycle and no preventive maintenance had been performed on the operating mechanism for the door. (ORPS Report RFO--KHLL-WSTMGTOPS-2004-0001)
- On August 28, 2003, at the Pantex Plant, vapors from accumulated oil in a compressed air system dryer ignited, causing a fire in the air system piping. The fire self-extinguished when the oil was consumed. Investigators determined that no preventive maintenance had been performed on the dryers or their associated filters for more than 3 years. This allowed oil to build up in the dryer filters and piping, which resulted in the fire and equipment damage. (ORPS Report ALO-AO-BWXP-PANTEX-2003-0043)
- On March 13, 1998, at the West Hackberry Site, hold-down bolts for the lid on a sandblasting pot failed when the pot was over-pressurized, propelling the lid a distance of 205 feet. Investigators determined that a subcontractor had not performed preventive maintenance (cleaning) of the pressure regulating system for the compressor, resulting in a pressure switch malfunction and over-pressurization of the pot. (ORPS Report HQ--SPR-WH-1998-0001)

Although it is often impossible to predict the failure of a particular component or piece of equipment, an effective preventive maintenance program that incorporates manufacturer and vendor recommendations can help prolong safe operation. DOE G 433.1-1, *Nuclear Facility Maintenance Management Program Guide for Use with DOE O 433.1,* provides useful guidance for facility managers on the maintenance of aging equipment.

These events illustrate the importance of ensuring that equipment and systems are included in a preventive maintenance program. It is important that manufacturer and vendor recommendations for inspection and replacement frequencies are heeded. The Yucca Mountain event underscores the importance of being aware of the problems associated with aging equipment and of service life limitations.

KEYWORDS: *Fire, welder, generator, preventive maintenance, electrical short, aging equipment*

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

Refinery Explosion Involved Infrequently Performed, High-Hazard Work

3

On March 23, 2005, a tremendous explosion (Figure 3-1) occurred at the BP Texas City Refinery, killing 15 workers and injuring more than 100 others on the refinery site. The refinery operator, BP Products North America, Inc., immediately established a team to investigate the cause of this tragedy. The cause is thought to be the ignition of a hydrocarbon vapor cloud that was accidentally released from a fractionating column. Members from the U.S. Chemical Safety and Hazard Investigation Board and OSHA are conducting separate investigations.

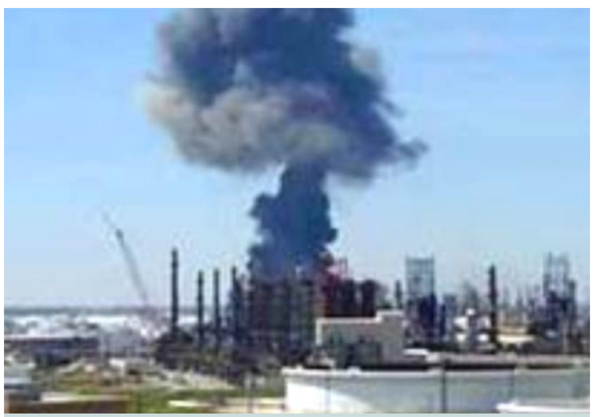

Figure 3-1. Photograph of initial explosion

The explosions and fires occurred during the infrequently performed startup of an isomerization unit. The unit is used to convert low-octane blending feeds into higher-octane components for unleaded regular gasoline. A 2-week turnaround (outage) on the unit had just been completed to replace the isomerization catalyst, which is changed out every 10 years.

The incident involved a 164-foot-tall fractionating column (raffinate splitter), which separates raffinate, a refined oil produced in a solvent extraction process, into highly flammable hydrocarbons, such as pentane and hexane. Also involved was a blowdown drum that handles pressure relief from the splitter and vents directly to the atmosphere through a 113-foot-tall stack.

When the splitter is operating normally, vapor flows from the top of the column through a condenser and is then returned as liquid via a reflux drum. If the column experiences excess pressure (> 40 psig), emergency relief valves open and vent to the blowdown drum and stack. During the startup, abnormal conditions caused the column to become flooded with liquid hydrocarbons, raising pressure rapidly to 60 psig and opening relief valves. The huge volume of liquid and vapor from the column overwhelmed the blowdown drum, resulting in a large quantity of flammable hydrocarbon being expelled from the top of the stack like a geyser. The resulting vapor cloud ignited, causing as many as five explosions and multiple fires. The exact ignition source remains unknown.

Many of the injured or killed were congregated in or around temporary trailers used to support turnaround work on a nearby ultra-cracker unit. Figure 3-2 is an aerial view showing the destroyed temporary office trailers at the bottom and a heavily damaged catalyst warehouse at the top.

BP Products North America, Inc., published an interim investigation report on the explosion on May 12, 2005. The report identified many deficiencies and safety concerns. For example, the 1950s-designed vent system on the blowdown drum did not tie into a flare system to safely combust flammable vapors during a release. Also, temporary office and work trailers were not sited in accordance with minimum safety setback requirements, tragically placing them and the occupants in the blast area near the blowdown drum and vent stack. The report also identified the following conduct of operations deficiencies and inadequacies.

- Operators used the wrong operating procedure to conduct the startup, and not all crew members reviewed the procedure.
- Operators on the night shift did not sign completed procedure steps.
- Operators failed to place the normal 3-psig vent system in operation per the procedure.
- Operators used a manual, 8-inch valve that bypassed the relief valves to control pressure rather than the normal vent system (an all-or-nothing approach).

Figure 3-2. Destroyed temporary trailers (red box)

- The procedure did not include the new de-rated relief valve settings, which reduced operating pressure margins (first-time operation).
- Operators filled the splitter to a level 20 times higher than specified in the procedure, and they exceeded the heat-up rate on the splitter by 25 percent.
- The shift turnover between operators and supervisors was less than adequate.
- The superintendent and other site personnel were unaware that the splitter was being started up.
- The startup was not mentioned at the shift director's morning meeting.
- Command and control of the operation was unclear after the shift supervisor left the site (before the accident).
- The emergency evacuation alarm was not sounded during system upset to warn personnel in the area of potential danger.
- Results of the weekly alarm test were not recorded in the unit logbook as required.

In addition to the conduct of operations failings, investigators from the Chemical Safety Board recently discovered that several key pieces of process instrumentation malfunctioned and alarms warning of abnormal conditions failed to sound. Investigators are examining maintenance records.

Despite the fact that DOE does not operate refineries, this event demonstrates the dangers associated with performing first-time or infrequent and potentially high-hazard operations. A review of the interim investigation report from the perspective of operations at DOE facilities reveals similar causal factors seen in occurrence reports.

- **Procedures** — Operators used the wrong procedure; procedure steps were omitted, not followed, or not signed as completed; procedure did not contain updated operational setpoints; and operators' process knowledge replaced procedural compliance (i.e., "winging it").
- **Hazards Analysis** — Failure to consider multiple failures within the same event; failure to comply with existing analyses; and failure to effectively incorporate hazard analysis outcomes into emergency management planning (e.g., failure of emergency protective measures to address the hazards and the failure to verify operability of notification systems).
- **Operational Oversight** — Command and control during unfamiliar operations and during upset conditions was less than adequate (i.e., who's in charge?); communication of potentially hazardous process activities to other workers or organizations was deficient (e.g., startup of the BP isomerization unit).

The following three DOE events are examples of infrequently performed, potentially high-hazard work.

1. In early April 2005, at the Y-12 Site, a facility representative observed Enriched Uranium Operations personnel preparing to replace a conveyor belt in a casting line glovebox. Because this task had not been performed in several years, the facility representative asked facility management if any work planning review protocols for conducting infrequently performed, potentially high-hazardous work had been used. He learned that no review protocols had been used for the job. After placing the work package on hold, the Operational Safety Board (one of the review protocol groups) evaluated it and concluded that the generic job hazard analysis used with this work package did not present a sound basis for safety. Work planners had screened out the need for a job-specific hazard analysis, which should have been required based on the criteria for breaching a boundary of a hazardous system. (DNFSB Site Representative Weekly Reports dated April 1st and 15th 2005)
2. In July 2004, at the Advanced Test Reactor, during reactor restart following a scram (shutdown), operator distractions caused by a high pressure precursor alarm during reactor heat-up resulted in a second scram on high coolant pressure. The facility was minimally staffed (no plant foreman), and a limited recovery time of 32 minutes, imposed by reactor physics, placed increased pressure on the operators to restart the reactor. The procedure used to perform a quick reactor restart did not address operational difficulties that could be encountered. In retrospect, the option not to start up, based on the limited time and reduced staffing levels, was not given adequate consideration by the operators or management. The command and control staff in the control room did not identify error precursors before conducting critical, time-sensitive evolutions. (ORPS Report ID--BBWI-ATR-2004-0007)
3. In December 1999, at the Y-12 Plant, an explosion injured 11 workers during cleanup of a sodium-potassium (NaK) spill. Depleted Uranium Operations workers were changing out a crucible in a furnace. The crucible, which is cooled by NaK, was last changed out in 1993. The workers were using a new procedure that contained numerous deficiencies and pen-and-ink changes that had not been reviewed and approved. A key step to drain the NaK piping was inadvertently deleted, and when a worker disconnected a hose, NaK sprayed out through an open isolation valve that was misaligned because of procedural deficiencies. During the cleanup, workers sprayed the NaK residue with mineral oil to minimize oxidation, but the combination created a

> shock-sensitive material that exploded upon impact with a metal tool used during cleanup. The workers did not fully understand the associated hazards of NaK, and the recovery plan was not subjected to any management or technical review beyond the core group. (Type A Accident Investigation, *Multiple Injury Accident Resulting from Sodium-Potassium Explosion in Building 9201-5 at the Y-12 Plant*, dated February 2000)

Procedural compliance and operator knowledge of system and equipment function and process response to input and change are extremely important to safe facility operation. DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Chapter XVI, "Operations Procedures," states that procedures should be referenced during infrequent or unusual evolutions when the operator is not intimately familiar with the requirements or when errors could cause significant adverse impact to the facility.

It is important to consider that, although authorization to start up or restart facility processes might involve a detailed Operational Readiness Review in accordance with DOE O 425.1, *Startup and Restart of Nuclear Facilities*, not all facility operations may undergo this level of readiness assessment. It is essential when any infrequently performed or high-hazard operation is undertaken to also perform a process of hazards evaluation and operational assessment commensurate to the complexity of the activity and associated safety risks.

The disaster at the Texas City Refinery is a stark example of what can happen when high-hazard operations are not safely performed. Special management attention should be directed to activities that are infrequently performed or represent first-time operations. Managers and supervisors, responsible for job performance, should ensure that hazards associated with infrequently performed evolutions are identified and properly addressed.

KEYWORDS: *Explosion, fire, fatality, injury, refinery, conduct of operations, infrequent, hazardous, communications, procedures, oversight*

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

Recommendations for Conducting First-Time or Infrequent High-Hazard Work

- Conduct a detailed briefing with all parties involved in the evolution and discuss expected responses and actions necessary if problems should occur.
- Follow all procedures — all the time.
- Ensure procedures are the latest revision, and incorporate system or equipment modifications. Ensure that operators are trained on these changes.
- Conduct a table-top review or walkthrough of procedures for first-time or infrequent evolutions.
- Ensure safety systems, instrumentation, and alarms are all functional.
- Practice all activities involved with the evolution from start to finish.
- Ensure all personnel, including supervisors, have the required level of experience and training or that their certifications are current.
- Ensure that command and control authority is clearly understood by all parties and is present during the evolution.

Worker Injured in Fall from Railroad Tank Car

4

On February 22, 2005, at the Oak Ridge Y-12 Site, an electrician preparing a railroad tank car for a move offsite fell nearly 10 feet from a climbing/work platform on the car to the ground below. The worker, who wore no fall protection equipment, fractured one wrist, chipped a bone in the other, and fractured both his left and right orbital bones. Emergency response personnel transported the worker to a local medical center for emergency care. Work on the tank car, as well as on tanker trucks across the site, which require similar fall protection controls, was suspended pending an investigation. (ORYS-YSO-BWXT-Y12SITE-2005-0002)

The tank car, one of two 1941-vintage rail tank cars that have been onsite since the 1970s, had been used to store polychlorinated biphenyl (PCB)-contaminated oil. The tank hatch had been opened and its contents pumped into holding tanks in August 2004. Both the electrician and his co-worker were trained in handling PCB-contaminated containers and equipment. They intended to cover the tank hatch with plastic to prevent water intrusion into the tank and then descend to the ground and secure the plastic with rope.

The electrician and his co-worker cut the plastic sheeting on the ground before climbing to the upper platform. The co-worker climbed up to the platform first, and the electrician followed him after placing a segment of rope on the platform for use during their descent. The co-worker placed the plastic over the hatch, as planned, just before the electrician fell (see Figure 4-1).

Investigators believe the electrician lost three points of contact and fell either when he reached for the rope or as he prepared for his descent. The electrician cannot remember the actual fall, and neither his co-worker nor other workers in the vicinity saw the beginning of the fall.

Figure 4-2 shows the tank car following the accident. A stepladder was placed next to the tank car for access to the lower platform, and the car has fixed ladders to access the upper platform. As shown in the figure, there is a handrail around the midpoint of the tank car that provides stability when workers are on the lower platform, as well as a rung at the top of the access hatch. The upper platform also has a climbing rung, which is approximately 10 feet above the ground.

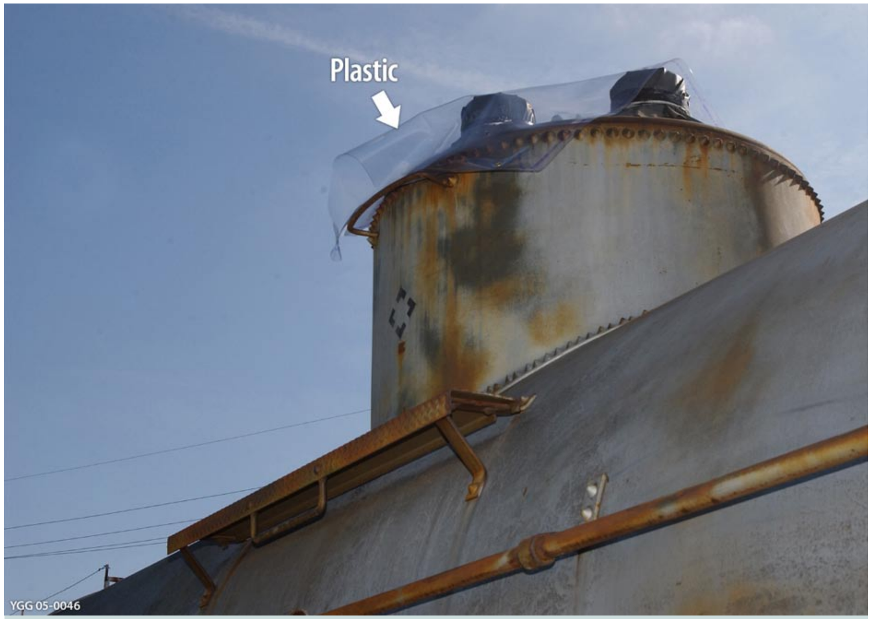

Figure 4-1. Plastic on rail tank car hatch

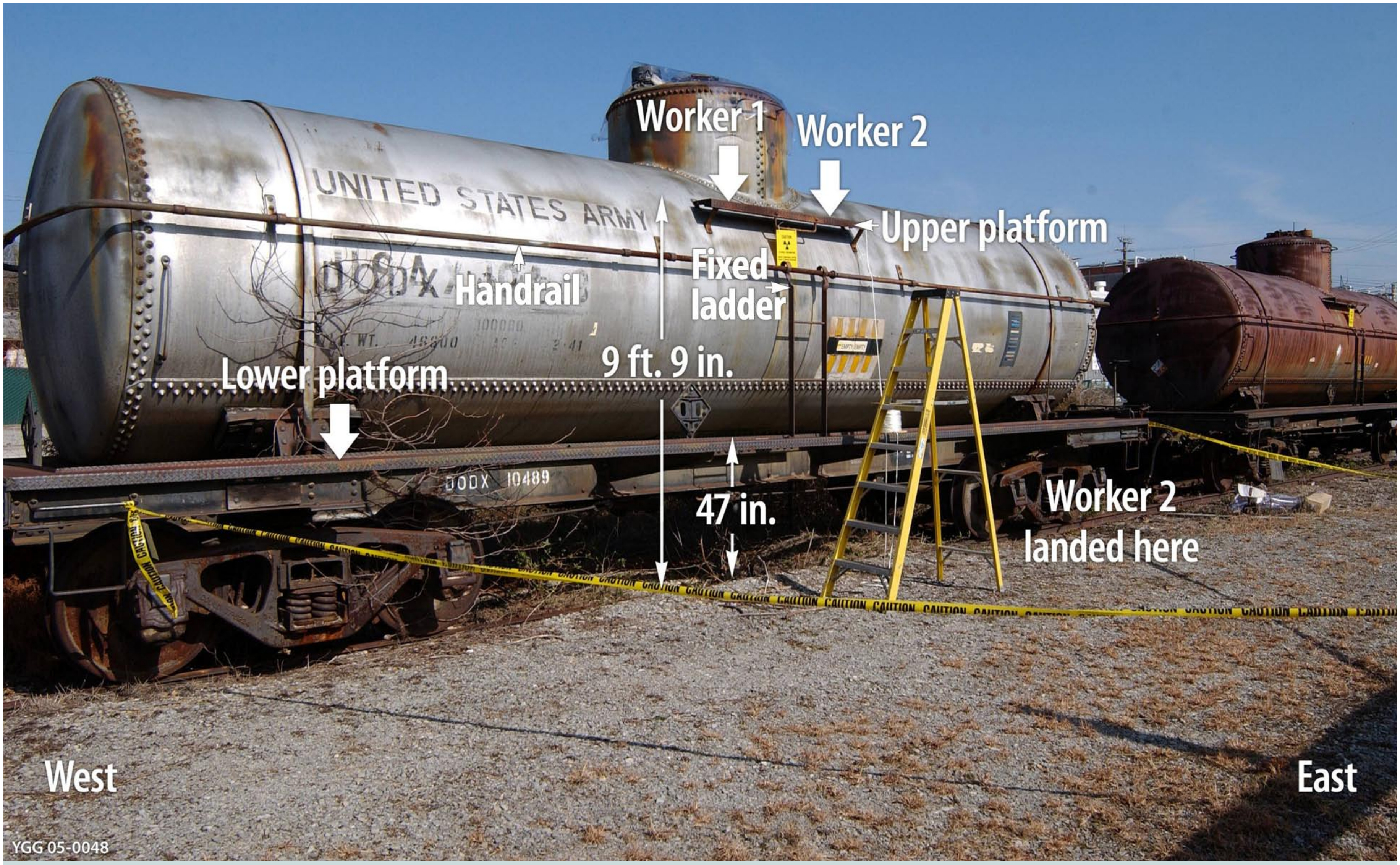

Figure 4-2. Rail tank car accident scene

Investigators learned that during a pre-job briefing, the two workers and their supervisor discussed the need for fall protection. All three agreed that fall protection was not necessary because they would be working only on the upper and lower platforms and could maintain three points of contact. However, investigators determined that the workers and supervisor misinterpreted a work instruction from the job planner that stated "when working on top of a railroad car, wear a safety harness" to mean when working on the curved surface (body) of the car rather than on the upper platform.

Site requirements (based on OSHA interpretations) relax requirements for work on tanker truck ladders and platforms. Requirements indicate that certain types of tasks (e.g., those that do not require workers to lean or reach beyond normal arm extension when both feet are on a ladder) do not require fall protection. The supervisor interpreted this to mean that safety harnesses were unnecessary so long as the workers remained on the ladder and platform.

Investigators identified the following probable causes for this incident.

1. Reliance on an appendix to the site procedure for elevated work/fall protection that incorporates OSHA interpretations relaxing fall protection requirements for rolling stock.
2. Poor communication between the work planner and the supervisor with regard to fall prevention strategies.
3. Poor understanding of the identification and proper use of ladders and platforms.

The investigators also pointed out that the job hazard analysis screening did not properly identify the hazards associated with the tasks identified in the work instructions and that the workers relied solely on three points of contact to perform the work safely.

The investigators concluded that the direct cause of the fall was the electrician's failure to maintain three points of contact, as planned, and identified the following judgments of need.

1. Evaluate whether to continue using the site requirement that permits three-point contact when working on tanker trucks.
2. Require a hierarchy of fall-protection options that includes (a) elimination of the hazard (i.e., work from the ground), (b) use of fixed or portable engineered fall protection, (c) use of PPE, and (d) administrative controls (e.g., procedures).
3. Ensure that procedures and training for elevated work address ladder safety. Topics should include using three points of contact as a control, selecting and using ladders, transitioning on and off ladders, and using dual-purpose equipment (i.e., platforms that also serve as a ladder rung).

Performing work at high elevations without fall protection compromises worker safety. OSHA requirements for fall protection during construction activities are found in 29 CFR 1926, *Safety and Health Regulations for Construction, Subpart M, Fall Protection.*

Any time work is performed at a height of 6 feet or more, the worker is at risk and needs to be protected. Both engineered controls and fall protection should be in place to ensure worker safety. Engineered controls can be as simple as moving the work to ground level to eliminate the work height or using platforms, railings, and toe boards. When engineered controls are not feasible or practical, a personal fall-protection system, including a harness or belt, connection device, and tie-off point should be used.

A previous near-miss event involving fall protection was described in OE Summary 2004-05, where a worker at the Hanford Waste Treatment Plant construction project fell approximately 6 feet and was only slightly injured because his fall-protection equipment arrested his fall. The article also includes photographs of various types of fall protection equipment.

This event demonstrates the importance of using fall protection when working at higher elevations. Work planners, supervisors, and workers should all carefully evaluate work tasks to be performed at heights to ensure that the appropriate engineered controls and fall-protection systems are in place before work begins.

KEYWORDS: *Injury, fall protection, tank car, platform*

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

Fall Protection Control Measures and Good Practices

- Determine if any of the work can be performed at ground level.
- Tether or otherwise restrain workers so they cannot reach an exposed edge of a floor or platform, thus eliminating the fall hazard.
- Use aerial lifts or elevated platforms for working surfaces instead of plates, beams, or pipes.
- Erect and use guardrail systems, warning lines, controlled access zones, personal fall-arrest equipment, or safety nets to protect workers from falls.

Commonly Used Acronyms and Initialisms

Agencies/Organizations	
ACGIH	American Conference of Governmental Industrial Hygienists
ANSI	American National Standards Institute
CPSC	Consumer Product Safety Commission
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
MSDS	Material Safety Data Sheet
ORPS	Occurrence Reporting and Processing System
PPE	Personal Protective Equipment
QA/QC	Quality Assurance/Quality Control

EH Publishes "Just-In-Time" Reports

The Office of Environment, Safety and Health publishes a series of Just-In-Time reports on its Lessons Learned and Best Practices web site. These reports are targeted to work planners and workers and discuss safety topics relevant to the work they do. Each report presents examples of problems and mistakes encountered in actual reported cases and offers points to consider to avoid similar mistakes in the future.

EH plans to issue more Just-in-Times soon on other safety issues. All of the Just-in-Times can be accessed at http://www.eh.doe.gov/paa/jit.html.

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