Operating Experience Summary

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Inside This Issue

Near Miss—Worker Falls Into Empty Effluent Tank When Ladder Shifts

1

On November 11, 2007, at Hanford, a subcontractor worker installing bolts to secure a lid on a plastic waste-water tank fell more than 6 feet into an empty, adjacent tank when the extension ladder he was using shifted unexpectedly. Figure 1-1 shows the tank he was working on, with the ladder placed against it, and the empty tank (to the left). The worker hit the bottom of the tank head-first, and the ladder fell into the tank on top of him. The worker could have been seriously injured, but his only injury was a scalp abrasion. The worker was taken to the onsite first-aid station for evaluation and released to return to work. (ORPS Report EM-RL--PHMC-GPP-2007-0007)

The worker had installed three or four bolts that were directly in front of him on the tank lid and then reached to the left back side of the lid to install another bolt. He leaned to the side to tighten the bolt, shifting his center of gravity, and the ladder began to slide sideways. The worker tried to stop the ladder from moving, but it was top heavy from his weight, so it continued to slide. The worker fell into the adjacent effluent tank while still holding the ladder, and it fell on top of him. After a few moments, he pushed the ladder off, set it up inside the tank, and climbed to the top of the tank. An engineer, who heard him call for help, put a step ladder on the outside of the tank, helped the worker out of the tank, and took him to the first-aid station.

Investigators learned that about 2 weeks before this incident occurred, the same worker had been seen standing on the rim of the effluent tank, which he had accessed using a step ladder.

Figure 1-1. Tank and extension ladder
(the worker fell into the tank on the left)

The worker's feet were above the 6-foot limit required by the site safety plan, and he was not using a safety harness as required. The subcontractor construction manager observed the worker, told him to come down from the rim of the tank, and reinforced fall protection and walking/working surface safety rules.

Following their investigation of this fall event, investigators concluded that the worker did not follow the safety training he had received and did not follow safety plan requirements to tie off the ladder.

Before working onsite, the worker had received training in OSHA supervisor training, site safety and health orientation for construction supervisors, the site-specific health and safety plan, and the subcontractor's job-specific safety analysis. However, the worker, who was acting as both safety representative and task supervisor at the pre-job briefing, did not discuss the method for accessing the tank top during the briefing and, when performing the work task, did not tie off the ladder or work from it in accordance with site portable ladder use policy.

Another ladder fall accident involving a subcontractor worker occurred at Sandia National Laboratories on March 13, 2007. In that incident, a subcontractor roofer fell from an extension ladder while descending it. He fell approximately 6 feet and landed on a second-tier roof, rolled off that roof, and fell another 10 feet to the main roof of the building. Fortunately, the worker's only injury was a broken bone in his right foot. Investigators determined that the slip-prevention material was missing from the bottom of one ladder leg and damaged on the other. Although the subcontractor's safety plan included ladder inspection requirements, it did not identify the frequency for conducting OSHA-required inspections. The ladder had not been inspected at appropriate intervals, nor had anyone inspected the ladder before it was used on the day of the accident. Investigators also learned that safety personnel were not included in the pre-job briefing. (ORPS Report NA--SS-SNL-NMFAC-2007-0002)

An article in OE Summary 2007-02 discussing a Type B investigation of a ladder fall injury at Lawrence Livermore National Laboratory that occurred on July 31, 2006, reported that an electrician was working alone to replace four air conditioning units on the roof of a building. He accessed the units from an exterior fixed ladder, missed a step, lost his balance, and fell approximately 5 feet to a deck below the ladder. Figure 1-2 shows the accident scene and the fixed ladder from which the electrician fell. The Accident Investigation Board concluded that the accident could have been prevented if the worker had maintained three points of contact with the ladder (i.e., used his feet and hands in any combination of three). Had he followed this technique, he would have been able to recover from the missed step without falling. (ORPS Report NA--LSO-LLNL-LLNL-2006-0037)

Figure 1-2. Accident scene showing the fixed ladder and an extension ladder added post-accident for temporary roof access

As a result of the fall, the electrician received multiple fractures of his wrist, shoulder, and pelvis; was hospitalized for 8 days; and spent an additional 18 days in a recovery center. OE Summary 2007-02 also reported that a post-event search of the ORPS database identified 33 ladder-safety events from 2000 through 2006 that resulted in injuries. Among the causes of these accidents were "positioning the ladder on unstable surfaces," "not securing the ladder base or having someone hold the ladder to prevent shifting," and "working outside the footprint of the ladder," all of which are applicable to the ladder-fall incident at Hanford.

General OSHA requirements for ladders are found in 29 CFR 1926.1053. The following is required by 1926.1053(b)(7).

> Ladders shall not be used on slippery surfaces unless secured or provided with slip-resistant feet to prevent accidental displacement. Slip-resistant feet shall not be used as a substitute for care in placing, lashing, or holding a ladder that is used upon slippery surfaces including, but not limited to, flat metal or concrete surfaces that are constructed so they cannot be prevented from becoming slippery.

The text box, taken from the OSHA publication, *Stairways and Ladders: A Guide to OSHA Rules*, shows the rules for all types of ladders. The OSHA Quick Card, *Portable Ladder Safety*, also provides tips for using portable ladders safely, including the need to maintain three points of contact on the ladder when climbing.

This event demonstrates the importance of securing ladders to prevent any unexpected movement or sliding across a smooth surface, as well as the importance of analyzing any potential hazards and developing actions to mitigate them.

KEYWORDS: *Ladder, fall, injury, waste tank*

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

OSHA Rules for All Ladders

- Maintain ladders free of oil, grease, and other slipping hazards.
- Do not load ladders beyond their maximum intended load nor beyond their manufacturer's rated capacity.
- Use ladders only for their designed purpose.
- Use ladders only on stable and level surfaces unless secured to prevent accidental movement.
- Do not use ladders on slippery surfaces unless secured or provided with slip-resistant feet to prevent accidental movement.
- Do not use slip-resistant feet as a substitute for exercising care when placing, lashing, or holding a ladder upon slippery surfaces.
- Secure ladders placed in areas such as passageways, doorways, or driveways, or where they can be displaced by workplace activities or traffic to prevent accidental movement. Or use a barricade to keep traffic or activity away from the ladder.
- Keep areas clear around the top and bottom of ladders.
- Do not move, shift, or extend ladders while in use.
- Use ladders equipped with nonconductive side rails if the worker or the ladder could contact exposed energized electrical equipment.
- Face the ladder when moving up or down. Use at least one hand to grasp the ladder when climbing.
- Do not carry objects or loads that could cause loss of balance and falling.

Hazards of Blind Penetrations Contacting Concealed Utilities

2

The unexpected penetration of concealed utilities when drilling or cutting through walls, floors, and ceilings during repairs, installations, and modifications can result not only in power disruptions, but also in serious injuries to the workers who drill or cut into them. These hazardous blind penetration events occur often across the Complex, as demonstrated by the following recent events.

On November 8, 2007, at Pacific Northwest National Laboratory, a carpenter securing a storage cabinet to a sheetrock wall drilled into an energized electrical conduit providing 120-volt power to an electrical receptacle. There was no arc; the circuit breakers did not trip; and the worker did not receive an electrical shock. (ORPS Report SC--PNSO-PNNL-PNNLBOPER-2007-0012; final report issued December 19, 2007)

Seven storage cabinets had been placed along a wall in the corridor before being secured to the sheetrock, and the carpenter had already installed three of them successfully. One of the remaining cabinets was in front of the electrical receptacle, hiding it from view, so the carpenter did not see it before he began to drill. When he stopped to inspect the penetration, according to procedure, he saw what he thought was a galvanized sheet-metal wall stud and proceeded to drill a ⅛-inch pilot hole. Following the procedure, the carpenter stopped again to inspect his work and realized that what he thought was a metal stud was the conduit for the electrical receptacle. Figure 2-1 shows the penetration and the wires removed from the conduit for inspection after the event. Figure 2-2 shows the drill site, the metal studs, and the conduit.

Members of a post-event critique determined that the carpenter, who had performed similar tasks successfully for many years, had carefully followed the site blind penetration procedure during installation of the cabinets. However, the procedure did not address penetrations into hollow walls, ceilings, or floors and did not caution workers to stop work if they encountered metal during the drilling operation.

To address situations such as those encountered in this event, the blind penetration procedure was revised to limit the depth of penetration to the thickness of the external surface of hollow cavities, or no more than 2 inches into solid materials, when using power tools. The procedure also was revised as follows:

> When a hollow cavity must be penetrated beyond the thickness of the exterior surface for the purpose of verifying the absence of hazards (e.g., utilities,

Figure 2-1. Wall penetration and wires pulled from conduit post-event

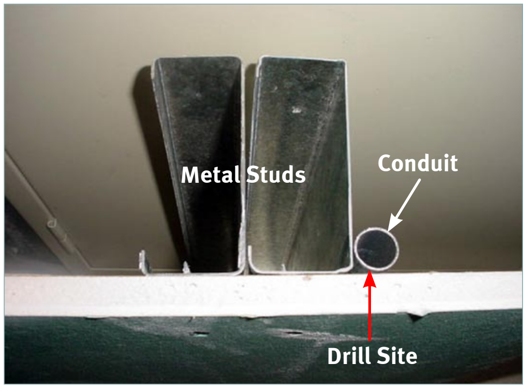

Figure 2-2. Drill site, studs, and conduit

asbestos), inspect the inside of the penetration by looking into the hole with a flashlight or boroscope or by probing with a nonconductive or insulated tool, such as a screwdriver or wooden handle punch. Stop work and notify your supervisor if this check reveals any potential hazards, such as asbestos-containing material, or any metallic material, such as a metal wall stud or conduit.

Another blind penetration event occurred on April 27, 2007, at the North Las Vegas A-13 Facility. A maintenance mechanic drilled into a concrete floor to install conduit and hit two energized, 120-volt electrical conduits encased in the concrete. The conduits had not been identified during pre-work walkdowns and were not shown on the available drawings, although a vague notation indicated that electrical conduits were running "below floor grade." The penetration permit required a non-intrusive examination, but none was performed because there was metal both above and below the concrete. Investigators determined that an alternate method of examination should have been used to meet the permit requirements and ensure worker safety. (ORPS Report NA--NVSO-NST-NLV-2007-0002)

At Lawrence Livermore National Laboratory in April 2006, workers troubleshooting non-functioning office equipment discovered that a circuit breaker had tripped because someone had inadvertently drilled through a wall into an electrical conduit. One 120-volt energized wire was severed, and the insulation on another wire was nicked. After further investigation into the problem, the workers determined that when seismic anchors were mounted to metal studs in a sheetrock wall to restrain a bookcase, one of the holes drilled into the stud penetrated the conduit, which ran through the stud. (ORPS Report NA--LSO-LLNL-LLNL-2006-0017)

Site procedures require that a hand scanner, a review of drawings, or a visual inspection be performed before penetration tasks. The procedures focus on controls to prevent drilling through unknown objects and obstacles during blind penetrations. Investigators determined that workers were not sufficiently supervised to ensure that they understood the work scope and followed appropriate procedures. They also determined that the supervisor did not effectively identify either the locations for mounting the items or locations that needed to be scanned before the penetration task began. In addition, they learned that the worker assigned to the work task had not completed site training on penetrations and anchoring in walls, floors, and ceilings.

OE Summary 2006-13 discusses an event in which a worker accidentally drilled into a pressurized fire extinguisher on the other side of the wall and recommends performing a pre-job walkdown that includes checking for the following.

- Identify the equipment you will be working on.
- Ensure that equipment requiring isolation is clearly marked.
- Verify that drawings reflect as-built conditions.
- Identify any safety hazards or issues that may not be immediately apparent.

In addition, a 1998 Lessons Learned Bulletin, *Penetrating Hidden Utilities* (Issue No. 98-02), includes seven strategies to prevent making blind penetrations. The Bulletin states that the following mitigation steps are necessary before any penetration into a building surface.

1. Determine if penetration can be avoided.
2. Identify signs of concealed wiring that are visible from outside the structure (e.g., receptacles, switches, conduits on the other side of the structure).

3. Ensure that drawings used to locate concealed utilities are up to date and verified by the engineering department.
4. Implement a utility-spotting program.
5. Ensure that all available instruments have been used to verify the absence of concealed wiring.
6. Verify that a penetration permit and all other conditions of the procedure for subsurface penetrations have been completed.
7. Confirm that concealed wiring located in the area has been locked and tagged out. Use appropriate electrical PPE even if there is an appropriate lockout/tagout.

The textbox shows the recommendations developed for the 1998 Lessons Learned Bulletin, which were based on a review of blind penetration events across the Complex over an 8-year period.

OSHA regulations in 29 CFR 1926.416(a)(3) state that before work is begun the employer shall ascertain by inquiry or direct observation, or by instruments, whether any part of an energized electric power circuit, exposed or concealed, is so located that the performance of the work may bring any person, tool, or machine into physical or electrical contact with the electric power circuit. The regulation also states that the employer shall post and maintain proper warning signs where such a circuit exists and that employees must be advised of the location of such lines, the hazards involved, and the protective measures to be taken. However, workers must also take responsibility for their safety and perform independent checks before they perform tasks that are potentially hazardous.

These events illustrate the importance of proceeding with caution when performing blind penetrations and the necessity of performing pre-job walkdowns, marking all piping and conduits, and discussing any associated hazards. Applicable procedures should specifically address penetrations into walls, ceilings, and floors and indicate that workers should stop work if they encounter obstructions during drilling or cutting operations. In addition, workers must take responsibility for their own safety by performing independent checks before performing potentially hazardous work tasks.

Recommendations for Avoiding Blind Penetration Electrical Hazards

- Ensure that subsurface penetration procedures and permits include walls, ceilings, and roofs.
- Penetrate no deeper than is required to do the job.
- Use drills equipped with an electronic drill stop. This device stops the tool when the bit contacts any grounded metal.
- Check drill holes frequently for signs of obstructing materials, such as wire fragments.
- If you hit an obstruction, stop and investigate.
- If the penetration location or work requirements change, ensure that the penetration permit addresses the change and that potential hazards are evaluated.
- Drill pilot holes.
- Ensure that the proper drilling or cutting equipment is prescribed for the job.
- Once concealed utilities have been located, they should be marked.
- Ensure personnel are properly trained in accordance with manufacturers' specifications if using electronic devices to detect concealed utilities.
- Never rely on the actuation of electrical circuit breakers as a safety barrier for personnel.
- When procedures or work plans appear to be inconsistent with actual conditions, stop work and notify supervisors.

KEYWORDS: *Concealed utilities, blind penetration, cutting and drilling, electrical conduit*

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

Type A Accident Investigation of the Mixed Waste Spill at Hanford Tank Farms—Part 4: Industrial Hygiene/Medical Factors

3

A Type A accident investigation into the spill of about 85 gallons of tank waste at the Hanford Tank Farms on July 27, 2007, determined that the cause of the spill was overpressure of the hose due to the lack of a required backflow device. However, the Accident Board also identified deficiencies in five program areas that contributed to the accident. OE Summary 2008-01 detailed the Board's conclusions and Judgments of Need (JON) in the emergency response and emergency planning program area. This article focuses on the industrial hygiene and medical factors that contributed to the event. (ORPS Report EM-RP--CHG-TANKFARM-2007-0009)

When the accident occurred, no workers were in the area of the spill. However, in the hours and days following the spill, a number of Hanford workers reported odors, experienced symptoms or health effects, or expressed concerns about their potential exposure to the waste chemicals from the spill. The Board interviewed workers who had identified medical symptoms or reported odors following the spill, reviewed procedures and accident events, evaluated the consequences of the spill, and investigated the reasons for the reported symptoms and health effects.

The primary focus of the Board's investigation was to determine the degree to which vapors released during the accident could cause worker exposures and subsequent health effects. The Board evaluated (1) industrial hygiene practices associated with monitoring chemical vapors from the tank and industrial hygiene response to the spill; (2) the chemical and toxicological exposure hazards and pathways associated with the spill; (3) medical symptoms and potential acute and chronic health effects of the workers in the vicinity of the spill; and (4) the adequacy of the medical response to this accident.

Industrial Hygiene Monitoring/Response

The potential for vapor exposures at the Hanford Tank Farms, as well as the appropriate controls, have been evaluated extensively over the past few years. More recently, the industrial hygiene program staff has studied the composition of the vapors in the tanks, the nature and magnitude of fugitive emissions, and the potential health hazards to workers and application of controls to manage risks to vapor exposure. The constituents of the hazardous chemicals within the waste tanks have also been well analyzed, and the industrial hygiene staff has done a considerable amount of monitoring and sampling of data within the past 2 years.

The Board determined that the sampling and monitoring program for normal waste tank operations is well defined in procedures, technical basis documents, and interoffice memoranda; but the procedures and provisions for coordination and integration of industrial hygiene in response to abnormal conditions were not sufficient to ensure that chemical vapor hazards were considered in the initial response. They also determined that procedures and response actions did not include adequate provisions for timely and relevant industrial hygiene monitoring to evaluate exposures in response to abnormal conditions. Industrial hygiene monitoring conducted specifically as a result of the spill was first performed more than 13 hours after the spill and was performed in support of the emergency response team's effort to establish respiratory protection requirements at the tank farm boundaries, not to evaluate chemical exposures to workers or provide a basis for evaluating health effects.

Some of the chemical hazard controls that were in effect at the time of the spill were incorrect or difficult to locate; some were not followed by workers. In addition, documents in the work package did not always accurately reflect current requirements. For example, the worksite hazard analysis, which identifies hazards, controls, permits, and associated personal protective equipment (PPE), indicated that workers should use silver shield gloves, self-contained breathing apparatus, and rain suits, none of which was required by current industrial hygiene procedures. As a result, the chemical PPE requirements at the time of the spill were indeterminate or were not followed.

The Board also determined that the potential hazards associated with abnormal conditions, such as high radiation, were not analyzed, even though a spill during pumping operations is a credible event at the tank farm and would be a possible cause of a high radiation condition. The likelihood that radiation hazards and chemical vapor hazards would co-exist is a foreseeable event that should have been reflected in response procedures and in responses to the accident by health physics technicians, workers, and supervisors, but the Board determined that existing procedures and protocols did not sufficiently address such an event.

The Board concluded that insufficient abnormal response procedures and issues with coordination and integration resulted in the industrial hygiene monitoring and sampling data collected post-accident being insufficient to provide an adequate estimate of worker exposures to the tank spill event.

Chemical/Toxicological Exposure Hazards

Over 92 percent of the solid wastes and all of the liquids, with the exception of liquid residual from dilution and sluicing activities performed on the waste in the tank, had been removed before the spill occurred. The chemical waste assumed to be released during the spill consisted of some fraction of dissolved waste solids and the vapors associated with this material.

Since there was no industrial hygiene instrumentation to monitor or detect the spill release within the initial 12 hours following the spill, worker exposures could only be estimated or surmised based on the solid and vapor chemical contents of the tank and the nature of the spill. In addition, no sampling of the spilled tank material was conducted, so the chemicals present in the spill cannot be accurately determined.

Source term and dispersion modeling was performed 3 days after the accident using two "marker" chemicals, ammonia and NDMA (N-nitroso-dimethylamine). The model indicated that both chemicals dispersed within minutes following release and that even in a worst case scenario only those close to the spill when it occurred would have been subjected to concentrations at the occupational exposure limit.

Two workers were within about 10 feet of the spill approximately 10 minutes after it occurred, but because of the assumptions made in the model and analysis, it was not possible to precisely estimate the concentrations of chemicals to which they were exposed. However, the Board believes it is credible to conclude that both workers were exposed to only low concentrations of chemicals during their brief time of exposure.

The Board concluded that it was very unlikely that the accident caused significant exposure to workers because no one was in the area when the release occurred, there was a limited quantity of spilled material, and the chemical vapors rapidly dispersed.

Medical Symptoms and Health Effects

The two workers nearest the spill reported no immediate irritant effects (e.g., burning eyes or nasal passages), although one of them reported that he had noticed a strong odor. Most of the other workers who reported symptoms reported skin symptoms, respiratory irritation, and eye irritation. These symptoms are characteristic of possible exposure to an irritant toxicant, such as ammonia (the primary irritant known to be a tank component). Although several workers were seen by medical personnel, who documented symptoms such as "red eye," some of them had been sequestered for approximately 3 hours in environments with limited ventilation and temperature control (promoting sweating) or without water, which may have contributed to their symptoms.

Most of the symptoms were reported several hours or more after the spill occurred, at which time concentrations would have been very low. The delayed presentation of symptoms is not the usual response to an irritant exposure, but could have been the result of unique individual response (minor respiratory tract irritation caused by coughing) or a low level of exposure.

Radiological exposures to personnel during the event were well below any regulatory action or company administrative control levels. The individuals with the greatest potential for exposure were the two workers who discovered the unexpected high radiation levels during the waste transfer line walkdown. Thermoluminescent dosimeter readings indicated that one worker received a 25 mrem shallow dose and 12 mrem deep dose, which was the highest dose either of the two received.

The Board determined that the diverse symptoms and complaints reported by workers in the hours and days after the event could have been attributable to other causes (e.g., herbicide spraying that occurred 5 hours after the spill) or to workers being sheltered in place for several hours in an area with limited ventilation and temperature control.

The Board concluded that because of the low concentrations and the short duration of exposure, it is not likely that the spill event caused an overexposure or chronic health impacts. However, they also concluded that the event could have been more severe if individuals had been in the immediate vicinity of the spill at the time of the release, where they could have been exposed to higher radiation levels and concentrations of chemical vapors.

Medical Response

The Board identified the need for improvement in three areas of the medical response: (1) communications between the Hanford Fire Department and Advanced Medical Hanford; (2) training for emergency medical technicians with respect to chemical exposures that are not trauma related; and (3) medical monitoring and accountability of individuals with health symptoms. The Board's findings in these three areas included the following.

- There is interaction between the Hanford Fire Department and Advanced Medical Hanford, but the integration is not well defined in procedures.
- The emergency medical technicians/paramedics are trauma-oriented and have limited training or expertise in chemical exposure events. Procedures place the responsibility for reporting to Advanced Medical Hanford on the employee and the manager.
- There is no requirement that visits to medical providers other than Advanced Medical Hanford staff are to be coordinated by Advanced Medical Hanford. The employee is the only source from which to obtain the conditions of exposure and type(s) of possible toxicants.

The Board concluded that the medical response to the mixed waste spill was generally in accordance with established procedures. However, the established procedures were not sufficient to fully address some aspects of a possible chemical exposure.

The Board identified the JONs shown in the textbox to address deficiencies in the industrial hygiene response to the event. The detailed two-volume Accident Board report is available on the DOE Office of Health, Safety and Security website at http://www.hss.energy.gov/csa/csp/aip/HanfordTankFarm.html. The Board's findings and JONs in the area of management systems will be the topic of an upcoming article in the OE Summary.

This event illustrates the importance of ensuring that industrial hygiene responses to abnormal conditions are well coordinated and that monitoring is accomplished as quickly as possible following an event that involves chemicals that could result in worker exposures. It is also essential that all procedures and hazard controls are completely documented, revised when appropriate, communicated properly to workers and followed by them.

KEYWORDS: *Type A accident, hazardous waste spill, industrial hygiene, chemical hazards, toxicological hazards, medical response*

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

Judgments of Need — Industrial Hygiene/Medical Factors

- Integrate industrial hygiene into the response to abnormal events that may involve a chemical release.
- Establish and implement industrial hygiene procedures, sampling and monitoring protocols, and training of industrial hygiene staff for responding to the range of abnormal events identified in tank farm hazard analysis documents.
- Improve performance of Hanford Fire Department emergency medical technicians/paramedics in the areas of documentation of patient encounters and communications with Advanced Medical Hanford. (More frequent review of records by physicians is one needed element in the efforts to enhance documentation of patient encounters.)
- Improve medical monitoring, documentation, and accountability of individuals with health symptoms and/or complaints following an accident.

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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
mg	milligram (1/1000th of a gram)
kg	kilogram (1000 grams)
psi (a)(d)(g)	pounds per square inch (absolute) (differential) (gauge)
RAD	Radiation Absorbed Dose
REM	Roentgen Equivalent Man
TWA	Time Weighted Average
v/kv	volt/kilovolt

Job Titles/Positions	
RCT	Radiological Control Technician

Authorization Basis/Documents	
JHA	Job Hazards Analysis
JSA	Job Safety 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
D&D	Decontamination and Decommissioning
DD&D	Decontamination, Decommissioning, and Dismantlement
RCRA	Resource Conservation and Recovery Act
TSCA	Toxic Substances Control Act

Miscellaneous	
ALARA	As low as reasonably achievable
HEPA	High Efficiency Particulate Air
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
SME	Subject Matter Expert