Operating Experience Summary

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In the Event of Fire, Follow Emergency Procedures

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On November 15, 2006, at the Nevada Test Site (NTS), an Operations Coordination Center dispatcher received a 911 call reporting that smoke was coming from behind an oven in the cafeteria. The dispatcher immediately sent Fire and Rescue (F&R) response units to the scene. They extinguished a fire inside the back panel of a portable warming oven and removed the oven from the building. The fire was confined to the oven, and no one was injured. (ORPS Report NA--NVSO-NST-NTS-2006-0006)

When the F&R unit arrived at the cafeteria, no smoke or fire was visible outside the building. They told all personnel to evacuate, checked the building to be sure that everyone was accounted for, and began a search of the building. When F&R personnel entered the cafeteria they saw flames coming from the oven. They determined that the fire was inside the back panel of the oven and was confined to the oven. After extinguishing the fire, F&R personnel removed the oven from the building.

Figure 1-1 shows the oven that was involved in the fire. Engineers inspected the oven and its circuit breaker and saw that the breaker had tripped. An evaluation of the burn patterns revealed that the fire was confined to the electrical controller housing. Investigators determined that the oven thermostat control device malfunctioned, causing the fire. Figure 1-2 shows the electrical control housing involved in the fire.

Although the fire caused minimal damage, other than to the 11-year-old oven, and no one was injured, management was concerned that no one activated the fire alarm when they saw flames. Cafeteria emergency team personnel alerted patrons dining in the cafeteria about the fire, but they did not warn staff in offices in other parts of the building. The Emergency Team personnel were reminded that procedures indicated they should not hesitate to activate the fire alarm system any time there is evidence of a credible fire threat (e.g., smoke).

Two similar, small-fire events were reported to ORPS in 2006, neither of which resulted in injuries. In both events, proper emergency procedures were followed.

Figure 1-1. Oven after fire in back panel

Figure 1-2. Electrical controller housing involved in the fire

On October 4, 2006, at East Tennessee Technology Park, an electrician noticed a small fire burning near a light and notified the site fire department. Before the fire department arrived, the electrician opened the main electrical disconnect feeding the light and used a fire extinguisher to put out the flames. Because the fire's exact location and size were unknown, management directed employees to evacuate the area. (ORPS Report EM-ORO--BJC-K25ENVRES-2006-0016)

On March 3, 2006, at the Y-12 National Security Complex, employees saw smoke near the fan motor of an air handler unit and called 911. The fire department responded, saw flames, and evacuated the building. The fire was extinguished and later traced to a faulty fan motor. (ORPS Report NA--YSO-BWXT-Y12NUCLEAR-2006-0011)

Fire is the third leading cause of accidental deaths in the United States—on average, there are more than 150 workplace fires every day—yet many people do not take the steps to ensure their safety and that of their coworkers. It is essential that all workers be trained in the actions that need to be taken in any emergency situation, and equally important for these steps to be followed, particularly in case of fire. As shown in the textbox on the following page, immediate actions to be taken in case of fire can be recalled by remembering the word **RACE**. All workers should be aware of the location of fire alarm pull stations and firefighting equipment (e.g., fire extinguishers and hose stations) within their work area and should know how to use them. Workers should also err on the side of caution when determining whether or not they can extinguish any fire. If there is even the slightest concern that the fire cannot be quickly extinguished, workers should leave the area and wait for assistance from emergency responders.

Water should never be used in an attempt to extinguish electrical fires such as the oven fire at NTS. Before using the fire extinguisher, make sure it is rated as Class C (for electrical fires). Many extinguishers available today can be used on different types of fires and will be labeled with more than one designator (i.e., A-B; B-C; or A-B-C). Icons (pictures) are also used on labels to indicate whether the extinguisher can be used for ordinary combustibles, flammable liquids, or electrical equipment fires. This type of labeling style shows a diagonal red line drawn through a picture to indicate that it is NOT suitable to use the extinguisher for a certain type of fire. Figure 1-3 shows the labeling system. When using a fire extinguisher, the word **PASS** is a reminder of how to use the extinguisher properly (see textbox).

OSHA regulations for emergency action plans are found in 29 CFR 1910.38, which states that an emergency action plan

Figure 1-3. Label showing fire extinguisher NOT suitable for electrical fire

must be in writing, kept in the workplace, and available to employees for review. The regulation also states that the emergency action plan must be reviewed with each employee covered by the plan when it is developed or the employee is assigned initially to a job; when the employee's responsibilities under the plan change; and when the plan is changed. Section 1910.38 (c) states that the following should be included in the emergency action plan:

- procedures for reporting a fire or other emergency;
- procedures for emergency evacuation, including type of evacuation and exit route assignments;
- procedures to be followed by employees who remain to operate critical plant operations before they evacuate; and
- procedures to account for all employees after evacuation.

DOE Guide 151-1, Volume 5-4, *Training and Drills*, states that general training for employee response is required as part of the Operational Emergency Base Program and should include emergency-related information such as emergency awareness, warnings and alarms, evacuation, accountability, and first aid.

These events illustrate the importance of following each step of the site emergency action plan in the event of a fire or other emergency. A fire, no matter how small it appears to be initially, may quickly spread out of control and result in injuries or even fatalities. At the first sign of fire, activate the fire alarm, call 911, and evacuate the building. Be extremely cautious when determining whether or not a fire can be quickly extinguished using a fire extinguisher. If there is any concern that the fire cannot be quickly extinguished, leave the area and wait for assistance.

It is also important to remember that water must never be used in an attempt to extinguish an electrical fire; instead, use a fire extinguisher that is marked Class 3 or a multiple-use extinguisher with a label indicating it is safe for Class 3 use (i.e., for electrical fires).

IN CASE OF FIRE — REMEMBER RACE AND PASS

R — Rescue and remove anyone from immediate danger.
A — Alert personnel. Activate the building fire alarm and call 911.
C — Confine the fire and smoke by closing all windows and doors.
E — Extinguish small fires, if possible. Evacuate the building and report to your supervisor.

P — Pull the pin.
A — Aim the nozzle at the base of the flame.
S — Squeeze the trigger while holding the extinguisher upright.
S — Sweep the extinguisher from side to side, covering the area of the fire with extinguishing agent.

KEYWORDS: *Fire, oven, alarm, evacuation, fire extinguisher, emergency response*

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

Excavator Accidents Can Be Deadly 2

On November 11, 2006, an explosion rocked a 36-inch natural gas pipeline near Cheyenne, Wyoming, killing an excavator driver, sending a fireball into the sky that could be seen for miles, and scorching 600 acres of land. Investigation indicates that the back end of the excavator hit the pipeline. Initially, 12 people were reported missing, but all 12 were accounted for after accountability procedures were followed. (*Wyoming Tribune-Eagle*, November 13 and November 16, 2006)

Since January 1, 2005, nearly 40 events have been reported to ORPS that involved unplanned impacts on safety, cost, and schedules resulting from excavator incidents. In 13 of those events, an excavator hit a gas line. Although consequences from the DOE events have not been as dire as those of the Wyoming pipeline accident, all of them have impacted cost and schedule and put excavator operators in jeopardy. The dangers are dramatically shown in Figure 2-1, which documents the aftermath of an accident in Lebanon, Missouri, in 1989. The accident occurred when a road grader hit a 10-inch propane line, which exploded, killing the operator.

OSHA provides explicit guidance for excavation operations in 29 CFR 1926.651, *Specific Excavation Requirements*. (See textbox.) The requirements are designed to protect employees and prevent accidental damage to underground utility installations. The regulation directs that the "estimated location of utility installation…shall be determined prior to opening an excavation," and "the employer may proceed…with caution… provided detection equipment or other acceptable means to locate utility installations are used." The regulation further states that, when excavation operations approach the estimated location of underground utilities, "safe and acceptable means" (such as hand-digging) "shall be used to determine the exact location."

In the following DOE events, OSHA guidance was not strictly followed, with potentially dangerous results.

On October 5, 2006, at Sandia National Laboratory, an experienced trackhoe operator hit a gas line while installing a new water line. The area had been potholed, and the gas line had been located at a depth of 5 feet 2 inches. Based on that information, workers planned to hand-dig starting at a depth of 4 feet. However, the entire line was not buried to a depth of 4 feet; instead, it was only 2½ feet below the surface in the area of impact. This event demonstrates that despite pre-work planning, using a spotter, and hiring experienced operators, accidents can occur when as-built conditions do not match the drawings and that even pre-testing methods, such as potholing, may not provide totally accurate information. (ORPS Report NA--SS-SNL-NMFAC-2006-0014)

Figure 2-1. Road grader engulfed in flames

On the same day, an excavation event also occurred at Los Alamos National Laboratory. Workers were excavating before laying base core and asphalt for a traffic lane. The area had been potholed to determine the depth of the gas line; but, when a skid loader bucket hit a rock, the rock hit and bent a gas line nipple that was not shown on old as-built drawings. (ORPS Report NA--LASO-LANL-PHYSTECH-2006-0010)

Another excavator event occurred at Sandia on May 17, 2006. An excavator punctured a gas line, even though the contractor performed the necessary pre-job activities. The contractor had a current permit and had potholed to locate the gas utility line, marked the gas line location on the construction prints, and held a pre-work meeting with the operator. However, the operator was paying attention to exposed duct banks on either side of him and miscalculated the depth at which he was to stop mechanical digging so that safer hand-digging could start. (ORPS Report NA--SS-SNL-NMFAC-2006-0009)

Two additional excavating events occurred at Sandia in April 2006. The first occurred on April 18, as an operator was moving wet, muddy soil from a borrow pile and spreading it to dry in a containment area. The front-end loader he was operating hit a gas line in the containment area. The job scope had not identified special conditions: the soil had been removed from the containment area over a 20-month period, gradually lowering the area's floor by 3 feet and leaving very little clearance between the gas line and the surface. (ORPS Report NA--SS-SNL-NMFAC-2006-0007)

Specific Excavation Requirements in OSHA 29 CFR 1926.651

- Establish the location of underground installations prior to opening an excavation.
- Contact utility companies or owners within established or customary local response times. When utility companies or owners cannot respond to a request to locate underground utility installations within 24 hours or cannot establish the exact location of these installations, the employer may proceed with caution using detection equipment or other acceptable means to locate utility installations.
- When approaching the estimated location of underground installations, the exact location of the underground installations shall be determined by safe and acceptable means.
- While the excavation is open, underground installations shall be protected, supported, or removed as necessary to safeguard employees.

The second event at Sandia occurred on April 11, when a backhoe hit a gas line while operators were working on a water line tie-in for a mobile lunch facility. Drawings showed that an abandoned electrical duct bank, a water line, a sanitary sewer, and a gas line were in the area. Spotters found and marked all the utilities except the gas line and uncovered them by hand-digging. They did not detect the gas line because its tracer wire had broken. Instead of stopping to re-evaluate the permit to ensure they had addressed everything, the contractor decided to change the location of the water line tie-ins. This required workers to enlarge the excavation, and no one considered the gas line until the backhoe hit it. This event demonstrates the need to reassess tasks when the work scope changes, the importance of staying on course and avoiding distractions, and the necessity of using non-intrusive excavating methods until all utilities are located. (ORPS Report NA--SS-SNL-NMFAC-2006-0004)

On November 8, 2005, at the National Renewable Energy Laboratory, a backhoe bucket punctured a buried, 2-inch natural gas line during work to determine if an underground water main had been installed at the correct depth. The line was punctured where it crossed the path of the water main. As soon as the operator heard and smelled the escaping gas, he shut down the equipment, evacuated the area, and initiated emergency notifications. Investigators determined that the work had not been performed in accordance with requirements specified in either of the two applicable excavation permits. The location of the gas line was clearly and accurately identified with

yellow paint, and, as a result, mechanized equipment should not have been within 5 feet of the gas line. The foreman had made a conscious decision to use the backhoe, and hand-digging was used only in conjunction with the backhoe, not alone. Workers were told in which direction to pothole east of the known gas line, but they were not provided with a diagram or written direction. Had such specificity been provided in a work package, the event may not have occurred. (ORPS Report EE-GO--NREL-NREL-2005-0012)

HEAVY EQUIPMENT OPERATORS MUST —

- Establish a detailed work plan.
- Train employees prior to excavating on the proper procedures of determining the locations of underground utilities.
- Contact and coordinate with the utilities companies to establish the locations of the underground installations.
- Take all necessary precautions to prevent damaging underground utility installations.

– OSHA 29 CFR 1926.651

On June 28, 2005, at the Thomas Jefferson National Accelerator Facility, an excavator bucket contacted a plastic underground natural gas line while placing gravel in a trench for a well distribution system. The gas line had been professionally located, and workers had dug by hand to locate and uncover the gas line. When the trench was ready for gravel, the excavator worked with a spotter. However, because of space restrictions, it was difficult to maneuver and gauge depth, and the bucket contacted and breached the pipe. After emergency services responded, the situation was stabilized, and work restarted, workers placed the gravel by hand in the pipeline's vicinity. (ORPS Report SC--TJSO-SURA-TJNAF-2005-0006)

An *Environment, Safety and Health Bulletin*, "Natural Gas Line Breaks" (DOE/EH 0697), issued in January 2006, includes a number of steps that can be taken to prevent gas line breaks, including the following.

- Conduct a pre-task meeting just prior to performing the work. Review procedures and discuss work activities.
- Buried gas lines need to be clearly marked on the ground before excavation work begins.
- Inconsistencies between as-built drawings and markings of gas lines should be resolved by hand digging or potholing (localized hole digging).
- Hand digging or potholing should be done within 5 feet of a marked gas line.
- Potholing should be done at several locations to ensure that the depth of the gas line did not change significantly at any point.
- Backhoes and similar equipment should not be used near gas lines.
- Observations at the work site that differ from the operational plan or from the work permit descriptions should be noted and immediately reported to the supervisor.
- Damage protection (e.g. installing bollards) needs to be provided for aboveground gas piping and meters.

These events demonstrate the importance of thorough pre-job planning with specific, not generic, work packages and the need for mandatory pre-work walkdowns that include task-specific "what-if" scenarios. Careful planning can also be augmented by operators who react quickly to changing conditions.

Some events demonstrate that, despite careful planning, as-builts may not match drawings or there may be conditions

If You Strike a Gas Line

- Stop work
- Notify supervisor
- Call 911
- Notify the gas company

– Department of Transportation and the American Public Works Administration

outside the planners' and workers' control. As a result, workers must be accompanied by a spotter and must stay completely focused on the job so they are prepared to react quickly to emerging conditions.

KEYWORDS: *Excavator, gas line, backhoe, excavation*

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

Safety XChange Reports on Best Practices of 2006

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On December 26, 2006, a SafetyXChange online news article, *SafetyXChange Year in Review: 2006 Best Practices*, provided links to a dozen articles on best worker safety practices, as published by *Best Practices Weekly* throughout the year. Although not all of the articles may apply to DOE, several of them identified best practices in areas discussed in the Operating Experience Summary during 2006.

In his best practices article, *Defeating Presenteeism: How to Get Sick Workers to Just Stay Home*, Dr. Kenneth S. Weinberg identifies three basic causes of "presenteeism."

1. Fear — Employees are afraid they'll be fired or that their boss or coworkers will think less of them if they stay home.
2. Denial — Some workers will not admit to themselves that they are sick. Or, they fool themselves into thinking they are over the cold, flu, stomach virus, or other ailment.
3. Dismissal — Workers might recognize that they are ill, but brush it off as "nothing serious."

Weinberg also offers advice to supervisors, stating that one of the best ways they can combat presenteeism is to speak directly to workers about the problem. He suggests that supervisors reassure workers of the following.

1. They won't get into trouble for staying home when they are sick. (Let them know that the best thing for the company is for them to stay home, take care of themselves, and get better as quickly as possible.)
2. They shouldn't place too much trust in medications. (Let workers know that some medications can cause drowsiness or affect their ability to concentrate and that these effects could be present at work, even if the medication is taken at home at bedtime.)
3. They should listen to what their body is telling them. (Tell workers to take their symptoms seriously.)

Unrevealed Health Issues Result in Injuries and Fatalities (OE Summary 2006-02) discussed being fit for duty and reporting to work mentally and physically fit to perform safely, responsibly, productively, and reliably. The article pointed out that when workers fail to disclose a health issue, either physical or psychological, the consequences can be serious (e.g., the 2003 Staten Island Ferry crash) and indicated that workers, coworkers, and supervisors need to take responsibility for reporting and addressing health-related issues.

Another of the Safety XChange best practices articles, authored by Catherine Jones, *Golf Carts: How to Keep Them on a Safe Course,* provides numerous tips designed to help workers protect themselves, their passengers, and their coworkers when using golf carts as work vehicles.

Among the tips that Ms. Jones provides are several to follow when stopping or parking a golf cart, including the following.

- Don't park in front of emergency exists, fire hydrants, fire lanes, sidewalks, ramps, or doors.
- When parking, set the brake, place the cart in neutral, and remove the key.
- Secure the parked golf cart with a cable or other locking mechanism.

Accidental Activation of Golf Cart Results in Near Miss, published in OE Summary 2006-09, reported on an event in

which a golf cart traveled about 120 feet, sideswiped several flammable material storage cabinets, and struck a parked articulating boom lift (Figure 3-1). A mechanic was working underneath the cart at the time of the accident and had not removed the key, disconnected the battery, or put the gearshift in neutral before beginning work.

Because these measures for hazardous energy control were not implemented, the resulting accident could have caused a serious injury or fatality.

Ms. Jones' article also lists safe procedures to be followed both before driving the cart and while driving it, as well as when carrying passengers or transporting goods in the cart. Some of these tips may be particularly useful at DOE sites where the carts are used for groundskeeping, including those listed below.

- Slow down in wet conditions, on steep slopes, when approaching corners, intersections, or blind spots, and in areas of heavy pedestrian traffic.
- To avoid tipping, drive the cart straight up and straight down slopes—not on a diagonal.
- Wear the seatbelt and make sure passengers wear theirs.
- Make sure materials are securely fastened.
- Don't overload the cart. Take only the bare minimum.

In *Working Alone: Helping Workers Handle the Hazards of Isolation*, Carola Hicks points out the risks isolated workers face and offers advice on how to teach workers to assess hazards themselves. She poses a worst-case scenario in which an isolated worker is suddenly overcome by an odorless and invisible gas, falls from a scaffold, or is threatened by an assailant and hours go by before the worker is reported missing, the next shift arrives, or the worker is found dead. Ms. Hicks proposes that working together, employers and workers can do much to

Figure 3-1. Aftermath of runaway golf cart event

ensure that these circumstances do not result in incidents that lead at best to terror and at worst to injuries, illnesses, and fatalities. Hicks states that, although it is the employer's job to ensure that others are aware of the worker's whereabouts and schedule and to furnish a means of communication that, at a minimum, enables the worker to call for help, it is also important for workers to take precautions to ensure they are prepared for eventualities that cannot be anticipated and to keep their heads when and if these unforeseen events arise.

Remote workers present distinct emergency management challenges, including the following.

- They cannot hear safety alarms or evacuation signals.
- They must have a viable method to summon help when needed.
- They may not be able to accurately describe their location to emergency response personnel.

In addition, site personnel responsible for the oversight of remote workers may not know exactly where the workers are or when they are expected to complete a task, particularly if they are subcontractor workers.

At the Savannah River Site (SRS), Operations personnel worked with Environmental and Geographic Information Systems (GIS) staff to develop a GIS tool that enables remote worker activities to be integrated into one system. The SRS Remote Field Worker Tool was the topic of a DOE best practices article in OE Summary 2006-01.

Using the Remote Field Worker Tool, an SRS dispatcher can identify a worker's location in an emergency and give explicit instructions to the responding unit. Figure 3-2 shows the graphical user interface map that is a key element of the Remote Field Worker Tool. Worker icons are color-coded by organization on the map, indicating which workers are logged in and their locations. Although the workers are dispatched by multiple organizations, the SRS Operations Center monitors them for emergency response.

Some of the other best practice articles in the *Safety XChange* list may also provide ideas and tips for steps that can be taken to enhance safety across the Complex. For example, *Near Misses: Getting your Employees to Report Them* offers ideas such as starting an incentive plan that rewards those who report near misses, and *Preparing for a Disaster: How to Develop a Readiness Plan* provides objectives for, and components of, a successful disaster plan.

All 12 of the *Safety XChange* articles, as well as articles on other safety topics, can be found at www.safetyxchange.org. OE Summary articles from 2002 through 2006 can be accessed from the DOE Office of Health, Safety and Security website in the Office of Corporate Safety Analysis on the Analysis page (http://www.hss.energy.gov/CSA/analysis/oesummary/index.html).

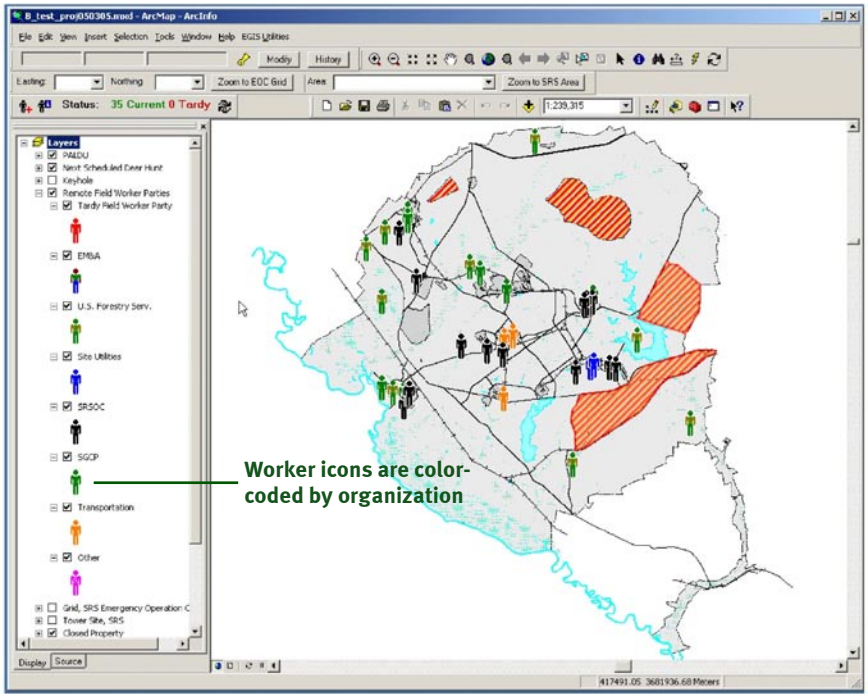

Figure 3-2. Remote Field Worker Tool display

Sites across the Complex are encouraged to share their own Best Practices with the Office of Health, Safety and Security so that others may also benefit from their experience.

KEYWORDS: *Best practices, fitness for duty, golf cart, hazardous energy, remote worker*

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

Fluor Hanford Develops Training Material on Hazards Involving Neutral Conductors

4

As part of an ongoing effort to improve electrical safety, Fluor Hanford has developed a slide presentation on potential hazards that may be encountered with neutral conductors. These current-carrying conductors can pose an electrical shock hazard if the current is broken or lifted under load.

Since 2005, 11 events have been reported to ORPS involving neutral conductors. Most recently, on January 11, 2007, an electrician at Hanford who was repairing an overhead halogen light unexpectedly observed a small electrical arc because of a shared neutral wire (reference: ORPS report EM-RL--PHMC-FFTF-2007-0001). In addition to shared neutrals, other examples include:

- Common neutrals improperly terminated;
- Spliced neutrals; and
- Discovery of energized neutrals even after zero-energy checks.

This presentation can be used as a visual aid to augment refresher training for electricians or to increase awareness of electrical hazards in other worker populations.

Operating Experience Summary 2005-15 contains an article that describes the electrical safety hazards posed by shared neutrals.

Click here to download and view the Fluor Hanford presentation.
(http://www.hss.energy.gov/csa/analysis/oesummary/oesummary2007/neutral_hazards.pps)

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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