DEPARTMENT OF ENERGY
ELECTRICAL SAFETY

Operating Experience and Lessons Learned Report

U.S. Department of Energy
Office of Corporate Performance Assessment

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Electrical Near Misses Continue to Occur

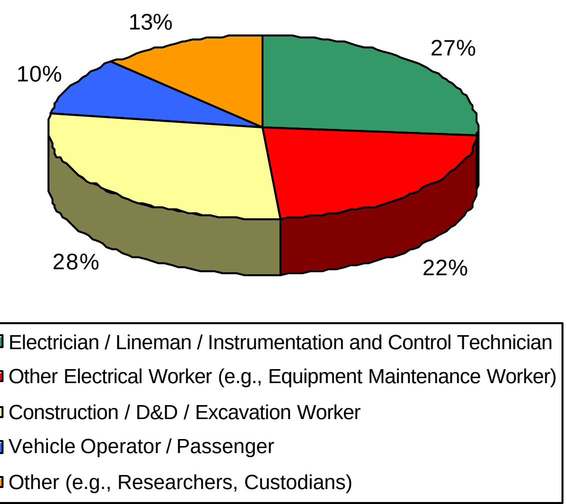
Electrical safety occurrences are the most frequently reported near miss events across the DOE complex, and thus pose the greatest risk to workers. In 2002 and 2003, electrical safety occurrences were reported at a rate of two per week, with three-quarters of them categorized as near misses (to serious injury or death). Thirty-five of the electrical occurrences in this 2-year period involved shocks to workers; six resulted in electrical burns.

An analysis of the electrical occurrences in 2002 and 2003 showed that about 50 percent involved electrical work performed by electricians and other electrical workers who install, remove, or maintain electrical equipment or components. DOE's non-mandatory *Electrical Safety Handbook* (DOE-HDBK-1092-98) addresses these activities. While deviating from recommendations in the handbook and other electrical standards often contributed to occurrences involving electrical work, the root causes largely stemmed from basic conduct of operations deficiencies involving work planning, lockout/tagout, and configuration management. (The *Electrical Safety Handbook* is available at http://tis.eh.doe.gov/techstds/standard/hdbk1092/hdbk1092.pdf.)

Electrical occurrences involving non-electrical workers (e.g., construction workers and vehicle drivers) comprised the remaining occurrences. In many cases, the electrical hazards in these occurrences resulted from errors and deviations previously made by electrical workers. Non-electrical workers are protected by general regulations, such as OSHA rules for construction, excavation, and vehicle safety. These workers' activities are not directly addressed in the DOE *Electrical Safety Handbook.*

The purpose of this report is to describe commonly made electrical safety errors and identify lessons learned and specific actions that should be taken to prevent similar occurrences.

Workers Involved in 2002-2003 Electrical Safety Occurrences



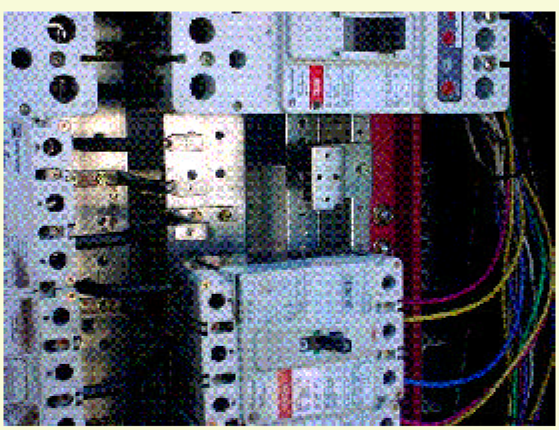
Electrical Work Near Misses

Qualified electricians, linemen, instrumentation and control, electrical or electronic technicians, and trained operations or maintenance workers who installed, removed, and maintained electrical equipment were involved in electrical near misses in 2002-2003. All such electrical

Electrician Burned by Electric Arc Flash in 2002

A journeyman electrician was replacing a 20-amp circuit breaker with a 60-amp breaker in an energized 480-volt, 1,600-amp distribution panel when an electric arc flash occurred. He received minor flash burns on his forearm and neck. In violation of procedures, the electrician tried to minimize downtime to the facility by mounting the replacement breaker without de-energizing the panel. He then planned to isolate the panel with a lockout/tagout before attaching the breaker to the bus bar and load side connectors. However, as he was attaching a mounting screw, his screwdriver slipped, made contact between a breaker lug and a grounded mounting plate, and created the arc flash.

Damaged screwdriver



Arc-flash damage to distribution panel

workers are expected to know how to protect themselves from the electrical hazards they will be exposed to while performing their tasks.

About three-quarters of the electrical work occurrences were caused by either personnel errors (e.g., procedure violations or "inattention to detail") or work control weaknesses. Common personnel errors included working on energized equipment or circuits without authorization or personal protective equipment, wiring mistakes coupled with failure to verify safe-energy conditions, and leaving unsafe conditions (e.g., improper grounding). The most effective safety barrier against electrical energy is to de-energize the source and control it with a lockout/tagout process. However, mistakes in establishing and clearing lockout/tagouts were common work control problems.

Lockout/Tagout Requirements

- OSHA regulation 29 CFR 1910.147(a)(3)(i) states: "This section requires employers to establish a program and utilize procedures for affixing appropriate lockout devices or tagout devices to energy isolating devices, and to otherwise disable machines or equipment to prevent unexpected energization, start up or release of stored energy in order to prevent injury to employees."

- OSHA regulation 29 CFR 1926.333(b)(2) *Lockout and Tagging*, states: "While any employee is exposed to contact with parts of fixed electric equipment or circuits which have been de-energized, the circuits energizing the parts shall be locked out or tagged or both in accordance with the requirements of this paragraph."

Weakness in configuration management contributed to about one-fifth of the occurrences involving electrical work. In the occurrences caused by configuration management problems, job planners were often at fault because they did not walk down the work site to verify as-built conditions and identify unexpected sources of energy. The lack of accurate drawings when needed to safely isolate electrical systems is also a continuing problem across the DOE complex. Changes in system configuration due to upgrades, construction work, and decommissioning work are not always incorporated into electrical drawings.

Measures to Prevent Electrical Work Occurrences

- Walk down the work site to (1) identify equipment to be worked on, (2) ensure that equipment to be isolated is clearly marked, (3) verify or modify drawings to reflect as-built conditions, and (4) identify additional hazards or other safety issues.

- For decommissioning work, re-evaluate electrical hazards as systems and equipment are dismantled and isolations are removed.

- Ensure that lockout/tagout procedures or work instructions include a zero-energy check to confirm the effectiveness of the lockout/tagout installation. Always perform a zero-energy check on the circuit to be worked, as well as on other nearby circuits and terminals. Perform these checks any time new areas or equipment are accessed.

- Upon completion of wiring work, check for proper voltages, phasing, and grounding.

- Use lockout/tagout processes if there is a possibility that work may be performed in close proximity to energized electrical conductors.

Electrician Shocked while Working on Energized Circuit in 2003

Electricians replacing light ballasts in a cafeteria worked on the energized, 277-volt circuits in accordance with past-approved practices. Due to the confined space, one electrician did not wear protective gloves. Design errors in the length of the wires connecting a ballast with a light fixture caused him to contact a live conductor. Current flowed into his finger and he sustained a burn on the little finger of his right hand, as well as exit burns on his right arm. After review of the incident, policies were changed to require de-energizing all circuits and securing them by lockout/tagout.

- Ensure that lockout/tagout procedures or work instructions include independent verification that the lockout/tagout has been correctly performed.

- Ensure that purchased electrical components and equipment are acceptance-tested before they are put into service.

- Work on energized circuits should be performed only after obtaining special approvals and developing job-specific safety controls.

- Always use electrical-rated personal protective equipment (e.g., insulated gloves and boots, ground-fault circuit interrupters, double-insulated tools, and rubber mats) when working on energized electrical circuits and equipment (required by 29 CFR 1910.335(a)(1)(i)).

- Stop work if an unanticipated electrical hazard or condition is encountered and seek appropriate assistance.

Electrical Intrusion Near Misses

Excavation, construction, and demolition workers are often placed at risk from

Discovered Energized Wires Cause Near Miss in 2003

While excavating a hole by hand in preparation for installing a counter-balance for a door, an equipment operator discovered unmarked wires in a corroded, broken conduit. The excavation work was stopped and a utilities locator reviewed the drawings, but could not find conduit and wires in that location. An electrician was dispatched to the site, and his initial checks of the wires did not reveal electric energy. The electrician then removed the cover from an electrical elbow in a nearby facility and discovered abandoned wires. To verify that the wires in the excavation were the same as the abandoned wires, the electrician had the equipment operator tug on the wires to see if they moved. Instead, an arc occurred in the conduit as the operator pulled the wires.

accidental intrusion into energized electrical lines. Electrical intrusion events include accidental contact with underground utilities during excavation and penetration of embedded or concealed utilities within structures such as walls, floors, and ceilings. The workers involved are generally not trained as electrical workers.

Such events can cause injuries ranging from minor electrical shocks to severe burns to electrocution, especially when personal protective equipment is not used. Intrusion events also incur monetary costs for the repair of breached wires and conduits and for the lost time associated with repairs, power outages, and delays in tasks and facility missions. Causes include inaccurate as-built drawings, procedure noncompliance (e.g., not hand digging as required), blind penetrations, lack of zero energy checks, and inadequate component marking during electrical conduit demolition. The range of voltages involved 120 volts through 13.8 kilovolts.

The review of these events was divided into two types: excavation and cutting / drilling.

Excavation Near Misses

Excavations that struck buried electrical utilities were reported at a frequency of once per month during 2002 and 2003, with the majority occurring during construction. The workforce in these events consisted primarily of subcontractors, and the voltage they were exposed to was typically 480 volts. The method of excavation during these occurrences was almost evenly divided between machine excavation and hand excavation. Machine excavation involved backhoes, trackhoes, loaders, and excavators;

Grader Snags an Energized 120-Volt Line in 2003

Construction workers assigned to install an erosion control fence decided to use a grader with a ripper blade when their ditch-witch could not penetrate the soil. They accidentally snagged an underground line running from an onsite utility pole to a facility building. The equipment operator checked the breaker for the line and it was tripped. Environmental restoration personnel have always used guidance known as the "1-foot rule" (i.e., if the soil will be penetrated less than 12 inches an excavation permit locating underground utilities is not necessary). The fence installation required only 6 to 8 inches penetration. What was not considered was that past activity at the site could have lowered the surface level in relation to the depth that underground utilities were originally installed. Workers did not realize that they should have stopped work and informed management when the electrical cable was discovered. When the excavation permit was requested, the area was not clearly defined. Facilities personnel thought there were no utilities in the area specified and wrote "no underground utilities" on the front of the permit.

while hand excavation involved jackhammers, shovels, picks, digging bars, and posthole diggers. Although equipment operators were generally separated by distance from the immediate hazard (e.g., inside their vehicles), laborers were in close proximity to the electrical hazard because they were using hand tools.

In many of the occurrences, inadequate as-built drawings or lack of drawings was cited as a major causal factor. Other causal factors included failing to use locating equipment or not complying with the requirements of the excavation permits, (e.g., hand-digging within 5 feet of buried electrical line in order to save time). Also, there were some occurrences in which using survey equipment did not provide a positive locate. Only one worker received an electrical shock while attempting to locate utilities.

Laborers Exposed to Energized 480-Volt Cable Damaged by a Trackhoe in 2003

An excavation operator cut into an energized 480-volt cable while digging a building foundation with a trackhoe, causing a circuit breaker to trip. The damage to the cable was not apparent because it was still buried. Laborers entered the excavation to hand dig and uncover the cable but they did not know that someone had reset the circuit breaker and reenergized the cable. Heat given off by the damaged cable caused water in the excavation to release steam to the atmosphere. The laborers immediately stopped work. Investigators determined that the subcontractor site superintendent knew of the requirement to de-energize and lock out the cable, and did not. He knowingly sent workers into the excavation to hand dig around an energized cable in violation of procedures. Exposure to the energized cable could have been avoided if the circuit had been locked out.

Cut electrical conduit

In several occurrences, workers assumed that utilities were abandoned or de-energized, or they assumed the wrong depth or direction of buried utilities. In addition, many workers failed to initiate a lockout/tagout when they knew there were utilities in the area.

Cutting and Drilling Near Misses

Cutting and drilling into energized electrical lines have been reported at a frequency of once per month. The majority of these occurrences happened during construction and facility demolition. The workforce in these occurrences primarily involved employees of the prime contractor, and

Craftsman Cuts into Energized Electric Line while Removing Conduit in 2003

A demolition craftsman was removing conduit with a reciprocating saw and cut into an energized 110-volt line. The work control document explicitly required verification that the line was either de-energized and air-gapped or covered by a lockout/tagout. Investigators learned that, based on work performed a month before, the craftsman assumed that electricians had de-energized the circuit. He also failed to request a zero-energy check or complete a thorough walkdown to verify that all electrical service was air-gapped.

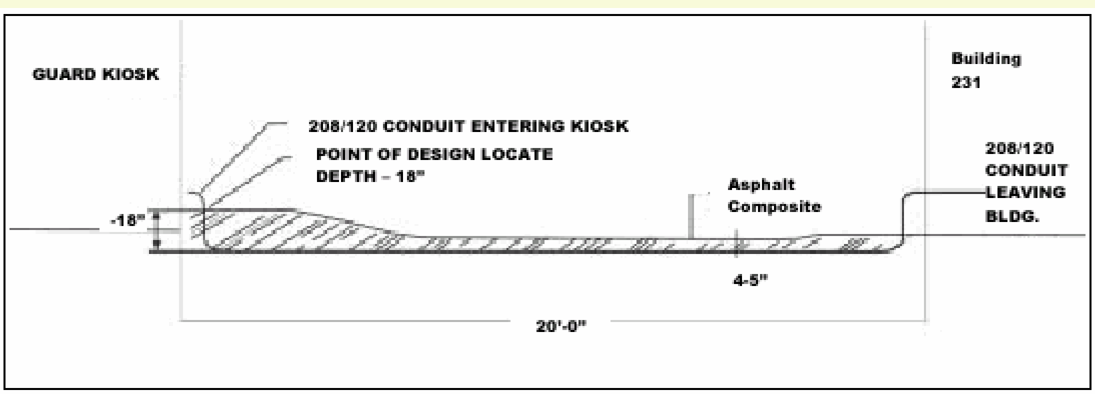
typically they were exposed to 120 volts. These occurrences involved drilling into structures (blind penetrations) or cutting conduit using hand tools. This is significant because hand tools place the worker in close proximity to the hazard (i.e., energized source).

The majority of the events occurred while cutting conduit with saws or core drilling with electric drills. One worker received an electrical shock while cutting conduit with a hydraulic shear. For facilities that are undergoing closeout and demolition, a typical activity involves the removal of electrical conduit. In many cases, some electrical systems may need to remain energized (such as lighting circuits) while other conduit and electrical systems are being removed. This can present a challenge to ensure that circuits are properly marked and de-energized.

In many of the occurrences, workers failed to perform a zero-energy check before cutting into conduit containing energized electrical conductors. In some instances they just assumed the circuit was de-energized. In other cases, workers failed to lockout the energy source, failed to verify the circuit was air-gapped (separated from an electrical source), or failed to verify (physically trace) the power source. Other causes included inadequately marked conduit or confusing markings on conduit to be removed. Also, in some of the excavation events, workers wrongly assumed the location or direction of concealed electrical lines.

Laborers Cutting Asphalt Severed a Buried Energized Line in 2003

Laborers performing an asphalt saw-cutting operation partially severed an underground 208/120-volt electrical conduit. The location of the conduit was correctly marked on the surface of the asphalt, but the depth was assumed to be 18 inches. The actual depth of the conduit below the surface was determined to be only 4 inches. However, because of the short distance of available conduit (20 feet), the depth locator on the locating equipment had a high degree of inaccuracy. The manufacturer specifications for the locating equipment stated that distances less than 50 feet would not produce accurate depths on buried utilities and air coupling might result. The workers expected to find the conduit at 18-24 inches below grade based on Laboratory experience and the design locate survey which showed a depth of 18 inches at the guard kiosk. Investigators concluded that Ground Penetrating Radar (GPR) might have provided additional information. GPR is used for locations when the locator believes the readings are suspect or if the length of conduit/pipe identified is less than 50 feet in length. The GPR readings compensate for the uncertainty in locating equipment when determining depth.



Common Aspects of Electrical Intrusion Events

Electrical intrusion-type events typically involve non-electrical workers (e.g., equipment operators, laborers), performing non-electrical work who may not have any type of electrical safety training or expectation that an electrical hazard exists. Fortunately there were no serious injuries from such events in 2002 and 2003. Stop-work authority was almost universally used when unexpected conditions were encountered and in some cases, workers used personal protective equipment.

Determining the precise location of buried and embedded utility lines is an industry-wide problem. As-built drawings should not be relied upon as the only source for locating underground or embedded utilities, particularly if the accuracy of the drawings is suspect. Scanning and survey equipment has been used successful to locate electrical lines. However the technology has limitations that need to be understood; for example, embedded conduit and rebar have similar reflective properties. The general uncertainties surrounding the existence and precise location of these utilities demand special planning and execution of any excavation, penetration, or cutting activity.

The potential hazard of energized utilities should be identified and controlled through the implementation of physical and administrative barriers to help prevent accidents. Barriers include appropriately rated personal protective equipment, lockout/tagout, and verification of zero energy.

OSHA requirements and prevention measures generally apply to all types of intrusion events, whether they were caused during excavation, penetration, or demolition work. OSHA defines concealed wiring as wiring rendered inaccessible by the structure or finish of the building. Wires in raceways are considered concealed, even though they may become accessible by withdrawing them. As shown in the text box, OSHA sets safety standards for employee protection.

OSHA Requirements to Prevent Electrical Intrusion

- 29 CFR 1926.416(a)(2) states: “In work areas where the exact location of underground electric power lines is unknown, employees using jack-hammers, bars, or other hand tools which may contact a line shall be provided with insulated protective gloves.”
- 29 CFR 1926.416(a)(3) states: “ 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 employer shall post and maintain proper warning signs where such a circuit exists. The employer shall advise employees of the location of such lines, the hazards involved, and the protective measures to be taken.”
- 29 CFR 1926.651(b)(1) states: “The estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, shall be determined prior to opening an excavation.”
- 29 CFR 1926.651(b)(2) states: “Utility companies or owners shall be contacted within established or customary local response times, advised of the proposed work, and asked to establish the location of the utility underground installations prior to the start of actual excavation.”

Measures to Prevent Electrical Intrusion Occurrences

- Mark all concealed electrical wiring when located.
- Drill pilot holes and penetrate no deeper than is required for the job.
- Check drill holes frequently for obstructive material, such as wire fragments or rebar.
- Always wear personal protective equipment.
- Clearly mark components that are to be removed and establish boundaries and hold points for zero energy verification when performing demolition work.
- Conduct source checks for energy near the work, and not just at "known" energy sources.
- Exercise "stop work authority" if unanticipated conditions are encountered.
- Use appropriate personal protective equipment that has proper electrical ratings.
- Standardize methods for identification and location of concealed or buried electrical utilities.
- M&O contractors should share information such as locator data, drawings, and permit information with subcontractors performing the work.
- Analyze the specific work activity and do not just base hazards controls on established standards and work practices.
- Perform excavation and penetration work in a timely manner following surveys and marking of locations. Markings can deteriorate over time, and conditions can change.
- Employ utility locator services or use the latest survey technology available.
- Hand-excavate in close proximity to the expected location of the utility rather using excavation equipment.
- Re-evaluate hazards analysis processes and associated controls for excavation and electrical penetration-type work.
- Place marking tape or electronic markers above newly installed utilities or excavated utilities to aid in future identification.

Vehicle Near Misses

Vehicles strike overhead electrical power lines and other electrical sources within the DOE complex almost monthly. Such occurrences in 2002 and 2003 involved dump trucks, cement trucks, tractor-trailers, front-loaders, trackhoes, excavators, and forklifts snagging overhead utility lines with voltages ranging between 120 volts and 13.8 kilovolts. In a few occurrences, the vehicles hit utility poles, guy wires, messenger cables and communication lines, and this damage indirectly severed the power lines. In some cases, live power lines fell onto the vehicles,

In 2002, excavator boom contacted 13.8 kv overhead power line

Gravel Truck Contacts 13.8 kV Electrical Transmission Line in 2002

The driver of a gravel-hauling truck had just completed a gravel dump at a DOE site and was lowering the truck bed when the bed came in contact with an energized 13.8 kilovolt transmission line. The truck served as an electrical ground, blowing one tire and scorching two others and causing a small grass fire. The driver was aware of the transmission line but had guessed incorrectly that he had enough clearance to lower the truck bed. His escort had not been trained as a spotter. Although the escort expressed concern over the clearances, he did not stop the operation. The driver and escort were fortunate not to have been injured or killed.

placing the drivers and passengers at risk from electrical shock.

In many of the occurrences, the vehicle drivers knew of the electrical hazards and initially passed them safely — most likely giving them a false sense of confidence. When the drivers' tasks changed the vehicles' profiles (e.g., by raising a truck bed, boom, fifth wheel, or forklift mast), they neglected to consider this effect and subsequently snagged the utility lines on their exit trips.

In one occurrence, a road was initially closed to truck traffic, and overhead lines were hung to an allowed lower clearance. When the road was opened to truck traffic, site personnel neglected to raise the overhead lines to the height required for trucks (see requirements text box). Subsequently, a concrete truck that had unloaded and was exiting snagged four overhead lines, breaking three utility poles. In recent years, a similar occurrence resulted from raising a roadbed at a construction site but neglecting to raise the lines crossing overhead.

In several occurrences, spotters were used as required by OSHA regulations (see text box) but the spotters lost communication with the drivers or a single spotter was insufficient to see all the hazards. In other cases, the spotters were effective only initially and either left or became diverted before the snagging occurred.

Vehicle / Overhead Line Requirements

- OSHA regulation 29 CFR 1910.333(c)(3)(III)(A) states: "Any vehicle or mechanical equipment capable of having parts of its structure elevated near energized lines shall be operated so that a clearance of 10 feet is maintained."

- OSHA regulation 29 CFR 1910.550(A)(15)(IV) states: "A person shall be designated to observe clearance of the equipment and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means."

- Institute of Electrical and Electronic Engineers *Standards for Overhead Conductor Clearances*, Part 2, Table 232-1 requires that for roads and other areas subject to truck traffic, the maximum sag for wires, conductors and cables is a height of 15.5 feet.

Measures to Prevent Vehicle/Electrical Occurrences

- Job hazard analyses for tasks involving vehicles need to include all work areas and travel routes to identify overhead electrical hazards and to address appropriate requirements for vehicle clearances and an adequate number of spotters.

- Job hazard analyses should also consider the possibility of changed vehicle profiles and load configurations, such as raised truck beds, the shifting of masts and booms, and the increased heights of vehicles after unloading.

- Spotters assigned to transports need to be dedicated for the whole job, including exiting.

- Drivers must be trained to stay in communication with spotters and to be aware of the effect of changed vehicle and load configurations on clearances.

- Guy wires, utility poles and overhead lines need to be marked if not clearly visible to drivers and spotters.

Other Electrical Near Misses

A significant percentage of the electrical safety occurrences could not be categorized in the work activities discussed above. For example, researchers, security guards, cafeteria workers and custodians experienced electrical shocks. In those occurrences, incorrectly installed or deteriorated wires, plugs, receptacles and improper grounding were the direct causes. In two separate occurrences, workers mowing grass cut unmarked electrical extension cords used to power outside monitors.

In most of these "other occurrences," the people affected were unaware of (or inadequately trained for) the electrical hazards to which they were exposed. Similar to the occurrences discussed above involving construction and excavation workers, the workers were placed at risk by the previous actions (or lack of action) of others.

Student Researcher Receives Electrical Shock During 2002

A student researcher performing an experiment was shocked when he touched the metal edge of a fume hood with one hand while the other hand held a stainless steel inspection mirror in contact with a metal reactor. An ungrounded cartridge heater inside the reactor had failed and produced the shock. Such failures occurred occasionally with this type of equipment; however, unlike other hoods at the facility, this one did not have a ground fault circuit interrupter (GFCI) device to prevent shocks. A corrective action was to install a GFCI device.

Safety Responsibilities

When performing tasks that may involve electrical hazards, roles and responsibilities should be clearly defined, understood, and reviewed before beginning work. In addition, all workers must be aware of their responsibility to stop work whenever the safety of the operation is questionable. The following questions, based on lessons learned from recent electrical occurrences, pertain to the safety responsibilities of all workers.

- **Managers**

  - Has sufficient rigor been applied to hazards analyses, work planning, and equipment inspection in work environments involving multiple tiers of contractor and subcontractor personnel?

  - Have site-specific electrical requirements been provided to subcontractors for implementation?

  - Are workers aware of their stop-work authority, and do they understand how to invoke it?

  - Do qualified supervisors oversee personnel in training and briefings?

  - Do electrical safety committees meet regularly and address emerging electrical safety issues, benchmark other site's programs, share best practices, self-assess their safety programs, and explore new technologies for locating concealed utilities and electrical hazards?

- **Work Planners**

  - Are accurate drawings and equipment identification used? Have the drawings and equipment identification been verified by walk-downs and subject matter experts to ensure they reflect as-built configuration?

  - Have walk-downs also been performed to check for potential hazards and anything that could interfere with the performance of work?

  - Are measures taken to locate undetected buried and embedded power lines?

  - Are workers assigned personal protective equipment suitable for planned tasks and for potentially undetected electrical hazards?

  - Have an adequate number of spotters been assigned to tasks involving vehicles, and are they dedicated until the vehicles complete their task or leave the site?

- **Supervisors**

  - Do pre-job briefings identify all electrical safety hazards?

  - Do workers understand their tasks and the potential hazards involved?

  - Do all workers understand that improvising is prohibited?

  - Do workers understand their responsibility to stop work when problems emerge instead of taking ad-hoc compensatory measures?

  - Are steps taken to ensure that electrical systems are not left in an unsafe condition at shift turnover?

  - Are barriers (e.g., lockout/tagouts) adequate and in place?

  - Are spotters and vehicle/equipment operators able to communicate verbally and visually?

  - Have workers passed on relevant and accurate information regarding electrical safety issues to co-workers and supervisors?

  - Do workers focus their attention on the safety-significance of the task and remain alert to the potential impact from distractions?

  - Do workers approach each task with a questioning attitude, thinking through the steps and key decision points before acting?

  - Are post-job briefings held to critique performance and identify improvements?

- **Electrical Workers**

  - Do the components, procedures, tools, personal protective equipment, and resources provided satisfy the requirements of the planned tasks?

  - Have checks been made to verify that electrical circuits/equipment are not left in an unsafe condition?

  - Are electrical equipment/component responses (e.g., voltage measurements) those that are expected?

  - Is equipment de-energized before being serviced or maintained?

  - Are correct shielding and insulating materials and tools being used when working on electrical equipment/ circuits?

– Has approval been given to work in energized equipment/circuits?

– Are procedures for working near energized equipment being followed or used?

- **Non-Electrical Workers**

  – Have steps been taken to identify and mitigate electrical hazards?

  – Has personal protective equipment been provided or have other measures been taken to prevent risks from undetected energized circuits during drilling, cutting and excavation?

- **Vehicle Drivers/Equipment Operators**

  – Have overhead power lines and sources and their heights been identified for the travel routes to be taken?

  – Will any operation of the vehicle place it, its mechanical equipment, or its load within 10 feet of overhead lines, utility poles, or supporting guy wires?

  – Are dedicated spotters provided for all travel routes and for all work activities? (If not, why not?)

- **Spotters**

  – Are there sufficient spotters to detect all hazards and communicate them to the vehicle drivers/equipment operators?

  – Have steps been taken to ensure communication with vehicle drivers/ equipment operators?

Office of Corporate Performance Assessment

The Office of Environment, Safety and Health, Office of Corporate Performance Assessment (EH-3) has two overarching responsibilities. These are to review existing operational safety data streams to determine if significant safety vulnerabilities exist, and to provide information in support of DOE decision making. Significant safety vulnerabilities are communicated to appropriate management so that intervention can take place before serious safety issues or events arise.

Although safety is difficult to measure in terms of accidents prevented, existing safety operational data identify safety vulnerabilities both at a site-level and complex-wide level. The Office of Performance Assessment and Analysis strives to provide line management with useful information to drive changes in the workplace that will continue to improve safety performance across DOE.

U.S. Department of Energy Office of Corporate Performance Assessment

Frank B. Russo
Deputy Assistant Secretary
(301) 903-8008
(301) 903-1257 fax
Frank.Russo@eh.doe.gov