

OE-3: 2017-07

December 2017

## Contact with Underground Utility Lines

### PURPOSE

This Operating Experience Level 3 (OE-3) document provides information about a safety concern related to excavation at Department of Energy (DOE) facilities involving equipment that disturbs the subterranean environment and has the potential to contact and damage buried utility lines.

### BACKGROUND

Several recent events have been reported to the Occurrence Reporting and Processing System (ORPS) involving unexpected contact with underground utility lines. These reports reveal a trend of inadequate work planning and safe execution of excavation and construction activities.

- 1) On May 22, 2017, during excavation at Oak Ridge National Laboratory (ORNL) to install a new roof drain line, a bucket loader operator detected that something was snagged on the equipment underground. Hand digging with a shovel revealed that a grounding cable had been disconnected from the grounding rod at the weld. Construction work was stopped and the general area was barricaded. A fact-finding review identified the loss of control of two necessary drawings to locate the underground utilities, which were not provided to the excavation subcontractor. (ORPS Report EM-ORO--UCOR-OENVRES-2017-0003)
- 2) On April 2, 2017, heavy-equipment operators were digging post holes with a Bobcat power auger to install road signs

outside the Materials Fuels Complex at Idaho National Laboratory when they struck an underground phone cable. A subsurface investigation was completed and the dig areas were marked. It was later determined that the fire alarm service to the Transient Reactor Test Facility was disrupted by this event. (ORPS Report NE-ID--BEA-CFA-2017-0003)

- 3) Two events occurred at the East Tennessee Technology Park in October, 2016 involving contact with buried utilities during the installation of new power poles. These incidents raised management concerns and identified opportunities for improvement in project understanding and execution of excavation/penetration program controls. (ORPS Report EM-ORO--UCOR-KENVRES-2016-0005)
- 4) On October 4, 2016, an underground fire loop water main was damaged during directional drilling operations at the West Valley Site. A subcontractor working under an approved work document, and an assigned Subcontract Technical Representative (STR), were within five feet of completing the 423-foot run, when water began to fill the eight-foot-deep trench where the drill head was expected to emerge. The STR heard the electric fire pump start and realized that the water main had been hit. All work on this activity was immediately suspended, the damaged section of the line was isolated, an impairment for the fire system was implemented, and the local fire department was notified. (ORPS Report EM-OH-WVDP-CHBW-CF-2016-0002)

5) On August 23, 2016, a construction subcontractor was excavating an area at the National Energy Technology Laboratory with a backhoe and shovels during a water line installation project when they hit an underground electrical conduit. The conduit was breached and a 110-volt electrical line was severed. A digging permit had been obtained prior to excavation operations and the electrical conduit had been indicated on the soil surface. No potholes had been dug for locating underground structures, lines, or equipment. An appropriate utility detection service had not been used to verify if any utility lines were present. The lines had not been locked and tagged out prior to excavation activities. (ORPS Report FE--NETL-GOPE-NETLMGN-2016-0004)

### **ANALYSIS AND OBSERVATIONS**

These events were reviewed to determine common factors and identify lessons learned. The following observations are noted:

- A common cause of these events was inadequate job planning.
- Loss of configuration control was also cited in several of the incident reports, with regard to the drawings and documents that noted locations of underground utilities.
- Heavy construction equipment was involved in all of these incidents.

### **DISCUSSION**

Underground utility lines are present in many locations throughout DOE facilities and on DOE-owned grounds. They include electrical lines for telecommunication, electricity distribution, cable, fiber optics, traffic lights, and street lights; plumbing systems such as storm drains, water mains, and wastewater pipes; and process and waste lines that transport hazardous materials.

Prior to beginning an excavation, construction, or demolition project, it is important to carefully

evaluate the subterranean environment and to mark the location of all existing underground utility lines, to protect the facility from damage by tools or equipment being used and to protect workers from exposure to hazardous energy and materials. This is a critical component of the job planning stage of work. It may involve coordination between different DOE departments, possibly local and state agencies, and/or a utility detection service to determine where the utilities/equipment are buried and what their status is. Excavation permits and review of the permits by authorizing personnel prior to work performance is necessary for successful job planning and work control.

When relying on historical drawings, consideration must be given to area condition changes over time. The cause of the October 4 event was that, during the planning stage, engineers and workers failed to take into consideration the backfill that had been added to the area, which altered the depth/elevation readings relative to the depth of the underground utilities based on existing drawings. In this incident, approximately 20 inches of backfill and asphalt was added to the area over the past 40-plus years. Since this information was neither known nor realized, it was not taken into consideration when calculating the horizontal drilling depth. Engineers, planners and workers believed they were well below the fire water line when in fact the drill head was at the same elevation as the water main.

When uncertainty persists, excavation work must proceed with caution, using hand digging or vacuum excavation to reveal the location of lines.

### **RECOMMENDATIONS**

Permitting, spotting, marking, and hand-digging or using vacuum excavators near underground utilities are all techniques to be used to prevent contact with underground utilities.

Accurate determination and marking of the locations of all underground lines must be completed before work begins.

Potholing the area exposes underground infrastructure to determine the horizontal and vertical location of the facility. Workers should dig carefully by hand if it is suspected that a line may have been overlooked when locations were determined. Note that many cables are buried side by side.

Only qualified persons should be allowed to operate equipment with the potential to contact underground utilities. All heavy equipment operators must be properly trained.

Non-conductive tools should be used when excavating near electrical lines.

## CONCLUSION

Failure to adequately identify the location of existing underground utility lines can result in extensive damage to facilities, high costs of repair and remediation, and compromised safety of workers, who may be exposed to hazardous energy or materials.

Thorough and careful job planning, including coordinating with the appropriate entities to determine the location of any underground lines, is the first step to performing the work safely. Communicating their location via marking, permitting, and jobsite supervision will enable the work to proceed safely. Cautious work practices, including hand digging, potholing, and the use of vacuum excavators, can assist with making final determinations of locations, and avoiding dangerous and costly damages to underground utility lines.

## REFERENCES

ORPS Report EM-ORO--UCOR-OENVRES-2017-0003. *Bldg. 7582 - Contact with Buried Grounding Cable.*

ORPS Report NE-ID--BEA-CFA-2017-0003. *Post Hole Auger Strikes Underground Phone Line.*

ORPS Report EM-OH-WVDP-CHBW-CF-2016-0002. *Underground Fire Main Damaged During Directional Drilling.*

ORPS Report FE--NETL-GOPE-NETLMGN-2016-0004. *Underground Electrical Conduit Damaged During Excavation Operations.*

ORPS Report EM-ORO--UCOR-KENVRES-2016-0005. *Opportunities for Improvement in Excavation/Penetration Program Content and Control Execution.*

## ADDITIONAL SOURCES OF INFORMATION

The following websites provide additional information about heavy equipment safety and regulations:

Occupational Safety and Health Administration.  
[osha.gov/](http://www.osha.gov/)

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This OE-3 document requires no follow-up report or written response.



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