

Good Work Practice

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Title: Work Near 230 Kilovolt Electrical Transmission Line

Date: July 11, 2006

Identifier: 2006-RL-HNF-0027

Lessons Learned Summary: Work near high voltage of 50 kV (kilovolt), or greater, electrical transmission lines involves additional precautions to avoid potential hazards not commonly encountered during work near lower voltage distribution lines. At those voltages, the standard ‘rule-of-thumb’ of maintaining a distance of at least 10 feet from energized overhead lines does not provide adequate protection for workers.

Discussion of Activities: Project planning for the 100-K Remedial Action Project considered the potential of exposing personnel to electrical hazard while working beneath a 230 kV transmission line in accordance with requirements contained in an Excavation Permit and activity hazard analysis. Work was initiated near the transmission line. Several disciplines including safety, electrical engineering, and field support were included in the planning.

The 100-K Remedial Action Project work scope includes excavation and removal of two subsurface pipelines that cross under the 230 kV transmission line. At the first pipeline location, the transmission line sag measured 42 feet above ground level. The scrapers, water truck, and bulldozer equipment used to excavate to the pipe maintained a safe working distance from the energized transmission line. The maximum equipment height is approximately 11 feet above ground level. Therefore, a safety gap of 31 feet between the transmission line and equipment existed. Key personnel reviewed the operation and agreed that work could proceed safely and in accordance with the excavation permit requirements (maintaining clearances of 10 feet from the line and 20 feet from the transmission tower). Work was initiated and completed safely.

At the second location of pipe removal under the transmission line, the line sag measured 24 feet above ground level. With the same equipment being used only 13 feet of clearance could be maintained from the line. As project personnel understood the requirements, the work



What happens when equipment contacts an energized overhead line?

These pictures were recently forwarded to us from DOE. They show what happened when a Link-Belt® crane contacted a 46kV power feeder line.



Here you see the crane in contact with the power line and on fire.



Here is a shot of the crane actually being blown into the air during a subsequent explosion.



The base of the crane then arcs to the steel reinforcement bars in the concrete, actually causing the concrete below the crane to explode!

Let's make sure that we are VERY careful near overhead power lines.

could be executed safely in accordance with the excavation permit requirements. The permit requirements were to notify Electrical Utilities when working within 10 feet of the transmission line and 20 feet from the transmission tower.

Prior to performing work in the second location personnel from Hanford Electrical Utilities, Contractor and Subcontractor met to jointly walk down the area. During the walk down the Subcontract Technical Representative (STR) was concerned because the precautions stated in the work governing documents were identical to those issued for work in the vicinity of 50 kV (or less) power lines. Work near the transmission lines was suspended until a consensus could be gained on determining proper working distances from the energized line. The following items were learned during the walk down:

- The minimum safe working distance from the 230 kV transmission line for unqualified workers (non-linemen) is 16 feet; not 10 feet as written in the permit. These limits are defined in 29CFR Part 1910 Subpart S Electrical General, Section 1910.333(c) and NFPA 70E 2000, Article 2-2
- Electrical transmission lines carrying greater voltages than a lower voltage (<50 kV) power lines are more able to “arc” to equipment at greater distances. The ability to arc depends on distance from the line, line load, and atmospheric conditions. A buffer of 16 feet decreases the possibility for this type of undesirable event
- Materials and equipment in the vicinity of a high voltage transmission line could possibly deliver a “nuisance shock” to workers. This may occur when equipment or material located within the transmission line’s induced electromagnetic field and becomes statically charged. When a person with a different level of induced electrostatic charge contacts the object, the static charge is equalized and the person may receive a nuisance shock. According to those attending the walk down, the nuisance shock can be quite noticeable, but rarely is harmful to personnel
- A counterpoise (grounding) system consisting of several thin (~ ¼ inch diameter) galvanized wires runs parallel to transmission lines. The counterpoise is located approximately 35 feet outside of the outermost transmission lines. The counterpoise is buried approximately 1.5 feet below ground surface. The excavation permit did not identify the counterpoise system. Project personnel believed the transmission towers were grounded in a manner similar to a conventional power pole, where ground rods are placed within 20 feet of the towers. Upon receiving the information regarding the counterpoise system, personnel inspected the trench in the first location. They found the counterpoise system was damaged during excavation activities. Hanford Electric Utilities was contacted and determined the counterpoise would not require repair until the trenches were backfilled
- Hanford Electric Utilities can de-energize and ground the 230 kV transmission line for short periods of time to allow the safe operation of equipment that would enter the minimum safe working distances.

Analysis: The application of ISMS core functions and guiding principles were implemented. This improved safe work conditions near a high voltage line. Had ISMS not been implemented, personnel may have been exposed to a significant electrical safety hazard.

Actions Taken/Recommended:

- A walk down was performed with a multi-disciplinary team that had experience working in this type of environment to determine adequate safety margins and standards
- Work was restricted to areas that did not encroach into potentially hazardous areas until safety controls could be put in place
- Additional scans were conducted to find the counterpoise system
- The Excavation Permit was amended to reflect the appropriate requirements
- The Activity Hazard Analysis was revised to incorporate the necessary safety requirements.
- Project personnel were advised of the changes to the documents and hazards of working near the high voltage lines
- A work order was issued to instruct Hanford Electric Utilities to remove the 230 kV transmission line from service when needed
- The high voltage line was taken out of service (de-energized and grounded) for excavation under the low sagging transmission line
- The excavation under the low sagging transmission line was progressed to a depth where safe distances were met
- The transmission line was placed back into service once safe working distance was maintained

Cost Savings/Avoidance: Not evaluated

Work Function: Conduct of Ops – Work Control, Environmental Restoration

Hazards: Electrical/NEC

Keywords: Electrical, high voltage, transmission line, remedial action

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References: None

Distribution: General - All PHMC Projects and Programs