March 23, 2006

Nebraska FACE Investigation 97NE030

SUBJECT:

Lineman Electrocuted on Tower

SUMMARY:

A 55-year-old senior line technician was killed when a personal protective grounding jumper clamp came loose and came in contact with him, resulting in his electrocution. He and his crew were in the process of aligning suspension clamps which supported shield wires on the electrical transmission towers. He had climbed up an electrical transmission tower to perform the task and had attached his personal protective grounding jumper between the structure (clamp end) and the shield wire (hook end) and was aligning the suspension clamp for the shield wire. The 345,000 volt conductor lines, which are approximately 35 feet below the shield wire, were energized, which was normal for this procedure. The flat faced grounding clamp that was installed on a section of beveled angle iron on the tower structure became disconnected and contacted the victim resulting in his electrocution.

The Nebraska Department of Labor investigator concluded that to prevent future similar occurrences employers should:

* ensure employees attach personal protective grounding jumpers to appropriate attach points.

* ensure information on proper grounding procedures for use with a flat faced grounding clamp are included in training.

* consider implementing a company policy requiring that shirt tails must be tucked in when working in an environment where they could become caught in equipment (such as the grounding clamp in this incident).

PROGRAM OBJECTIVE:

The goal of the Fatality Assessment and Control Evaluation (FACE) workplace investigation is to prevent work-related deaths or injuries in the future by a study of the working environment, the worker, the task the worker was performing, the tools the worker was using, and the role of management in controlling how these factors interact.

This report is generated and distributed **solely** for the purpose of providing current, relevant education to employers, their employees and the community on methods to prevent occupational fatalities and injuries.

INTRODUCTION:

On July 22, 1997, at approximately 1:10 p.m., a 55-year-old senior line technician was killed when a personal protective grounding jumper came loose and contacted him, resulting in his electrocution. The Nebraska Department of Labor was notified by the company on July 28, 1997. Information for this report was obtained from a meeting with the company safety specialist, from the internal accident report and other information provided by the company.

The employer is a public power company. The company employs approximately 2,240 people. This was the ninth fatality in the history of the company which has been in operation since 1970. The company has a written safety program and a full-time safety specialist.

The victim had been employed by the company for 32 years. The company has a comprehensive written safety program and they are active in sharing safety information with other power companies. They have already briefed this incident to other power companies to help ensure the same thing does not happen to any of their employees.

INVESTIGATION:

On the day of the incident, the victim (who was the crew leader at the time) and four coworkers met at an area office and discussed the plans for the day. This was their second consecutive

week of performing maintenance work on the 345,000 volt system and they were continuing the work they had performed the previous day. The crew drove to the worksite in two vehicles and worked the morning and broke for lunch around 11:30 a.m. After lunch the victim, a Journey Line Technician (JLT-1) and heavy equipment operator went to a tower structure to align the suspension clamps (shoes) that support the shield wires on the structure. Two other members of this crew went to another structure about 10 to 12 driving miles away.

The victim told his coworkers that he would climb the tower and perform the required maintenance. The JLT-1 stated that both suspension clamps needed adjusting and that he would do the one on the north side while the victim did the one on the south side. They were wearing their line belts and both had their personal protective grounding jumpers also. They ascended to the shield wires which were at 106 feet, the highest part of the structure. They communicated as they climbed and upon reaching their work location, positioned themselves to apply the personal protective grounding jumpers and begin the job of aligning the suspension clamps.

The Journey Line Technician (JLT-1) reached his work location first and proceeded to ground the shield wire. He then loosened the nuts on the suspension clamp, and the conductor, due to the angle of the suspension clamp, "ran through" about 5 inches. This caused the tower to shake, which is expected. JLT-1 shouted to the victim that a lot of strain existed and to be ready for the movement. The victim acknowledged his warning. The JLT-1 finished straightening the suspension clamp by using his hammer to "drive" the suspension clamp into alignment and began to tighten the nuts to secure the shield wire. He felt the tower shake and heard the victim shout "You were right, there really was a lot of tension." The JLT-1 then heard the victim "drive" the suspension clamp on his side into alignment. While he (JLT-1) was finishing tightening the nuts on the clamp, removing his personal protective grounding jumper and preparing to descend he heard a "gasp" from the other side of the structure. This was approximately two minutes after he felt the tower shake from the victim's activity on the other side. He immediately looked in the direction of the victim and saw him standing mostly erect looking over the top of the structure. The victim then fell backwards and became suspended by his line belt with his legs entangled in the structural members.

The Journey Line Technician (JLT-1) shouted to the Heavy Equipment Operator below to call 911. He called 911 and also contacted the other two crew members to return and assist them. JLT-1 climbed across the structure to gain access to the victim. The Journey Line Technician

noticed as he got near the victim that the victim's flat faced grounding clamp had become disconnected and was hanging near the victim's leg. Recognizing this potential hazard, he stayed clear of the grounding clamp. He said the victim was moving slightly and had a very slight pulse. The victim was not breathing and JLT-1 performed rescue breathing immediately. Approximately 15 minutes later the two other crew members arrived at the scene. A Line Technician from this crew donned his tools, protective equipment and a hand line and ascended the tower to assist the JLT-1 who was with the victim. JLT-1 instructed him to get the personal protective grounding jumper that was on the north shield wire and place it on the south shield wire above the rescue location. Another Journey Line Technician also ascended the tower to assist with the rescue operation. They proceeded to lower the victim to the ground. The rescue squad arrived just prior to the victim reaching the ground. The victim was airlifted to the hospital where he was pronounced dead at 2:58 P.M.

The company investigation revealed that the flat faced grounding clamp had become disconnected from the structure. It had been connected to a beveled surface which allowed it to become easily disconnected (see figure 1). Previous measurements and computer modeling by the power company revealed approximately 235 volts were present from the south shield wire to ground due to induced voltage from the energized phase wires. Measurements taken at the scene indicate 3.8 amperes available. This voltage and amperage could result in fatal current flow according to IEEE references.

CAUSE OF DEATH:

The cause of death, as stated on the death certificate, was cardiopulmonary arrest as a consequence of electrocution.

RECOMMENDATIONS/DISCUSSION:

Recommendation #1: **Employers should ensure employees attach personal protective grounding jumpers to appropriate attach points.**

Discussion: It is imperative that personal protective grounding jumpers be attached to surfaces that will ensure a good connection. In this incident the flat faced grounding clamp was attached to a beveled surface which allowed it to become easily disconnected. Tests were conducted by

the company to determine how this clamp could be securely attached to beveled surfaces. Movements, similar to the ones during the incident, consistently disconnected the clamp. This type of clamp should only be secured to a flat surface (see figure 2).

Recommendation #2: **Employers should ensure information on proper grounding procedures for use with a flat faced grounding clamp are included in training**.

Discussion: All employees who use a flat faced grounding clamp during the performance of their duties should be trained on its proper use to include appropriate attach points. This company has briefed all affected personnel of this incident and proper procedures for using the flat faced grounding clamp. They have also included this information in their Personal Protective Grounding Training program. Other companies should ensure these procedures are included in their training programs.

Recommendation #3: **Employers should consider implementing a company policy requiring that shirt tails must be tucked in when working in an environment where they could become caught in equipment (such as the grounding clamp in this incident).**

Discussion: In this incident a piece of the victims shirt was found snagged on the flat faced grounding clamp. The piece of shirt was traced to a spot corresponding with the location of the clamp and the victim's body prior to electrical contact. It is possible his shirt got caught in the clamp while performing his duties and his movement pulled the clamp loose.