The National Institute for Occupational Safety and Health (NIOSH)

Promoting productive workplaces through safety and health research

Transportation Employee Dies from Electrical Injuries Resulting from Contact with Overhead Powerline

FACE 85-03

Introduction

The National Institute for Occupational Safety and Health (NIOSH), Division of Safety Research (DSR), is currently conducting the Fatal Accident Circumstances and Epidemiology (FACE) Project, which is focusing primarily upon selected electrically-related fatal injuries and confined space fatalities. By scientifically collecting data from a sample of fatal accidents, it will be possible to identify and rank factors which influence the risk of fatal injury for selected employees.

On November 5, 1984, a 49-year-old crew leader for a state department of transportation was measuring the amount of asphalt in a 10,000 gallon storage tank. As he removed the 12' 8" iron measuring rod from this tank, the rod came in contact with a nearby overhead powerline (7200 volts). The crew leader sustained severe electrical burns to the hands, arms, axilla, back and thighs. He was taken by the local emergency medical service to the nearest hospital and transferred later that day to a hospital burn unit. On November 25, 1984, while still a patient in the burn unit, the worker died due to pulmonary emboli resulting from the electrical burn injuries.

Contacts/Activities

On November 27, 1984, DSR was notified by the Occupational Safety and Health Division of the State Department of Labor and invited to send a team to accompany their safety officer during his accident investigation. The DSR research team, consisting of an epidemiologist and industrial hygienist, provided assistance to the safety officer and collected research information for the FACE project.

On November 29-30, 1984, the safety officer and research team conducted their joint field activities. An opening conference was held with the highway safety engineer and the supervisor for the department of transportation county office where the victim worked.

Interviews were also held with the chairman of the facility's safety committee, other supervisors and foremen, co-workers, nurses and doctors from the burn unit, a prison inmate who was the only witness to the accident, the city electrical engineer, and the next-of-kin. A survey of the accident site was conducted and video and 35 mm pictures were taken.

Synopsis of Events

The department of transportation county office has approximately 35 employees, including the victim and one other worker who were occupationally classified as crew leaders II, and 20 road maintenance workers. The responsibilities of this office include the maintenance of public roads in the county. The existing safety program seemed primarily orientated towards potential hazards associated with working out on roads rather than in the supply yard.

The victim had ten years' experience with this office and had been promoted four months earlier to crew leader II. He was the crew leader responsible for patching roads. Approximately two weeks before the accident, he aggravated a back problem by lifting objects on the job and missed a week of work. He had returned to work for a week when the accident occurred.

On Monday morning, November 5, the victim and inmate worker left the yard by truck and worked along various roads, hauling dirt and picking up concrete block along the sides of the road(s). After lunch they returned to the supply yard where their first task was to fill a portable "tar kettle" from the 10,000 gallon storage tank of asphalt.

Apparently, this storage tank had originally been the tank for a railroad storage car. The supply yard had been established in 1966 or 1967 and the tank had been there, at the same location as at the site of accident, since then. The three overhead powerlines (each single phase, 7200 volts) running along the perimeter of that side of the yard, had been there since 1968. The approximate special relationships of the tank and powerline are shown in the accompanying figure. The method used by the county office to ascertain the fullness of this asphalt tank entailed climbing to the top of the tank, removing a long iron measuring rod (analogous to the oil dipstick of an automobile engine), and measuring or approximating the length of asphalt adhering to the rod. Conversations with other workers at the office revealed that a two man team would often perform this task and that a near-miss (circumstances almost identical to the fatal accident) occurred approximately five years earlier.

The victim connected the "tar kettle" to the asphalt tank through a portable pump. Although the tank is designed (elevated height) to gravity feed the asphalt, in cold weather it is difficult for the asphalt to flow and a pump is needed.

After starting to fill the "tar kettle," the victim went to the yard offices, where he was instructed to check how much asphalt remained in the storage tank.

According to the highway maintenance engineer-supervisor, co-workers, and next-of-kin, the victim had no experience at this task. Furthermore, the worker who usually checked the tank was off that day.

The victim climbed to the top of the tank while the inmate worker stayed on the ground and watched. With his back against the platform railing such that he faced away from the powerline, he pulled the rod (measuring 12' 8" long) out of the tank. As the bottom end exited the tank, the top end apparently swung in a downward motion and the rod contacted the closest of the three overhead powerlines, which was approximately seven feet away.

Immediately following the victim's contact with the energized lines, several employees responded to his aid. One employee was a trained volunteer paramedic who tried to stabilize the victim while awaiting the rescue squad. The emergency medical team arrived within a few minutes of the occurrence and transported the victim to a local hospital.

After the accident, the highway maintenance engineer-supervisor had the tank moved approximately 33 feet from the powerlines. He stated that there were intentions to move the tank before the accident so that a berm could be placed around the tank, in order to contain any spillage. According to the supervisor, the fatal accident expedited the tank being moved but it was not the primary reason.

Conclusions/Recommendations

The most probable path of the electrical current was from the rod to the victim's hands, through his body, out his knees and back, to the platform's ladder and then to ground. Various factors contributed to the occurrence of this fatal accident. Some of these factors are:

1. The location of the tank in close proximity to the proximal overhead powerline. The horizontal distance between the closest part of the work platform and the proximal powerline may have been as little as seven feet.

2. The elevation of tank. The tank was elevated in order to allow gravity to cause asphalt to flow out of the bottom of the tank. However, in cold weather, the viscosity of the asphalt increased such that use of an external pump was necessary to remove asphalt. The continuous availability of a pump circumvents the need for the tank being elevated so high. The work platform on top of the tank was approximately 18 feet off the ground. Given an approximate shoulder height of 51 for most workers, this elevation places a diagonal distance of approximately 7-9 feet between the powerline and worker. The length of the measuring rod was 12' 8".

3. The type of measuring rod used. The rod consisted of metal rather than a non-conductive material.

4. The weight of the measuring rod. When a worker(s) holds the 1/2 inch rod at one end (as when it is just pulled out of the tank), its heaviness, approximately 20 lbs which includes adhering asphalt, causes a loss of control and gravity forces the other end to go in a downward direction.

5. The existing method used by the company to check the fullness of the tank. This tank required workers to climb to the top of the tank, which increased the hazards of not only contacts with the nearby electrical line but also falls from elevations. Suitable alternative methods existed, such as sounding the tank from the ground or keeping inventory records pertaining to when and how much asphalt is removed.

6. Given the existing method of checking the tank, the company did not establish a written standard operating procedure (SOP) which ensured safety. Since no SOP existed, employees were not trained in the safe procedures.

7. The inexperience of the victim and possibly his physical condition. No experience with the task and no SOP minimized the worker’s ability to recognize the electrical hazard. Since no SOP existed, the worker possibly did not realize that the task was often done with two workers rather than just one. The only witness stated that the victim’s back had been bothering him that day. Consequently, the victim might have chosen the body position (posterior of body against rail and towards powerlines) he did in order to reduce strain on his back. However, regardless of the condition of his back, it most likely did not directly cause the rod to contact the powerline.

The cooperation of and assistance from the OSHA safety officer, the state OSHA agency, and the employer were greatly appreciated.

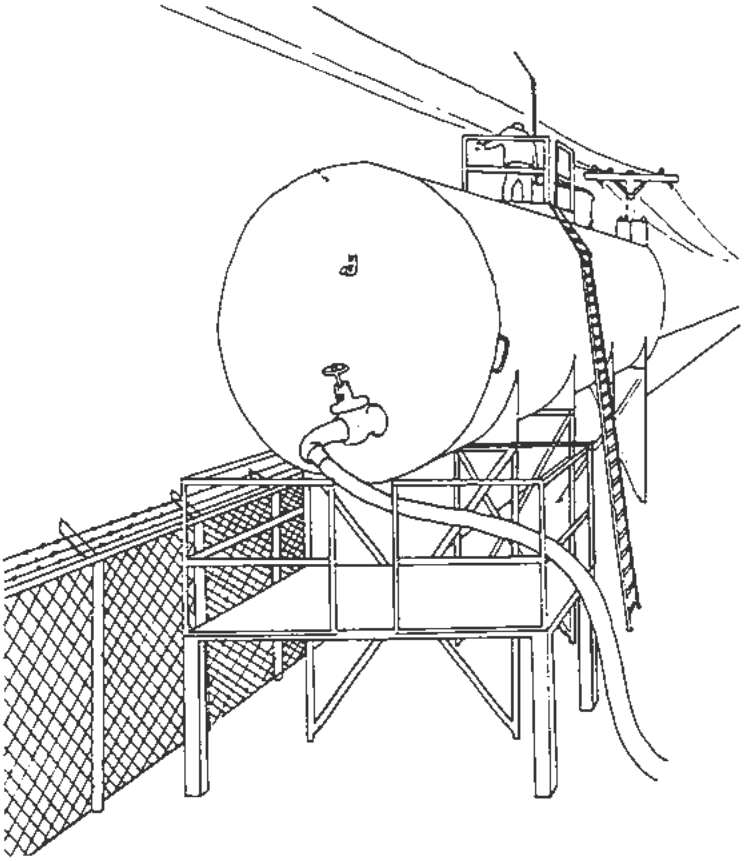

Figure. Configuration of Accident Site

Return to In-house FACE reports

Last Reviewed: November 18, 2015