The National Institute for Occupational Safety and Health (NIOSH)

Promoting productive workplaces through safety and health research

Labor Foreman Falls to His Death Inside Municipal Water Tank in Indiana

NIOSH In-house FACE Report 88-14

Introduction

The National Institute for Occupational Safety and Health (HIOSH), Division of Safety Research (DSR), performs Fatal Accident Circumstances and Epidemiology (FACE) investigations when a participating state reports an occupational fatality and requests technical assistance. The goal of this evaluation is to prevent fatal work injuries in the future by studying: the working environment, the worker, the task the worker was performing, the tools the worker was using, the energy exchange resulting in fatal injury, and the role of management in controlling how these factors interact.

On March 21, 1988, a 28-year-old male labor foreman died when he fell 50 feet inside a 700,000-gallon municipal water tank.

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Contacts/Activities

Officials of the Occupational Safety and Health program for the State of Indiana notified DSR of this fatality and requested technical assistance. A research safety specialist discussed this case with the OSHA compliance officer and on April 4th met with the employer's representatives. April 5th a meeting was held with municipal officials and with responding ambulance personnel. The incident site was also photographed on this date.

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Overview of Employer's Safety Program

The employer in this incident is a multi-state corporation specializing in cathodic protection systems which provide a form of protection against electrolytic corrosion. Of the company's 250 employees, 16 perform the same type of work as the victim. The company has a written safety policy which prescribes the use of fall protection where there is potential that a worker may fall in excess of 10 feet. This policy also calls for testing the atmosphere prior to entering any confined space, and for

the use of a lifeline, safety harness, and appropriate respirator when working inside a confined space. The victim was employed as a tank department foreman and served as supervisor at various sites where work on cathodic protection systems for water tanks was being performed.

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Synopsis of Events

The victim and a co-worker were assigned routine maintenance work on the cathodic protection system within an elevated municipal water tank. Approximately 2 months prior to this incident, the tank developed a leak and was drained. A small amount of water remained in the tank at a level below the riser which serves as the tank drain. There was ice on the surface of the water.

The cylindrical tank is approximately 40 feet wide by 60 feet high. A ladder on one of the legs supporting the tank provides access from the ground to a catwalk on the tank. The catwalk circles the tank approximately 125 feet above the ground. A second permanently-mounted ladder extends from the catwalk to the top of the tank. At the top of the tank, a 2-foot-square door provides entry to the tank.

On the day of the incident, the victim and his co-worker arrived at the job site at 11:00 a.m. Prior to climbing the tank, they noticed an entry hatch on the side of the tank bowl at the level of the catwalk. They decided not to use this entry hatch because they weren't sure they could properly seal it at the conclusion of the work.

At approximately 12:15 pm, the two men climbed to the top of the tank and found the entry door locked. The men descended the tank, obtained a key from city officials, climbed again to the top of the tank, and opened the door. They suspended a rope ladder through the door to provide access to the tank floor.

The maintenance work on the cathodic protection system required that they replace a fitting which was below the level of the water in the tank. The victim used a section of garden hose to begin siphoning the water from the bottom of the tank and routing it down the wet riser at the center of the tank bowl. Because the water would not be removed by the end of their shift, they performed other necessary maintenance work, planning to return the following day to finish the job.

At approximately 5:10 p.m., the co-worker exited the tank and stopped on the catwalk to wait for his supervisor. When the supervisor did not follow after 4 to 5 minutes, the co-worker climbed to the top of the tank in search of him. The co-worker saw the supervisor inside the tank approximately one quarter of the way up the ladder. The supervisor stated that he was tired and that his arms were numb. The supervisor then continued to climb the ladder.

The co-worker noticed that the supervisor "was climbing wrong and had a funny look on his face." (The supervisor was facing the ladder, as opposed to the standard procedure for climbing a rope ladder from the side thereby producing less swaying motion.) The co-worker asked the
supervisor if he needed help. Upon receiving a positive response, the co-worker descended the ladder to assist him. The co-worker managed to grasp the supervisor's hand, however the supervisor was unresponsive to the co-worker' s repeated calls to grasp the ladder. The co-worker was unable to retain his grip, and the supervisor slipped from the ladder and fell approximately 50 feet to the bottom of the tank. The co-worker descended the ladder to aid the victim and moved him slightly from the facedown position near the water where he landed. He returned to the top of the tank where he cried out for help. He got the attention of several individuals located at a business establishment across the street who, in turn, summoned help.

The local fire department received the report of the accident via telephone at 5:15 p.m. and were on the scene at 5:19 p.m. Two firefighters and an EMT from the local ambulance company entered the tank through the man-way located at the catwalk. The victim was found to be bleeding from the mouth and nose, with noticeable deformation of his forearm and right upper leg. No vital signs were detected. The victim was secured to a back board and lowered to the ground. The ambulance departed the scene at 5:54 p.m. and arrived at the local medical center at 6:00p.m. where the victim was pronounced dead shortly after arrival.

Neither the co-worker nor the responding rescue personnel noted any unusual odors in the tank, nor did they experience any symptoms indicative of possible oxygen deficiency.

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Cause of Death

The Medical Examiner gave the cause of death as a skull fracture and lacerations of the brain, along with contusions to the lungs.

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Recommendations/Discussion

Recommendation #1: Employers should periodically re-evaluate company confined space work procedures to ensure that the following areas are addressed:

- atmospheric testing is performed prior to entry
- safe climbing devices are employed where needed
- safety harness and lifeline are used in all cases (for rescue as well as fall protection when working at elevations)
- an observer outside of the confined space is available to summon help if needed.
- communication devices are available to ensure adequate communications between workers in confined spaces and those outside.

Discussion: The company that employed this foreman has written safety procedures that require the testing of the atmosphere of any confined space prior to entry. In addition, the procedures specify that a lifeline and safety harness is to be worn while working in a confined space and that an appropriate respirator be worn when indicated by the atmospheric testing. None of these procedures were followed in this case, nor was any provision made for the use of safe climbing devices. In addition no observer was present, nor was any means provided for communication between the tower and anyone on the ground. If an oxygen deficient atmosphere existed within the tank it could have proved fatal to both workers.

Recommendation #2: Employers should provide periodic refresher training which stresses the hazards that exist within confined spaces to all employees who work in or around confined spaces.

Discussion: Although the victim in this case was a supervisor who had received training in confined space entry procedures, he elected to forego written company safety procedures regarding atmospheric testing and the use of safety harnesses and lifelines. His failure to follow standard written procedures concerning confined space work was an important factor in this incident.

Recommendation #3: Company management (safety) personnel should conduct periodic worksite evaluations to ensure that written procedures are being followed in the field.

Discussion: In this case a foreman apparently chose to ignore company procedures regarding work in confined spaces. Since safety is an inherent function of management, workers cannot be expected to follow safety procedures if their supervisors do not. Periodic inspection of worksites by company safety personnel would serve to show management's interest in the safety program and reinforce within all workers the need to follow company standard operating procedures.

Recommendation #4: An evaluation of the worksite should be performed prior to the start of all operations to determine potential safety and health hazards as well as concerns which would affect the efficiency of the operation.

Discussion: An evaluation of the worksite prior to the start of work would permit safety hazards to be identified and plans for corrective action to be prepared prior to employee exposure. In the above case, such an evaluation might have enabled the workers to avoid the initial climb up the tower to unlock the door at the top of the tank. In addition, a thoughtful evaluation might have convinced the supervisor to utilize the hatch at the catwalk rather than the opening at the top of the tank. Such action may have eliminated the need for the rope ladder and thus prevented the fall.

Recommendation #5: Rescue personnel entering confined spaces should utilize appropriate protective equipment.

Discussion: Discussion: In the above case, rescue personnel entered a confined space where a victim became ill and had fallen for unknown reasons without either checking the atmosphere first or utilizing self-contained breathing apparatus. In similar situations rescue personnel themselves often become victims. NIOSH investigations of 41 confined space incidents have revealed that 18 (31%) of the 59 victims were would-be rescuers.

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