The National Institute for Occupational Safety and Health (NIOSH)

Promoting productive workplaces through safety and health research

Steelworker Dies in Oxygen-Deficient Confined Space

FACE 8820

Introduction:

The National Institute for Occupational Safety and Health (NIOSH), 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 these evaluations 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, the 36-year-old male general supervisor for the midnight shift at a steel mill died when he entered the oxygen-deficient service area beneath a 75-ton-capacity, turret-mounted, molten-steel ladle.

Contacts/Activities:

State Occupational Safety and Health Administration officials notified DSR of this fatality and requested technical assistance. On April 20, 1988, a DSR research team conducted a site visit, met with employer representatives, and discussed the incident with the county coroner and the OSHA compliance officer.

Overview of Employer's Safety Program:

The victim was employed by a privately owned steel mill that has been in operation for 19 years. At the time of the incident, the mill employed 700 workers. The mill has a designated manager of safety and health and a comprehensive safety training program. The turret-mounted ladle involved in the incident had been placed into service in February 1988. Confined space entry procedures for the turret service area were being developed at the time of the incident and have since been implemented. All workers at the mill have now been trained in confined space entry procedures. Mill policy at the time of the incident prohibited access to the turret service area to all personnel except workers in the maintenance department who had been trained in confined space entry procedures. During steelmaking operations, no one was allowed in the turret area.

Synopsis of Events:

The mill uses two 75-ton electric arc furnaces to blend components into molten steel. During the process, the molten steel is transferred to and from a turret-mounted ladle that travels between the two furnaces. Electrodes in the ladle maintain the temperature of the molten steel during the refining process until any required alloys are added. Argon is piped into the ladle to create turbulence to mix the alloys. An enclosed, 8-foot-high by 14-foot-diameter dome shaped service area, located beneath the turret, houses the gears and motor that drive the turret. The argon is piped through this service area into the ladle. The service area is accessed by any one of three, 24-inch by 36-inch service doors located on one side of the service area.

On March 21, 1988, the victim and his crew worked the 11:00 p.m. to 7:00 a.m. shift. They were scheduled to work 2 overtime hours (from 7:00 a.m. to 9:00 a.m.) to prepare the plant for a tour of 500 international steelmakers. During the regular shift, one of the crew members informed the victim that a gauge indicated an abnormal consumption of argon. The victim acknowledged this fact, but made no mention of searching for the leak. At 9:00 a.m. the crew was relieved. Later, one member stated that he had seen the victim in the locker room and presumed he was leaving the plant. At approximately 11:00 a.m., the victim's wife contacted the mi1l concerning her husband's whereabouts and was told he had left the mill. Shortly after lunch a worker noticed the victim's truck still in the parking lot. A search was initiated and the victim was found in the service area. Fire department personnel were summoned, and removed the victim from the service area at 1:15 p.m. He was pronounced dead at the scene by the coroner.

The victim did not alert anyone that he was going to enter the service area. Although no one saw the victim enter the service area, it is assumed that he attempted to locate the argon leak in the piping after he and his crew were relieved, entered the oxygen-deficient atmosphere of the service area, and lost consciousness.

During the installation of the turret in January 1988 the victim and two members of his crew entered the service area, lost consciousness, and were rescued. As a result of the January incident, the employer established the policy that only maintenance workers trained in confined space entry procedures were to enter the service area. Since the fatal incident, the piping for the argon has been routed outside the service area and all workers have been trained in confined space entry procedures.

Cause of Death:

The coroner listed the cause of death as anoxia due to a presumed excessive argon gas exposure in a confined space.

Recommendations/Discussion

Recommendation #I- Employers should ensure that restricted areas can be accessed only by authorized personnel.

Discussion: Mill policy allowed only plant maintenance personnel, trained in confined space entry procedures, to enter the turret service area. The victim apparently made a conscientious effort to guarantee proper mill operations for the tour of international steelmakers by entering the service area to locate and correct the argon leak.

The victim knew and understood mill policy. Additionally, he had been exposed to and overcome by argon less than two months prior to his fatal exposure. In this instance, knowledge of the existence of a hazard was not a strong enough deterrent. To ensure that unauthorized personnel do not enter restricted areas, all entrances to such areas should be locked. Only authorized persons should be provided with the means to enter.

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Last Reviewed: November 18, 2015