The National Institute for Occupational Safety and Health (NIOSH)

Promoting productive workplaces through safety and health research NIOSH

Two Farm Laborers Die in Oxygen-Deficient Manure Pit

FACE 8944

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 June 26, 1989, a 31-year-old male dairy farm laborer entered a manure pit to clear a pipe, lost consciousness, and collapsed at the bottom. In a rescue attempt, his 33-year-old brother, also a farm laborer, entered the pit, lost consciousness, and collapsed. Both workers (hereinafter referred to as initial victim and rescuer victim) were pronounced dead at the scene.

Contacts/Activities

State officials notified DSR of this multiple fatality and requested technical assistance. On July 20, 1989, a DSR research industrial hygienist met with the farm owner (the victims' father), discussed the incident with the county coroner, and traveled to the incident site to conduct an investigation.

Overview of Employer's Safety Program

The employer is a family-owned farm operated by the father and five sons. The farm consists of a 60-cow dairy herd with 80 acres of wheat, corn, hay, and pasture. The two victims, who had both worked on the farm since the age of 12, were in charge of the dairy operation. The family has owned the farm for 42 years and maintained a dairy herd for the past 28 years. Discussions with the farm owner indicated that the family members were aware of some of the hazards associated with tractors and other machinery, and oxygen-limiting silos. This hazard awareness was mostly due to farm machine manufacturer information.

Synopsis of Events

The dairy operation has a barn with 60 stalls where the cows are milked twice a day. The barn has a built-in manure removal system consisting of a 2-foot-wide, 1-foot-deep trough (recessed into the concrete floor), which runs the length of the barn under each stall. Inside the trough is an electric-powered, chain-driven paddle conveyer which is turned on once a

day to remove the manure. The conveyor discharges the waste into an underground open-top concrete pit adjoining the end of the barn. The 12-foot-square pit is 4 ½ feet deep (see Figure). The pit is housed in a small insulated, unventilated room to protect it from freezing. Animal waste at the bottom of the pit is pulled into a 6-inch-diameter steel pipe by a pump powered by a 25-horsepower electric motor mounted 6 inches above the top of the pit. A grinder inside the pipe/pump apparatus breaks up large solids. From here the waste pipe runs underground to a 200,000-gallon, open-top waste storage tank 10 feet away from the barn. The waste pump, grinder and storage tank had been installed 10 years before the incident. During this time, the piping, pump, and grinder inside the pit had corroded. The pipe developed several holes as a result of corrosion. Straw and other solid material moving through the pipe would often lodge in these holes causing blockages. In order to clear such blockages the victims would routinely enter the pit (without first testing the atmosphere and ventilating), disconnect the pipe at a joint, and manually clear the pipe.

On the day of the incident, the two victims went to the barn to milk the cows. Although the incident was not witnessed, evidence suggests the following sequence of events.

When the victims arrived at the barn, the pit contained about 3 feet of waste. The victims turned on the waste pump, but it did not remove any of the waste. Realizing that the suction line inside the pit was blocked, they decided to enter the pit to clear it. The initial victim put on rubber chest waders, entered the pit with a pipe wrench, disconnected the end pipe section and manually removed the blockage. The rescuer victim stood on the edge of the pit providing assistance to the initial victim as he worked in the pit. The victim soon collapsed inside the pit due to the lack of oxygen. (It is presumed that a high concentration of gases [hydrogen sulfide, carbon dioxide, methane, etc.] produced by the decomposition of the waste material, displaced the oxygen in the air inside the wastepit.) In a rescue attempt, the rescuer victim entered the pit and collapsed on top of the initial victim.

When the victims failed to return to their homes 4 hours after they were last seen, other family members began a search for them. An hour later they found the victims submerged in the waste pit. The local volunteer fire department and the emergency medical service (EMS) were notified by family members and arrived at the scene in 10 minutes. Fire fighters put on self-contained breathing apparatus (SCBA), entered the waste pit, and removed the victims.

Efforts to resuscitate the victims were unsuccessful and they were pronounced dead at the scene by the county coroner.

Cause of Death

The coroner listed the cause of death for both victims as drowning.

Reconmendations/Discussion

Recommendation #1: Farm owners should become familiar with the hazards of confined spaces and adopt safe procedures specific for each type of confined space.

Discussion: Manure waste pits, by their design, meet the NIOSH criteria for the definition of a confined space. Entrance into these pits should be governed by NIOSH guidelines for working in confined spaces (NIOSH Publication 80-106). The following items have been outlined in NIOSH Publication 87-113, “A Guide to Safety in Confined Spaces.” Not all of these issues can be addressed practically on a family farm. However, they do provide some guidance to farm owners who are adopting their own safe work practices for work in confined spaces.

1. Is entry necessary? Can the assigned task be completed from the outside (such as clearing the blockage through a clean-out pipe outside the pit)? Components of manure waste pits should be designed and installed in a manner that would allow maintenance to be performed on all serviceable parts from outside the pits.

2. Are confined spaces posted with warning signs and are confined space procedures posted where they will be noticed by workers?

3. Are confined spaces tested before entry and continuously monitored while work is being performed, especially when agitation of manure has not occurred recently, thus allowing the buildup of fermentation gases?

4. Is ventilation equipment of explosion-proof design (or silo fans that can be positioned outside of the building that houses the manure pit)available and used before and during entry?

5. Do workers know howand when to use the following:

- protective clothing,
- respiratory protection,
- hard hats,
- eye protection,
- gloves,
- lifelines, and
- emergency rescue equipment?

6. Can workers recognize confined spaces (pits, tanks, silos, grain bins, etc.) and are they aware of their hazards?

7. Are confined space safe work practices discussed before attempting entry?

8. Is there a confined space safe rescue plan and do workers know how to safely respond in an emergency?

Recommendation #2: Manure pumping equipment should be constructed of materials that are corrosion resistant.

Discussion: Manufacturers of manure pumping equipment should be encouraged to use corrosion-resistant materials such as heavy plastic or stainless steel in pump parts. In this incident the high acid level of the animal waste severely corroded the pump parts. Since its installation 10 years before this incident, the waste pump and piping, which were constructed of steel and cast iron, had been repaired many times due to corrosion. This required workers to enter the pit frequently to clear blocked pipes and to perform pump maintenance. Pump parts constructed of a corrosion-resistant material would require less frequent entry for maintenance.

Recommendation #3: Farm owners and workers need task-specific worker safety guides through improved dissemination efforts.

Discussion: The farm owners in this incident received little if any useful farm safety literature on the operation and maintenance of farm machinery, and no information on the hazards of farm-related confined spaces. Worker safety guides specific to each type of farm machine and confined space should be developed. Dissemination of this material through agricultural extension agents, farm bureaus, and other agricultural associations should be improved. In this way farm workers and owners will receive useful information that will heighten their awareness of farm machine and confined space hazards.

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