



The National Institute for Occupational Safety and Health (NIOSH)

Promoting productive workplaces
through safety and health research



Five Family Members Die After Entering Manure Waste Pit on Dairy Farm

FACE 8946

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 July 26, 1989, a 65-year-old male dairy farmer, his two sons (37 years old and 28 years old, respectively) a 15-year-old grandson, and a 62-year-old nephew died when they entered a manure waste pit with an oxygen-deficient atmosphere.

Contacts/Activities

Officials of the Water Pollution Control Federation notified DSR of this multiple fatality and requested technical assistance. On August 7, 1989, two safety specialists conducted an investigation and a site visit; discussed the incident with surviving family members, the county medical examiner, the state health department, the prosecutor's office, the sheriff's office, the two responding fire departments, emergency medical service (EMS) personnel, and the owner of a farm equipment business who removed the victims from the pit with the aid of his helpers. Weather conditions for the day of the incident were obtained from certified records at the local airport. The site was photographed and videotaped. Gas readings were taken for oxygen, methane, and hydrogen sulfide inside the pit and compared with readings taken by the State Department of Labor the day following the incident.

Overview of Employer's Safety Program

The farmer owned and operated a dairy farm with his family. The nephew owned and operated a welding repair shop but was at the farm on the day of the incident. The 1,800-acre farm, 800 acres, of which is leased for pasture for their 800 head of cattle, has been in the family for 100 years.

The farm has no written safety policy or safety program. Grain silos located on the farm are recognized as potential confined space hazards and are equipped with exhaust fans. The manure pit, which was installed 18 years ago, was not regarded as a confined space hazard. Many times in the past, workers had entered the manure pit to perform maintenance operations without incident.

Synopsis of Events

The cattle-holding barn at the farm is equipped with a conveyor system to remove the manure. The system runs throughout the barn and conveys the manure to a waste-holding pit which is 24 feet long by 20 feet wide by 10 feet 8 inches deep (see Figure). The pit is accessed by a 4-foot-square opening located inside a 17-foot by 35-foot service shed attached to the holding barn. A second entrance in the concrete top of the pit is located outside the barn. This entrance measures 3 feet 6 inches by 6 feet and is usually covered by a sheet of plywood. When the pit becomes full, the waste is pumped into a holding pond outside the barn. This slurry system is powered by a 20-horsepower pump located at floor level at the entrance of the pit. The pit contains an agitator to break up large clumps of manure so that it can be pumped out. Although the agitator shaft extends from above floor level down into the pit, the shear pin for the agitator shaft is located approximately 1 foot below floor level inside the pit. The pit had been entered in the past whenever this shear pin needed to be replaced. A 12-foot wooden ladder was used by workers to descend into the pit.

On the day of the incident, it is believed that the farmer's 28-year-old son entered the pit to replace the shear pin on the agitator shaft. One farmhand interviewed stated that the pump had not been operating for several days before the incident. The farmer's 15-year-old grandson was with his uncle. The grandson's 8-year-old brother was outside the barn door. The 8-year-old heard his brother yell for him to get help because their uncle had fallen into the pit. The 8-year-old ran to the farmhouse for help. While the farmer's 37-year-old son and nephew ran to the pit, the wife of the first victim called the fire department, the sheriff's department, and the owner of a farm equipment business located a mile from the farm. The owner of the farm equipment business stated that the call was received at 9:00 a.m., and that he and two of his workers left immediately for the farm. Apparently, the 15-year-old grandson, the farmer, his 37-year-old son, and his nephew all entered the pit to attempt rescue. A carpet installer working at the farmhouse went to the pit and saw all five men unconscious inside the pit. He entered the pit and was overcome, but did not lose consciousness. He was assisted from the pit by his helper. The farm equipment business owner instructed one of his workers to get a rope from their truck. His worker returned with a rope which had a hook on one end. The worker held his breath, entered the pit, and looped the rope around the waist of one of the victims and hooked it. After the worker exited the pit, he, his co-worker, and their boss lifted the victim out of the pit. All five victims were removed in this manner. The younger son was removed first, then the farmer, the nephew, the elder son, and the grandson. The business owner stated that the last victim was removed from the pit at 9:20 a.m. By this time, EMS personnel had arrived at the scene and begun to administer cardiopulmonary resuscitation along with fire department personnel. The nephew was pronounced dead at the scene by EMS personnel. Four victims were transported to the emergency room. The farmer and the younger son were pronounced dead upon arrival. Although the elder son and grandson were breathing, the elder son died 1 hour later in the emergency room. The grandson was transferred by helicopter to a major trauma center and was pronounced dead upon arrival 6 hours after being removed from the pit.

Gas readings taken the day after the incident by the State Department of Labor investigator showed a methane level of 2% and a hydrogen sulfide (H_2S) reading of 18 ppm. This H_2S reading is well below the NIOSH Immediately Dangerous to Life and Health (IDLH) limit (300 ppm.), but exceeds the OSHA Permissible Exposure Limit (PEL) of 10 ppm. Readings taken by the DSR team 12 days after the incident showed a methane level of 3.5%, an oxygen level of 20.2%, and a hydrogen sulfide level of 7 ppm. It should be noted that the temperature and humidity for the 3 days preceding the incident were in the mid 90°F range and the barometric reading at the time of the incident was 30.17 and there was no wind. These conditions would have been favorable for a buildup of methane and/or hydrogen sulfide inside the tank. A thunderstorm occurred later in the morning of the incident that significantly reduced the temperature. While taking gas readings at the inside entrance to the manure pit during their investigation, the DSR investigators removed the plywood cover on the outside opening. The gas levels (H_2S and methane) dissipated almost immediately. On the day of the DSR investigation, the temperature was 55°F and conditions were windy.

Cause of Death

The medical examiners listed the cause of death for all of the victims as asphyxiation due to methane gas exposure.

Recommendation/Discussion

Recommendation #1: Manure waste pits should be identified as confined spaces.

Discussion: Manure waste pits, by their design, meet the criteria established by NIOSH to define confined spaces. A space is considered "confined" if it: 1) has limited openings for entry and exit; 2) has unfavorable natural ventilation which could contain or produce dangerous air contaminants; and 3) is not intended for continuous employee occupancy. Entrance into such pits should be governed by NIOSH guidelines for working in confined spaces (NIOSH Publication No. 80-103). Ideally, a manure pit should be ventilated, and the atmosphere within the pit tested prior to entry and monitored while work is being performed. Self-contained breathing apparatus should be utilized by those entering the pit if an oxygen-deficient and/or toxic atmosphere is found to exist. Although such specialized equipment and training in the use of this equipment may not be readily available to many farm workers, these worker must, at a minimum be made aware of potential hazards associated with manure waste pits, such as oxygen-deficient or toxic atmospheres. NIOSH is preparing an alert detailing the hazards associated with manure waste pits. Additionally, NIOSH requests the assistance of agricultural extension agents, farm journals, agricultural associations, and farm equipment manufacturers in alerting farm workers to the hazards associated with manure waste pits.

Recommendation #2: Manure waste systems should be constructed in a manner that would allow maintenance to be performed on all serviceable components from outside the pits.

Discussion: Components of manure waste system should be installed in a manner that allows maintenance to be performed from outside the pits, or provide for the easy retraction of serviceable parts for maintenance. Typically, these waste systems are not purchased as a single unit; however, it may be possible to install waste pit components that would eliminate the need to enter the pits to perform maintenance. Had the shear pin for the agitator shaft been located outside the pit, it is likely that this tragedy would have been prevented.

Recommendation #3: Manure waste systems should be equipped with some type of powered ventilation system.

Discussion: Waste systems should be equipped with some type of powered ventilation system. Ideally, these systems should be equipped with both supply and exhaust ventilation to eliminate the accumulation of gases. In the case of explosive gases such as methane, the system should be of sufficient size to prevent the gas from reaching its explosive limits and should be of explosion-proof design as defined in the National Electrical Code. The system might be composed of portable fans, but must be of sufficient size to ensure constant circulation of fresh air throughout the waste system, and be of explosion-proof design.

Recommendation #4: Manure waste systems should never be entered unless absolutely necessary.

Discussion: Because dangerous gases may be present, a waste system pit should never be entered unless absolutely necessary. If entrance into the pit is necessary, a standby person(s) with the capability to remove the person from the pit, if necessary, must be stationed outside the pit and must maintain visual or vocal contact with the person in the pit. If the standby person(s) is not physically capable of removing the person from the pit, some sort of mechanical lifting device (a winch, hoist, etc.) should be in position over the pit. Anyone entering the pit to perform any work must wear a safety belt or harness and have a lifeline attached to a substantial anchor point outside the pit. This would enable a standby person(s) to remove someone from the pit without entering the pit. Details of a rescue plan must be resolved before entry. Should an emergency develop, a short delay caused by lack of preparation could be fatal.

Recommendation #5: Entrances to waste pits should be covered by a grate-like cover.

Discussion: All entrances to waste pits should be covered with a properly secured grate-like cover to prevent someone from accidentally falling into the pit and to aid ventilation.

Recommendation #6: Farm employees must be instructed never to enter a manure pit, or any other confined space to attempt a rescue operation, without proper consideration for their own safety.

Discussion: Farm workers should never, under any circumstances, enter a pit to attempt a rescue operation unless properly equipped and trained in the use of the equipment and methods required for rescue. The agent that caused the victim or victim in the pit to be overcome will have the same effect on any would-be rescuer, and the rescuer may become a victim. Farm workers should be instructed that if anyone is observed unconscious or ill inside a pit they should immediately contact the local fire department or rescue squad. These squads will have the training and equipment needed to accomplish a rescue without further endangerment of life.

Recommendation #7: Manufacturers of equipment designed for manure waste pit systems should include warnings on the hazards associated with these systems.

Discussion: Manufacturers of equipment designed for animal waste pit systems should include information concerning the hazards of these pits to all purchasers of their equipment, and should provide information (diagrams, etc.,) on how to install their equipment so that it can be serviced without requiring workers to enter the pit.

[Return to In-house FACE reports](#)

Last Reviewed: November 18, 2015

How helpful was this page?



Not helpful

Very helpful