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Waste Hauling Service Worker Dies After He Collapsed In An Underground Manure Waste Pit

Minnesota FACE Investigation 94MN057

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SUMMARY

A 25-year-old male died after he entered an underground manure waste pit and collapsed after being exposed to hazardous gases. The pit had a square access opening fitted with a removable stainless steel cover. The pit was not equipped with any type of ventilation system or gas monitoring equipment. On the morning of the incident, the owner and an employee (victim) of a waste hauling service arrived at a farm to empty a nearly full, underground manure waste pit. The workers finished pumping the third and final load from the pit. There was only three or four inches of liquid remaining in the bottom of the pit. The victim, using metal braces on the pump, climbed down into the pit. He apparently was either going to install a cover on an open agitation port or move a cover from a closed port to an open port. Within minutes after entering the pit, the victim felt the effects of hazardous gases in the pit and attempted to climb out. As he neared the top of the pit, he collapsed and fell back into the pit.

The owner of the waste hauling company entered the pit to attempt to rescue the victim. Within a few minutes, he also was overcome by gases in the pit and collapsed, face down, on top of the victim. The farm owner's son placed a 911 call and informed his father what had happened. The farm owner ran across a road and asked a neighbor for assistance. They found a rope and a steel rod which they bent into a hook. Using the hook tied to the rope, they were able to hook the owner's sweatshirt and lift him from the pit. They were unable to hook the victim's clothing to remove him. Rescue personnel arrived approximately 25 to 30 minutes after the victim collapsed. Equipped with self-contained breathing apparatus, they entered the pit and removed the victim. The victim was transported to a local hospital where he died approximately 24 hours after the incident. MN FACE investigators concluded that, in order to reduce the likelihood of similar occurrences, the following guidelines should be followed:

- positive-pressure self-contained breathing apparatus should always be used by workers when entering manure waste pits;
- manure waste pits should be identified as confined spaces and posted with hazard warning signs at all entrances;
- workers should never enter manure waste pits unless absolutely necessary and only when following established safe entry procedures;
- manure waste pits should be equipped with a powered ventilation system;
- coworkers should never enter a confined space to attempt a rescue operation without proper consideration for their own safety; and
- all manure waste pit access openings should be fitted with concrete covers.

INTRODUCTION

On September 28, 1994, MN FACE investigators were notified of a farm work-related fatality which occurred September 23, 1994. The county sheriff's department and the county medical examiner were contacted and releasable information obtained. This information consisted of a copy of the sheriff's report of the incident and a copy of the medical examiner's report. A site investigation was conducted by a MN FACE investigator on October 15, 1994. During the site investigation, information concerning the incident was provided by the owner of the farm where the incident occurred.

INVESTIGATION

On the morning of the incident, the owner and an employee (victim) of a waste hauling service arrived at a farm to empty a nearly full, underground manure waste pit. The pit was located on the east side of a calf confinement building. The pit was 17 years old and was not equipped with any type of ventilation system or gas monitoring system. The pit was approximately 16 feet wide by 20 feet long by 8 feet deep. The pit had a square access opening, 4 feet by 4 feet, located in the south-west corner of the top of the pit. The access opening was fitted with a removable stainless steel cover.

The farmer hired the waste hauling service, once per year, to empty the pit. The company provided a large spreader unit for hauling and spreading the waste on the farmers field. They provided a power take-off driven manure pump that was approximately 10 feet long. They also provided an adjustable height, inclined steel pipe (approximately 6 inches in diameter by 35 feet long). The manure pump forced the liquid through the pipe to the top of the spreader tank. A tractor, owned by the farmer, was used to power the manure pump.

After hooking the manure pump to the tractor's hitch, the pump was backed over the pit access opening. The tractor's hydraulic system was used to lower the pump to the bottom of the pit. The pump had steel legs which held the pump several inches off the bottom of the pit. The pump also had two agitation ports which enabled the pump to agitate the sludge in the pit. Apparently one port was open and the other port was closed while the pit was being pumped. One port was located approximately 12 inches, and the other approximately 24 inches from the bottom of the pump. The location of the ports allowed agitation of the pit at different levels.

The workers finished pumping the third and final load from the pit. There was only three or four inches of liquid remaining in the bottom of the pit. For unknown reasons, the victim, using metal braces on the pump, climbed down into the pit. He apparently was either going to install a second cover on the open agitation port or move the cover from the closed port to the open port. Within minutes after entering the pit, the victim felt the effects of hazardous gases in the pit and attempted to climb out. As he neared the top of the pit, he collapsed and fell back into the pit, landing on his back along side the pump. Witnesses indicated that he was not submerged under the few inches of liquid in the bottom of the pit.

The owner of the waste hauling company entered the pit to attempt to rescue the victim. Within a few minutes, he also was overcome by gases and collapsed, face down, on top of the victim. The farmer's son placed a 911 call and informed his father what had happened. The farmer ran across a road and asked a neighbor for assistance. They found a rope and bent a steel rod into a hook. Using the hook tied to the rope, they were able to hook the owner's sweatshirt and lift him from the pit. They were unable to hook the victim's clothing to remove him. Rescue personnel arrived approximately 25 to 30 minutes after the victim collapsed, removed the victim, and transported him to a local hospital. He died at a local hospital approximately 24 hours after the incident.

CAUSE OF DEATH

The cause of death listed on the death certificate was severe anoxic encephalopathy.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Positive-pressure, self-contained breathing apparatus should always be used by workers when entering manure waste pits.

Discussion: The anaerobic decomposition of manure in waste pits produces a variety of harmful gases. Among the most hazardous are hydrogen sulfide, methane, ammonia, and carbon dioxide. These gases are a primary concern because of the high levels which are produced and because of their toxic effects. When manure waste pits are pumped, any agitation of the liquid manure causes a rapid release of gases suspended in the liquid. A rapid release of hydrogen sulfide, ammonia, and carbon dioxide quickly produces an extremely toxic atmosphere within an underground pit or possibly within a confinement building directly above a manure pit. Since hydrogen sulfide and carbon dioxide are heavier than air, these gases tend to settle and remain in high concentrations within pits as the pits are emptied. Because of the potential existence of an oxygen-deficient and/or toxic atmosphere within manure waste pits, positive-pressure, self-contained breathing apparatus should be used when workers enter these pits. Workers should be informed of potential hazards associated with manure waste pits, such as oxygen-deficient or toxic atmospheres. If a positive-pressure self-contained breathing apparatus had been used by the victim in this incident, this fatality might have been prevented.

Recommendation #2: Manure waste pits should be identified as confined spaces and posted with hazard warning signs at all entrances.

Discussion: Manure waste pits meet the National Institute for Occupational Safety and Health (NIOSH) definition of a confined space. A space is considered “confined” if it has any one of the following characteristics: (1) limited openings for entry and exit; (2) unfavorable natural ventilation; or (3) is not designed for continuous worker occupancy. Entrance into confined spaces are addressed in NIOSH Publication No. 80-106 (Working in Confined Spaces). Ideally, a manure pit should be ventilated, and the atmosphere within the pit should be tested prior to entry and monitored while work is being performed. Warning signs to alert workers of the hazards associated with manure waste pits should be posted at all entrances. In some areas, signs should be printed in more than one language for workers who might not be able to read and understand English. If the pit involved in this incident had been identified as a confined space and if a warning sign had been posted at the pit entrance, this fatality might have been prevented.

Recommendation #3: Workers should never enter manure waste pits unless absolutely necessary and only when following established confined space entry procedures.

Discussion: Manure waste pits should never be entered unless it is absolutely necessary because of the potential presence of hazardous concentrations of dangerous gases. During this incident, the victim entered the pit to perform a task which should have been done outside the pit. The tractor’s hydraulic system should have been activated to lift the pump from the pit. The workers could have then changed the agitation port cover or installed a cover on the second port while the pump was outside the pit. The pump could have then been lowered into the pit again if they wanted to attempt to remove the last few inches of liquid from the pit. If entrance to a pit is necessary, workers should follow established confined space entry procedures such as those described in NIOSH Publication No. 80-106. Anyone entering a pit should wear a safety belt or harness and a lifeline which is attached to a fixed external anchor point. These procedures also include the presence of a standby person stationed outside the pit. Visual contact and/or audible communication should be maintained between the worker in the pit and the standby person at all times. If the standby person is not physically capable of removing the worker from the pit, then a mechanical lifting device (winch, hoist, etc.) should be positioned over the pit entrance. Details of a rescue must be discussed and understood by the worker and the standby person before entry into a pit. In addition, NIOSH has prepared an Alert, Publication No. 90-103, which describes the hazards associated with manure waste pits. If established confined space entry procedures had been followed in this case, this fatality might have been prevented.

Recommendation #4: Manure waste pits should be equipped with a powered ventilation system.

Discussion: Manure waste pits should be equipped with supply and exhaust ventilation to eliminate the accumulation of hazardous gases. The system should be composed of fans with sufficient capacity to ensure constant circulation of fresh air throughout the manure waste pit system. In the case of explosive gases such as methane, the system should be capable of preventing the gas from reaching it's explosive level or concentration. In addition, the system should be of explosion-proof design as defined in the National Electrical Code, Article 100-A. If the pit involved in this incident had been equipped with a ventilation system and if the system had been in operation at the time of entry, this fatality might have been prevented.

Recommendation #5: Coworkers should never enter a confined space to attempt a rescue operation without proper consideration for their own safety.

Discussion: Manure waste pit incidents often result in multiple fatalities when coworkers or family members attempt to rescue the initial victim. Personnel attempting rescue operations within a confined space should be properly equipped and trained in the use of the equipment and methods required for rescue. The hazardous agent(s) in a confined space which affected the victim(s) will have the same affect on any rescuer(s) who enters the space without proper personnel protective equipment. Coworkers should immediately contact a local emergency rescue squad and/or a local fire department whenever someone in a confined space is in need of emergency assistance. These personnel are properly trained and equipped to safely accomplish rescues from confined spaces without additional endangerment to human life.

Recommendation #6: All manure waste pit access openings should be fitted with concrete covers.

Discussion: The access opening in the top of the manure pit involved in this incident was fitted with a removable stainless steel cover. The cover was not fastened to the access opening with hinges nor was it locked or secured in position with any type of locking devices. The use of a light weight unsecured cover creates a situation where the cover could be easily removed by teenagers and small children. Concrete covers should be used on all manure pit access openings. All covers should be of sufficient weight such that removal of the cover requires either more than one adult or the use of some type of mechanical lifting device. The use of concrete covers would prevent unsuspecting teenagers and children from being inadvertently exposed to the dangers of manure waste pits. Although the access cover on this pit was not unintentionally removed, all light weight access opening covers should be replaced with concrete covers.

REFERENCES

1. NIOSH (1979). Criteria For a Recommended Standard: Working in Confined Spaces. Morgantown, WV: U.S. Department of Health, Education, and Welfare, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, DHEW (NIOSH) Publication No. 80-106.

2. NIOSH (1990). NIOSH Alert: Request for Assistance in Preventing Deaths of Farm Workers in Manure Pits. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 90-103.

3. National Electrical Code: ANSI/NFPA 70, An American National Standard. August 14, 1992.

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