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Farmer Dies After Becoming Entangled In Silo Unloading Auger

MN FACE Investigation 02MN049

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SUMMARY

A 20-year-old farmer (victim) died after he became entangled in a silo auger. The inside of the silo was illuminated by natural light that entered the silo through skylights in its dome and a small opening near the bottom of the silo. This made it difficult to see anything inside the silo without looking through the small opening at the base of the silo.

In the floor of the silo was an unloading auger that extended to the center of the floor. A gearbox in the center of the floor at the auger intake opening connected one end of the unloading auger to a sweep auger located inside the silo. The sweep auger extended from the center of the silo to the silo wall and was used to remove feed when it no longer flowed to the center of the silo. When running the sweep auger traveled clockwise around the silo floor. The unloading auger extended beyond the outer edge of the silo and dumped into a horizontal conveyor located beneath it. One end of the conveyor was inclined to provide an elevated discharge point so a portable feed mixer could be parked beneath it.

The victim and his brother were doing chores at the farm however they were not working together at all times. The victim parked a feed mixer at the end of the silo conveyor and was filling it with corn, hay and commercial dairy feed supplements. The silo containing the corn only had about 6-8 inches of corn in it. The victim turned on the unloading auger, the sweep auger and the horizontal conveyor to transferring corn from the silo to the mixer.

While mixing the feed, his father stopped at the farm, picked up his younger son and drove to a nearby town. When they returned about 30 minutes later, the father dropped his younger son off and he drove to a nearby farm where he lived. The victim's brother soon noticed that the mixer was still parked where it was when he left the farm. He investigated and found all of the equipment running but he could not find his brother. He looked through the opening at the base of the silo and saw his brother caught in the sweep auger. He stopped the augers and then drove to his father's farm and informed him of the incident. Emergency personnel were called and then the victim's family returned to the scene. Emergency personnel arrived shortly after family members returned to the scene. They and the victim's father entered the silo and determined that the victim was deceased. A coroner arrived and after the victim was examined by the coroner, he was removed from the silo.

The victim's cell phone and his pliers were found on the ground outside the silo and directly below the small opening at the base of the silo. The victim was wearing a hooded sweatshirt that had a drawstring to tighten the hood. Based on the evidence at the scene, the victim probably looked into the silo to determine how much corn was still in it. While doing so,

the sweep auger apparently moved past the opening and the ends of the drawstring in the victim's hooded sweatshirt became entangled in the auger. Unable to free himself or stop the augers, the victim was pulled into the silo. MN FACE investigators concluded that to reduce the likelihood of similar occurrences, the following guidelines should be followed:

- **all machines and equipment should be turned off and completely stopped before any component or aspect of a work place environment is evaluated,**
- **an adequate artificial light source should be available to illuminate those areas of work place environments that are poorly illuminated; and**
- **loose-fitting clothing should not be worn near operating machines and equipment.**

INTRODUCTION

On November 7, 2002, the MN FACE program was notified of a work-related fatality that occurred on October 12, 2002. On March 10, 2003 a site investigation of the incident was conducted by a MN FACE investigator. During the site investigation, the victim's parents were interviewed and provided detailed information about the incident and the incident site was examined. During MN FACE investigations, incident information is obtained from a variety of sources such as Minnesota OSHA, law enforcement agencies, county coroners and medical examiners, employers, coworkers and family members.

The victim was a 20-year-old farmer who worked with his father operating a dairy farm including the daily work associated with feeding and milking approximately 120 dairy cows. In addition to the dairy operation, they farmed approximately 300 acres of land on which they grew corn and alfalfa hay. Most of the corn and alfalfa hay was harvested and put into grain silos and used as feed for the dairy herd.

INVESTIGATION

Located toward the east side of the farm site was a row of four Harvestore silos. Harvestore silos are made of sheets of steel to which molten glass is fused to both sides of the steel sheets creating a coating that is hard, durable and long lasting. The glass coating is formulated to resist the acids from fermented grains and feeds that are stored in the silos. Harvestore silos, like other vertical silos are filled from the top however they are unloaded from the bottom. The smooth glass surface allows feed to easily slide down the silo as it is emptied from the bottom via an unloading auger in the silo floor.

The Harvestore silo associated with this incident had a diameter of 20 feet and was 90 feet tall. In the dome of the silo were two plexi-glass sky lights that provided a small amount of natural light to enter the silo. The only other natural light that entered the silo came through a rectangular opening at the base of the silo. The opening was approximately 18 inches high and 24 inches wide and was about 24 inches above the ground. As a result of the limited openings for natural light to enter the silo, it was quite dark inside of it. This made it very difficult to see anything inside the silo without placing one's head very near or even through the rectangular opening at the base of the silo and then waiting momentarily until your eyes adjusted to the light conditions inside the silo.

In the base of the Harvestore silo was a covered unloading trough that extended from the south edge of the silo to the center of the silo floor where an intake opening existed. In the trough was a round auger, approximately 7 inches in diameter that was powered by an electric motor attached to the discharge end of the auger. A gearbox was located in the center of the silo floor at the auger intake opening. The gearbox connected the end of the unloading auger to a small 3-inch diameter "totally exposed" sweep auger inside the silo. The sweep auger extended from the center of the silo to the silo wall and was used to remove the corn when it no longer flowed to the center of the silo. Although it was driven off the inside end of the unloading auger, it could be independently engaged and was only used when the silo was nearly empty. Sweep augers are by design totally exposed, which enables them to move grain that comes in contact with the auger at any point along the length of the auger.

When the corn no longer flowed toward the auger intake, the remaining corn in the silo formed a funnel configuration with as little as several inches of corn at the auger intake to 6-8 feet of corn along the silo wall. The sweep auger was then engaged and as it operated, it slowly moved in a clockwise direction inside the silo and pulled most of the remaining corn toward the unloading auger intake. The last 4-5 inches of corn had to be manually shoveled toward the auger intake to completely empty the silo.

The unloading auger extended about 30 inches beyond the outer edge of the silo and dumped into a long horizontal conveyor located directly beneath it. The horizontal conveyor was approximately 80 feet long and extended across the south side of all four silos. The east end of the conveyor was inclined to provide a slightly elevated discharge point so a portable feed grinder/mixer could be parked beneath the end of the conveyor.

On the day of the incident, from mid-to-late morning, the victim and his 16-year-old brother were doing various chores associated with the dairy farm. Although they were both working around the barns, they were not working together at all times. The victim used a tractor to park a portable grinder/mixer at the east end of the long silo conveyor and was filling it with a combination of shelled corn, chopped hay and commercial dairy feed supplements. The corn was stored in the silo at the east end of the row of four silos and chopped hay was stored in the silo adjacent to it. The victim was using the scoop of a skid-steer loader to pick up and add chopped hay to the feed mixer.

The silo containing the corn only had about 6-8 inches of corn in it which was why the rectangular door at the base had been removed and provided access to the inside of the silo. The victim had turned on the unloading auger, the sweep auger and the horizontal conveyor and was transferring corn from the silo to the feed mixer. He was also operating a skid-steer loader to add chopped hay to the mixer. While he was mixing a load of feed, his father stopped at the farm, picked up his younger son and they drove to a nearby town. When they returned about 30 minutes later, the father dropped his younger son off and he left the farm and drove to another farm place about three miles away where he lived.

The victim's brother soon realized that the portable mixer was still parked at the end of the feed conveyor as it was when he left the farm about 30 minutes earlier. He decided to investigate and found all of the equipment running but he could not find his brother in the area. He then looked through the rectangular opening at the base of the silo and saw his brother caught in the sweep auger. He turned the power off to stop the augers and called to his brother but he did not respond. He then drove to his father's farm and informed him of what had happened. Emergency personnel were immediately notified and then the victim's parents and brother returned to the scene.

Emergency personnel arrived shortly after family members returned to the scene. They and the victim's father entered the silo and determined that the victim was deceased. A coroner was called to the scene and after the victim was examined he was removed from the silo.

Emergency personnel and the victim's father examined the scene to attempt to determine what may have happened. They found the victim's cell phone and a pliers that he carried in a pocket on the ground outside the silo and directly below the rectangular opening at the base of the silo. The victim was wearing a hooded sweatshirt that had a drawstring to allow the wearer to tighten the hood during cold weather. They also noted that there wasn't a shovel or a broom inside the silo or just outside the silo opening. This indicated that the victim probably hadn't decided to enter the silo with the augers running to clean out the few remaining inches of corn which would have required a shovel or broom.

Based on the evidence at the scene, it appeared that the victim probably looked into the silo to determine how much corn was still in it. While doing so, the sweep auger apparently moved past the opening and the ends of the drawstring in the victim's hooded sweatshirt became entangled in the auger. Unable to free himself or stop the augers, the victim apparently was pulled into the silo at which time his cell phone and pliers fell from his pocket.

CAUSE OF DEATH

The cause of death listed on the death certificate was massive traumatic injuries to head, chest, abdomen and limbs.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: All machines and equipment should be turned off and completely stopped before any component or aspect of a work place environment is evaluated.

Discussion: Whenever a work place environment contains operating machines and equipments, workers are at risk of being injured due to the existence of hazardous conditions and situations associated with moving components. While performing work place tasks, workers need to remain focused on the tasks they are performing and any hazards that exist rather than evaluating specific aspects of the work environment. If any component or aspect of a work place environment needs to be evaluated, all machines and equipment should be turned off and completely stopped. In this incident, the victim apparently attempted to determine the amount of corn that was in the silo. When he looked into the base of the silo, his focus probably was on an aspect of his work environment, i.e., the amount of corn in the silo and not on the hazards associated with the work environment and in particular, the hazards associated with the rotating sweep auger. In this case, if all of the silo unloading equipment had been turned off and completely stopped before the victim apparently looked into the base of the silo, this fatality would have been prevented.

Recommendation #2: An adequate artificial light source should be available to illuminate those areas of work place environments that are poorly illuminated.

Discussion: Most work place environments are well illuminated to ensure that workers can easily see everything associated with the work they are performing. However, the interior of most if not all upright farm silos are poorly illuminated as a result of their basic overall design. In this case the interior of the Harvestore silo was illuminated by only a small amount of natural light that entered through two skylights in the silo dome and a small opening at the base of the silo. Although the inside of the silo was not an area of the work site that was occupied by workers when corn was being removed from it, it was a part of the overall work site. Work sites like this, which have poorly lighted areas should be supplied with an adequate artificial light source. If an adequate artificial light source had been available, the victim might have been able to position himself a safe distance away from the operating unloading equipment while attempting to determine the amount of corn in the silo. However, although this recommendation by itself would have enabled the victim to more safely determine the amount of corn in the silo, it does not supersede or exceed in importance recommendation #1. In fact, this recommendation in conjunction with recommendation #1 would have enabled the victim to safely and more accurately determine the amount of corn in the silo.

Recommendation #3: Loose-fitting clothing should not be worn near operating machines and equipment.

Discussion: The risk of entanglement in rotating shafts and machine components can be reduced if operators do not wear loose fitting clothing. Work clothing should be well-fitting and zippered or buttoned, not open. Frayed or loose fitting clothes, jackets and sweatshirts with drawstrings, and boots or shoes with long shoelaces should be avoided. In this incident, the victim was wearing a hooded sweatshirt that had a drawstring to secure the hood which apparently became entangled in the rotating sweep auger. This recommendation is a general safe work practice that should always be followed by operators of equipment and machines where the risk of entanglement exists.

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