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**FROM:** Minnesota Fatality Assessment and Control Evaluation (MN FACE)  
Program Minnesota Department of Health

**SUBJECT:** MN FACE Investigation 96MN08301  
Farmer Dies After Being Engulfed In Corn Screenings Inside A Steel  
Grain Bin

### **SUMMARY**

A 31-year-old male farmer (victim) suffocated after he was engulfed inside a steel grain bin. The victim was unloading corn screenings that consisted of crushed kernels and other damaged grain material from the bin. The bin was equipped with an unloading auger and a ventilation fan that was not turned on at the time of the incident. It had an access hatch located near the edge of the roof that was accessible by an exterior ladder attached to the side of the bin. The victim used the bin's unloading auger to remove screenings from the bin. While he filled the wagon, the flow of screenings from the bin apparently stopped. He stopped the bin's unloading auger and climbed to the roof of the bin where he apparently discovered that the flow stopped because the screenings had a consistency that caused them to cluster together. He entered the bin through the access hatch to break apart the screenings and became engulfed when they collapsed. Several hours later, the victim's father arrived at the farm but was unable to locate his son. He climbed to the bin roof and discovered one of the victim's feet protruding from the screenings. He placed a call to rescue personnel who arrived shortly after being notified. Approximately thirty minutes later, the victim was removed from the bin and transported to a local hospital where he was pronounced dead. MN FACE investigators concluded that, in order to reduce the likelihood of similar occurrences, the following guidelines should be followed:

- workers should follow established confined space entry procedures when entering grain bins;
- grain bins should be identified as confined spaces and posted with hazard warning signs at all entrances;
- workers should never stand or walk on the unstable surfaces of stored material;

and

- grain bin ventilation fans should be turned on and operating properly before workers enter bins which are either full or partially full.

## **INTRODUCTION**

On November 26, 1996, MN FACE investigators were notified of a farm work-related fatality that occurred on November 23, 1996. The county sheriff's department was contacted and a releasable copy of their report of the incident was obtained. A site investigation was conducted by a MN FACE investigator on February 3, 1997. During MN FACE investigations, incident information is obtained from a variety of sources such as law enforcement agencies, county coroners and medical examiners, employers, coworkers and family members.

## **INVESTIGATION**

On the day of the incident, the victim was removing corn screenings from a steel grain bin. The screenings consisted of crushed kernels and other damaged grain material that was removed during the drying of corn by a local grain elevator. The bin was 20 to 25 years old and was 20 feet in diameter and 18 feet high. It had a storage capacity of 5,000 bushels and contained approximately 3,000 bushels of corn screenings at the time of the incident. The bin was equipped with a ventilation system that consisted of a fan and a raised grated steel floor. The ventilation fan was not turned on at the time of the incident. The bin had an access hatch located near the edge of the roof that was accessible by an exterior ladder attached to the side of the bin. A steel ladder was also attached to the inside wall of the bin and was located directly below the roof access hatch. The bin had a side access door that was 3 feet wide by 6.5 feet high. The door was fitted with a hinged exterior door that opened outward and with 8-10 overlapping panels that slid into slots along the sides of the door. Each panel was 3 feet long and approximately 7-8 inches wide and when in place, prevented stored grain from exerting pressure against the hinged exterior door. The bin was equipped with a 6.5 inch diameter unloading auger mounted horizontally below the raised steel floor of the bin. It extended from one side of the bin to the center of the bin floor where a round auger intake opening was located. The intake opening was not fitted with a steel safety grid to prevent workers from being directly exposed to the auger.

The victim was working alone and used the bin's unloading auger to remove corn screenings

from the bin and transfer them into a portable feed mixing wagon. While he filled the wagon, the flow of screenings from the bin apparently stopped. The victim stopped the tractor's power-take-off but left the engine running. He also stopped the bin unloading auger before he climbed to the roof of the bin to determine why the flow of screenings had stopped. He apparently discovered that the flow stopped because the screenings had a consistency that caused them to cluster together versus flow smoothly. He entered the bin through the roof hatch and as he climbed down the inside ladder of the bin, he apparently stumbled and fell into the screenings which collapsed and engulfed him. This probable scenario seems most likely to have occurred since one of the victim's feet was protruding from the screenings.

Several hours later, the victim's father arrived at the farm to assist his son with various livestock chores. He found the tractor and wagon near the bin but was unable to locate his son. He climbed to the roof of the bin and discovered one of the victim's feet protruding from the screenings. He ran to the farm house and placed a call to rescue personnel who arrived at the scene shortly after being notified. They cut one hole in the side of the bin and removed the sliding panels from the side access door to empty the bin. Approximately thirty minutes after they arrived, the victim was removed from the bin and transported to a local hospital where he was pronounced dead.

## **CAUSE OF DEATH**

The cause of death listed on the death certificate was suffocation in grain bin.

## **RECOMMENDATIONS/DISCUSSION**

**Recommendation #1:** Workers should follow established confined space entry procedures when entering grain bins.

**Discussion:** If entrance into a grain bin is necessary, workers should follow established confined space entry procedures such as those described in NIOSH Publication No. 80-106. Anyone entering a bin should wear a safety belt or harness and a lifeline which is attached to a fixed external anchor point. In addition, a standby person should be stationed outside the bin whenever a worker enters a bin. Visual contact and/or audible communication should be maintained between the worker in the bin and the standby person at all times. Details of a rescue must be discussed and understood by the worker and the standby person before entry into a bin occurs.

**Recommendation #2:** Grain bins should be identified as confined spaces and posted with hazard warning signs at all entrances.

**Discussion:** Grain bins meet the 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). Warning signs to alert farm workers of the hazards associated with grain bins 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.

**Recommendation #3:** Workers should never stand or walk on the unstable surfaces of stored material.

**Discussion:** Walking or standing on the unstable surface of stored grain and other materials may expose workers to various hazards. Materials like the screenings in this incident do not flow smoothly but instead tend to cluster together. If a worker stands or walks on these types of materials they may collapse and engulf the worker. In situations where flowing material is being removed from the bottom of storage bins, a worker walking in flowing material may become entrapped and pulled below the surface in less than ten to fifteen seconds. A condition known as bridging creates hazardous situations that workers should avoid. Bridging occurs when grain or other stored material forms a ridged crust that does not collapse as the grain or material is removed from beneath the crust. A pocket develops beneath the surface that is concealed from workers who enter the storage structure. While standing or walking on the surface of bridged grain or other material, the material may collapse without warning and completely engulf workers. It could not be determined whether or not the victim in this incident actually stood or walked on the surface of the screenings, however, this recommendation is a safe work practice that should be followed.

**Recommendation #4:** Grain bin ventilation fans should be turned on and operating properly before workers enter bins which are either full or partially full.

**Discussion:** Older grain bins typically were not equipped with ventilation fans but many grain bins built in recent years are equipped with electric ventilation fans. These fans are used

primarily to circulate unheated air through the stored grain. Ventilation fans force outside air into a space between the concrete bin foundation and a raised steel floor containing small holes. The air is forced upward through the grain and escapes through seams in the bin roof. When ventilation fans are operating, they are capable of providing a continuous flow of air through the stored grain. Although this flow of air is small, it may prevent a buried worker from suffocating if the worker is located within a short time after being buried in the grain. The presence and use of ventilation fans does not lessen or eliminate the confined space hazards of steel bins nor does their use reduce the need for workers to follow the guideline provided in Recommendations 1, 2 and 3. However, grain bin ventilation fans should be turned on and operating properly before workers enter bins which are either full or partially full. Operation of the ventilation fan in this incident may not have prevented this fatality, however, this recommendation is a general safe work practice that should always be followed.

## **REFERENCES**

1. NIOSH ( April 28, 1993). NIOSH Update: NIOSH Warns Farmers of Deadly Risk of Grain Suffocation. 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. 93-116.

George Wahl, M.S.  
Senior Safety Investigator  
MN FACE

David L. Parker, M.D., M.P.H.  
Principal Investigator  
MN FACE