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**TO:** Director, National Institute for Occupational Safety and Health

**FROM:** Iowa FACE Case No. 2005IA020 Report Date: 30 December 2008

**SUBJECT:** Farmer engulfed and suffocated in soybeans during unloading of steel grain bin

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## SUMMARY

Mid-spring 2005, a 64-year-old lifelong farmer died in northeast Iowa when he was engulfed and suffocated in soybeans inside a cylindrical, steel grain bin on a farm he rented. He had entered the three-quarters full bin while the truck driver outside manned the high-capacity auger which conveyed beans from the bin to his semi-truck trailer. Concerned about the farmer's whereabouts when the flow of beans stopped, and unable to quickly find him, the trucker summoned emergency assistance. A Sheriff's Deputy was first on the scene in thirteen minutes, ahead of local volunteer fire/rescue personnel from two nearby towns. Area farmers responded, too, with torches to cut openings around the bin and assist in the hour-long rescue attempt. The farmer was pronounced dead at the scene.

## RECOMMENDATIONS

- 1. Never enter a grain bin while it is being unloaded and never unload a grain bin while someone is inside the bin.*
- 2. Apply safety signs along grain bin access ways and, if the bin must be entered, use confined space entry procedures and recommended equipment.*
- 3. Store and maintain grain in proper condition and break up surface crusts or material sticking to bin walls from outside the bin.*

## INTRODUCTION

A 64-year-old, northeast Iowa farmer suffocated when buried in soybeans after entering a steel grain bin from which soybeans were being conveyed by an auger into an adjacent semi-truck trailer. Iowa FACE investigators became aware of this incident through a newspaper press clipping account the second day after it happened. Preliminary information gathering began immediately. Additional information was obtained in a telephone interview with the victim's spouse and from reports by responding and investigating authorities.

## INVESTIGATION

The 64-year-old farmer and his wife had moved to an acreage in a small nearby town more than a dozen years earlier. They had both grown up on local farms, raised a farming family together, and were now continuing to enjoy farming by helping their two sons. It was mid-spring 2005. Farmers were starting fieldwork and it was time to empty the remainder of last year's soybean crop from the storage bin located 8 miles (12 km) from the acreage where they lived.

There was no electrical service at the bin site with which to power equipment to stir or aerate the stored beans, and a layer of beans had formed a crust on top of the beans. Crusting of a top layer of grain, often due to sprouting and molding, occurs when the grain's temperature and moisture content are not effectively controlled, such as by use of aeration fans. A soggy surface can also form due to condensation inside the bin and moisture absorption in the grain. Shortly after 4 o'clock that morning, the farmer, his son and the son's two daughters had gone to the bin site to remove the crust from the top of the beans before unloading started for the day.

The truck driver had unloaded his previous load more quickly than expected and was returning for another load late in the day to get a head start on the next day's run when he called the farmer on his cell phone. The trucker maneuvered his semi into position and began to auger more beans from the steel bin into his truck trailer before the farmer had once again returned to the bin site.

When the farmer arrived, he walked past the trucker to check on the beans in the bin and see how the auger was performing. The truck driver was instantly concerned when the flow of beans from the auger stopped. Unable to quickly find the farmer, and thinking he might have climbed the ladder to check for clumps or clogs, the trucker telephoned for emergency assistance and alerted the farmer's wife. The County Sheriff's Deputy arrived first, thirteen minutes after the initial call and ahead of volunteer fire/rescue personnel from two area communities.

The bin (Photo 1), formed by sections of corrugated steel bolted end-to-end in rings placed one on top of another, was 30 ft (9.1 m) in diameter and 7-rings high, about 18 feet (5.5 m) to the edge of its cone-shaped roof. It had a capacity of ten thousand bushels (350 cubic meters) and was three-quarters full at the time of the incident.

The Deputy climbed the ladder on the outside of the bin to the top entry hatch in the bin's roof and looked inside. He saw impressions in the surface of the soybeans that appeared as though someone had walked to the middle of the bin, the area over the intake opening for the auger, perhaps to remedy a plug or retrieve a clump of crusted beans.



**Photo 1** – Rescue workers on top of bin assessing situation through entrance hatch of grain bin.

Cylindrical, flat-bottomed grain bins like the one in this incident empty out the center of the bin floor. Grain flowing toward the center and then down to the floor forms a column of moving grain. That column of moving grain can engulf a person like quicksand, making escape impossible in seconds and submerging a person in less than a minute. This can occur suddenly, especially with modern, high-capacity unloading augers running underneath. Convinced the farmer had walked to the middle of the bin and become trapped in the flowing soybeans, rescue personnel, family members and neighbors used torches to cut openings in the steel rings and worked to empty the bin as fast as possible in an intense hour-long rescue attempt before the farmer's body was found.

## **CAUSE OF DEATH**

There was no autopsy performed. The Certificate of Death described the immediate cause of death as suffocation.

## **RECOMMENDATIONS AND DISCUSSION**

**Recommendation #1**        *Never enter a grain bin while it is being unloaded and never unload a grain bin while someone is inside the bin.*

**Discussion:** As evidenced by this incident, a person inside a grain bin when grain is flowing in or out may become buried in flowing grain. Modern conveying equipment such as augers can move large volumes of grain quickly enough to bury a person or pull them below the surface of the grain in seconds. Workers should not enter or work in a bin when it is being emptied or filled and co-workers should not operate unloading or loading equipment while a person is in the bin. Automated systems, and co-workers who are not aware, can cause loading and unloading equipment to restart while a person is still inside a bin. To ensure this does not occur, persons should never enter or work in a bin without locking out and tagging everything that could automatically or inadvertently result in a restart of loading or unloading equipment.

**Recommendation #2**        *Apply safety signs along grain bin access ways and, if the bin must be entered, use confined space entry procedures and recommended equipment.*

**Discussion:** Grain bins have one or more of the following characteristics of confined spaces. They have limited openings for entry and exit, unfavorable natural ventilation, and/or are not designed for continuous worker presence. Safety signs identifying the hazards and the procedures to be followed should be posted in conspicuous locations so they catch the person's attention before they attempt to enter the bin and inform co-workers of proper precautions, such as stopping and locking all conveying equipment. Typically, anyone entering a bin should wear a harness and have a lifeline attached to an external anchor. In addition, a properly trained standby person should be stationed outside the bin where they can maintain constant communication with the person in the bin, provide assistance, and summon help in an emergency. A third person should remain on the ground to go for help or render assistance in freeing the person in the bin. A harness and lifeline tended by a trained person may have prevented this incident.

**Recommendation #3**      *Store and maintain grain in proper condition and break up surface crusts or material sticking to bin walls from outside the bin.*

**Discussion:** Damp, moldy grain clumps together and hardens. It creates material handling problems and unexpected hazards.

Old grain bins were not equipped with ventilation fans and aerating or stirring mechanisms. Such devices help keep maintain grain temperature and moisture content and keep it from forming into clumps and layers in storage. Extra efforts are needed to prepare grain for storage in older bins and to maintain proper stored crop conditions. Bins equipped with ventilation fans provide airflow through the stored grain so its temperature and moisture condition can be more easily controlled.

If stored grain gets wet, sprouts, or molds surface crusts can form and grain can stick to bin walls. The surface may seem solid but underneath there can be a void. Such crusts and buildup should be broken apart from outside the bin if a void or cavity could have formed under the surface crust, due to decay or previous unloading, or when material is sticking to walls at more than head height. A non-conductive pole (to prevent electric shock in the event of contact with an overhead power line) or a weighted line should be used to dislodge and break apart buildup. The obvious difficulty of properly dealing with crusted material as recommended provides additional incentive to store and maintain grain in proper condition by controlling its temperature and moisture content.

## REFERENCES

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# Fatality Assessment and Control Evaluation FACE

Fatality Assessment and Control Evaluation, FACE, is a program of the *National Institute for Occupational Safety and Health* (NIOSH), which is part of the *Centers for Disease Control and Prevention* of the *U.S. Department of Health and Human Services*. Nationally, the FACE program identifies traumatic deaths at work, conducts in-depth studies of select work deaths, makes recommendations for prevention, and publishes reports and alerts. The goal is to prevent occupational fatalities across the nation.

The NIOSH head office in Morgantown, West Virginia, carries out an intramural FACE case surveillance and evaluation program and also funds state-based programs in several cooperating states. In Iowa, *The University of Iowa* through its *Injury Prevention Research Center* works in conjunction with the *Iowa Department of Public Health* and its *Office of the State Medical Examiner* to conduct the Iowa FACE program.

Nationally, NIOSH combines its internal information with that from cooperating states to provide information in a variety of forms which is disseminated widely among the industries involved. NIOSH publications are available on the web at <http://www.cdc.gov/NIOSH/FACE/> and from the NIOSH (1-800-CDC-INFO (1-800-232-4636) or email [cdcinfo@cdc.gov](mailto:cdcinfo@cdc.gov)).

Iowa FACE also publishes its case studies, issues precautionary messages, and prepares articles for trade and professional publications. In addition to postings on the national NIOSH website, this information is often posted on the Iowa FACE website at <http://www.public-health.uiowa.edu/FACE/>. Copies of FACE case studies and other publications are also available by contacting Iowa FACE directly.

The Iowa FACE team includes the following specialists from the University of Iowa: Craig Zwerling, MD, PhD, MPH, Principal Investigator; John Lundell, MA, Co-Investigator; Murray Madsen, MBA, Chief Trauma Investigator; and Co-Investigator/specialists Risto Rautiainen, PhD, and Wayne Sanderson, PhD, CIH. Additional expertise is provided from the Iowa Department of Public Health, including Rita Gergely, Principal Investigator, and John Kraemer, PA, from the Office of the State Medical Examiner.

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