

## Prevent fatalities from grain entrapment

Across the Midwest, record-size harvests, domestic demand for corn and ethanol, and increases in grain storage capacity have resulted in more grain storage than ever before. With increases in grain storage and longer storage periods, the potential for grain to go out-of-condition increases. There is a direct relationship between out-of-condition, or spoiled grain, and the risk for grain entrapment.

Out-of-condition, crusted or frozen grain can form a horizontal “bridge” over a hollow area below. While bridged grain appears to be an intact surface, it is rarely hard enough to support a person. ***There is little chance of survival if you are in a bin walking on the grain surface when the crust breaks or a grain unloader is operating.***

A person standing on crusted grain can fall through to the air space below and be covered in grain that caves in on them, or be pulled down through the grain in a matter of seconds when unloading equipment is running. Out-of-condition grain can also adhere to the vertical sidewall of a bin or storage structure and collapse onto a person inside.

### 2010 U.S. Grain Entrapment Facts

- Suffocation from entrapment is the leading cause of death in grain bins.
- More entrapment incidents were recorded in 2010 than ever before.
- The primary cause leading to entrapment was entering a bin to loosen crusted, spoiled, or frozen grain while unloading equipment was running.
- Over half of engulfment incidents resulted in fatalities.
- 69% of entrapments occurred on farms; 31% occurred at commercial facilities.
- The age of entrapped victims ranged from 7 to 81.
- 5 of 6 entrapment cases involving youth under age 16 were fatal.
- Iowa had the 4<sup>th</sup> highest number of entrapments in the U.S.



The Iowa Fatality Assessment Control and Evaluation (Iowa FACE) program is conducted by the Injury Prevention Research Center at the University of Iowa College of Public Health working in conjunction with the Iowa Department of Public Health and its Office of the State Medical Examiner.

## Iowa fatalities

From 2000 through 2010, 17 individuals died in incidents involving grain entrapment. Five of these fatalities occurred in the 2 year period 2009-2010. An additional 9 individuals died due to falls off of or into grain bins from 2000 through 2010.

- A 64-year-old farmer was “walking down the beans” in a grain bin, knocking beans loose from the bin sidewalls while grain was being unloaded from a bottom-feeding auger. He became entrapped and died of suffocation.
- A 72-year-old farmer and 2 other men were unloading corn from a bin into a semi-trailer when the bin auger malfunctioned. The farmer entered the bin from the top while the auger was on and became entrapped. He was freed within 30 minutes but later died in the hospital of his injuries.
- A 49-year-old of a grain cooperative employee was working in a bin to dislodge a grain crust or fix equipment and was entrapped in soybeans. He radioed his co-worker stationed outside the bin to ask for assistance. When the coworker entered the bin the victim was already engulfed.
- A 45-year-old farmer and his brother were using a grain vacuum to empty 8000 bushels corn from a bin. The brother returned from the local elevator to see grain overflowing into the wagon. Rescue crews located the victim who was buried in grain; they assumed spoiled grain in the center of the bin suddenly shifted, trapping the farmer.
- A 48-year-old supervisor of a small town grain elevator was found in a bin, buried in corn screenings. Because there was no grain moving or entanglement in machinery, authorities suspected he slipped or fell into the 60-foot tall bin and was engulfed.
- An 82-year-old cattle farmer was removing corn from a silo on his farm when the floor auger got clogged with out-of-condition corn. When the farmer entered the silo to break up the clumped grain, corn that was adhered to the silo walls dislodged and fell on the farmer, burying him.

### ***Did you know...***

- **Wet harvests or long storage periods increase the risk for crusted and bridged grain, and clogged grain-moving equipment.**
- **Newer larger bins move grain faster than workers are accustomed to.**
- **A 6-foot tall person can be trapped waist-deep in moving grain in less than 5 seconds and buried in 11 seconds.**
- **Grain creates friction that resists the force a rescuer uses to remove a victim. It takes over 900 pounds of force to raise an adult mannequin covered in corn.**

## Recommendations

Entrapment from flowing grain is preventable. Proper grain storage, safe work practices, use of personal protective equipment, effective emergency response practices, and anticipation of hazardous conditions save lives.

Proper grain storage practices can reduce the potential for grain to spoil or go out-of-condition, which leads to bridging, clumping, and clogging of unloading equipment.

Working alone greatly increases the risk for grain entrapment. Work with coworkers and keep each other informed of your whereabouts – particularly before entering storage structures and before engaging grain loading or unloading equipment. Make sure grain moving equipment is shut off and securely locked out to prevent inadvertent operation when someone must enter a bin. If entry into a structure containing grain is necessary, it should only be done with the use of a harness, lifeline, and partner, and after atmospheric conditions are proven safe.

Be aware of potentially dangerous conditions due to out-of-condition grain. When a grain storage unit appears to be too full for the amount of grain you have put in, grain may have formed a dangerous bridge over an open cavity below. If problems occur while unloading, look for signs of spoiled or bridged grain from *outside* the bin or silo. If you see no “funnel shape” at the surface of grain after removing grain from a bin, or the surface looks undisturbed, the grain has bridged and there is a cavity under the surface.

### ***Never enter a grain storage bin, wagon, or container unless you:***

- Have an accident response plan in place.
- De-energize (lock out) all grain moving equipment before entry, and communicate this to co-workers.
- Notify coworkers and have 2 trained partners available: an observer who monitors the entry from outside and a 2<sup>nd</sup> person who can go for help if needed.
- Wear a full-body harness connected to a lifeline tether short enough to keep from being submerged beyond waist-high.
- Test the atmosphere in the bin to assure there is adequate oxygen concentration and no toxic gases.
- Probe or strike the surface of potentially bridged grain with a long tool, pole, or weighted line from outside the bin ***before*** standing on it.
- Follow confined-space entry procedures and permitting if you are required by OSHA.

#### References:

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- University of Arkansas Division for Agriculture. Suffocation Hazards in Grain Bins. 2010. [http://www.uaex.edu/Other\\_Areas/publications/PDF/FSA-1010.pdf](http://www.uaex.edu/Other_Areas/publications/PDF/FSA-1010.pdf).
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