



Grain Storage Problems Are Increasing the Dangers to Farm Operators

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Not all is well with the 1996 corn crop that is in storage, and that poses more than just a financial threat to farmers. Late harvest, immaturity, high moisture levels at harvest, high humidity levels, and in some areas inappropriate drying techniques and storage practices have led to unusually high amounts of poor quality corn. The result has been corn that has crusted because of excessive heating and mold damage.

Such grain spoilage increases the personal danger to farmers who are trying to remove the 1997 corn crop from storage. Since the 1996 corn crop has been put into storage, there have been at least a half dozen reported deaths due to grain entrapment. Most have involved removing grain from storage and one involved a wagon load of crusted grain that flipped over when it became unbalanced during unloading, burying the farmer underneath the remaining grain. In addition, conditions that encourage mold growth have increased the potential for exposure to high concentrations of mold spores that can lead to severe respiratory illnesses.

Flowing Grain Entrapments

Generally, stored grain presents few hazards, but flowing grain increases the risk of entrapment and suffocation. Over the years, hundreds of deaths have occurred in bins that appeared to pose no danger. An unsuspecting farmer who enters a grain bin with the unloader running may be caught in the grain flow before realizing what has happened. It takes only four or five seconds for a person to submerge to the point where he or she is helpless. And it takes fewer than 20 seconds to be completely submerged in flowing grain at the center of the bin. Flowing grain entrapments fall into four primary categories:

1. Engulfment in a Flowing Column of Grain

Entrapment or suffocation most often occurs when an individual enters a bin during the unloading process and is drawn into a flowing column of grain. As the bin empties out the bottom, a rapidly moving column of grain forms over the outlet. This vertical column of grain acts somewhat like a fluid, and it flows down through the grain mass at nearly the rate of the unloading auger.

The rate of flow at the center top of a bin is so great that once a person is trapped in the flow, escape is impossible. Once engulfed in the flow of grain, the victim is rapidly drawn to the floor of the bin. The potential of entanglement with the bottom unloading auger is also a possibility.

2. Collapse of Horizontal Crusted Grain Surface

Entrapments and suffocations are possible when an individual enters a bin in which the surface of the grain has become caked because of spoilage. The surface appears solid, but can, in fact, be a thin crust concealing a void that forms as the grain is removed. The victim breaks through the crust and is quickly covered by the avalanche of grain collapsing into the cavity. Often the unloading equipment is still operating, which causes the victim to be pulled even deeper into the grain mass.

3. Collapse of Vertical Crusted Grain Surface

On occasion, farmers have been buried beneath a collapsed wall of free-standing grain. Dry grain in good condition will pile at a 30 degree angle, but spoiled or caked grain can stand almost vertical. As grain is removed from

the base of a caked mass, the potential for an avalanche and engulfment increases. This type of engulfment also can take place inside bins where the spoiled grain is clinging to the bin walls. Attempting to remove these chunks of grain from below using a long pole can be extremely dangerous.

4. Entrapment or Suffocation in Grain Transport Vehicles

The risk of engulfment also is present around any grain transport vehicles such as wagons and trucks. With the high-volume capacity of many on-farm storage facilities, it is not difficult to imagine someone being covered over in seconds during an unloading operation. Many of the victims of this type of suffocation, historically, have been children.

At least two deaths have been reported that involved a wagon load of grain that flipped over onto the operator during unloading. This was caused by crusted grain stacked up on one side of the wagon causing the unit to be unbalanced.

Preventing Flowing Grain Entrapments

Suffocation and entrapment in grain storage facilities don't have to happen. The following safety tips are designed to protect you and others.

- Never enter a bin when unloading equipment is running, whether or not grain is flowing from the outlet.
- Keep children off grain vehicles and out of bins. These locations are completely inappropriate play areas. Never transport children in empty hopper wagons or grain trucks. Grain flow can cover them quickly, before they or the combine operator realizes what is happening.
- Don't enter a bin with automatic unloading equipment without locking out the control circuit.
- Be especially cautious when working with grain that has gone out of condition.

Dangers result from molds, blocked flow, cavities, crusting, and grain avalanches. Never work alone!

- Beware of steep piles of grain. Dislodge them from above, if possible, with a long pole, rather than with a short shovel.
- Never rely on a second person outside the bin, to whom you shout instructions. Equipment noise may block out or garble your calls for action or help. The second person may fall or stumble in the panic and haste of climbing and running to shut down the equipment.
- Always have three people involved when entering a questionable storage situation. Utilize a safety harness and life line. Two adults outside are needed to lift one from the inside on a rope and safety harness if a problem develops. One can go for help while the other gives preliminary aid.
- Always be cautious before walking on any crusted surface of grain. A break-through can plunge you into flowing grain with little chance of survival. Use a long pole from outside the bin to test grain surfaces.

Respiratory Hazards

Even a small amount of spoiled grain can produce millions of tiny mold spores, which easily become airborne when disturbed. Airborne mold spores can be inhaled through the nose and mouth, irritating sensitive lung tissue and in some individuals causing reactions so severe that hospitalization is necessary. Farmers working without respiratory protection inside a bin or other grain storage facility in which moldy grain is present are especially vulnerable to mold reactions.

When handling any grain where mold damage is present, the use of an appropriate respirator is essential. This applies even to truckers, scale operators, and those supervising the dumping operations at an elevator.

After exposure to high concentrations of mold spores, it is important to change clothing (or use disposable overalls) to avoid bringing the mold spores home and exposing family members. If you do become ill after exposure to moldy grain, consult your physician and make him or her aware of your activities. Medical attention may be necessary in some cases.

Preventing Falls

The more frequently a farmer has to climb and enter a bin to complete the unloading, the greater the risk of falling. It is likely that the greater level of storage problems this year will result in more injuries from slips and falls around bins and transport equipment. The potential for falls can be reduced by:

- Installing appropriate ladders inside and outside all bins. Avoid the use of portable ladders.
- Installing resting platforms at the top of each ladder to ease the transfer onto the bin roof or into the bin hatch.
- Installing ladder cages, if possible, on all outside ladders over 30 feet high.
- Keeping shoes free of mud when climbing bin ladders. If conditions are icy, delay access if possible.
- Installing access ladders on trucks and using tarp rollers to reduce the need to climb on trucks.

If Someone Is Entrapped in Flowing Grain ...

If someone does become entrapped in flowing grain, an appropriate response is critical if there is to be any chance of survival. First shut off all equipment, then call for emergency assistance. Make sure that the dispatcher is informed of the nature of the accident, specific location, and directions if needed. If the bin is equipped with an aeration blower, turn it on to increase the flow of air through the bin. This may help the entrapped person to breathe. While waiting for the emergency rescue units,

assemble any equipment that will assist with the rescue. This would include front-end loaders, shovels, plywood for coffer dams, and portable augers.

The only successful technique for removal of a person submerged in grain is to cut the bin and remove the grain from around the victim. This should be accomplished by the trained rescuers and after careful consideration of the structure involved.

For more information on grain bin rescue, consult NRAES-10, *Farm Accident Rescue*, which is available from The Farm Building Plan Service, 1146 Agricultural and Biological Engineering Department, Purdue University, West Lafayette, IN 47907 or call (317) 494-1172.

Summary

All of the grain in storage is not worth the life of one farmer, and there is no reason that there ever should be another victim of a flowing grain entrapment. If everyone involved is patient and follows the few basic strategies outlined above, not only will the '96 crop reach the market safely, but everyone involved also will be around to enjoy the rewards from its sale.

This fact sheet was originally published as Grain Quality Fact Sheet #8 and released March 23, 1993. It has been updated by the original author.

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