



Agricultural Engineering Update



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AEU-74

GRAIN SUFFOCATION HAZARDS

Grain and feed storage systems are a common sight on Kentucky farms and usually present no particular hazard for the user. However, flowing grain or grain that is caked or spoiled can pose a serious threat of entrapment and suffocation. To protect yourself and your family, you need to become familiar with this potential hazard.

To understand grain-entrapment and suffocation, you need to understand how grain flows from a storage system. When a grain bin is unloaded, the grain on the top surface flows in a funnel shaped pattern to a point above the outlet. This is usually in the center of a bin or sometimes on the side for smaller bins or gravity unloading wagons. At the point directly above the outlet, the grain flows in a vertical column down through the grain mass to the outlet. The remaining grain at the bottom of the bin and surrounding the column of moving grain remain stationary. (See Figure 1.)

If a worker or child becomes entrapped in the vertical column of moving grain they can be quickly pulled into the grain and suffocated. Research at the University of Kentucky has shown that the time for an adult to be totally submerged in the grain can be as little as 60 seconds when a 6- to 8-inch auger is being used to unload a bin. For a 10-inch unloading auger the time required to cover up an adult in the grain can be as little as 30 seconds.

Often times workers mistakenly believe they can save themselves with a rope suspended in the bin. However, tests show that the downward grain forces pulling on an adult buried up to the waist was 350 pounds plus the weight of the individual. For a fully submerged adult, the forces were 600 pounds plus the weight of the individual. These forces continue to increase as the victim is further submerged under the grain surface.

Large grain transport wagons and trucks can also pose hazards, especially for children since the time required to be submerged and the forces involved are not affected by the size bin. Whether it is a large storage bin, or gravity unloading wagon, the rate of descent into the grain will depend upon the unloading rate and the forces are dependant upon how deep the person is buried in the grain. Once the grain flow is stopped the force required to remove a person trapped in the grain mass is similar to the forces exerted by the flowing grain. Thus, even rescue of a partially submerged person in the stationary grain is difficult.

Another potential suffocation hazard in grain bins occurs when a worker enters a bin and breaks through a grain crust that has bridged over a void or cavity. This can happen when stored grain becomes moldy and cakes forming a crust on the grain surface. If grain is removed from the bin a empty void forms under the crust. When the worker ventures out onto the crust unaware of the void beneath, the crust can quickly give away and burying the worker under the avalanche of grain collapsing into the void. Workers can also be buried when attempting to break up vertically crusted or caked grain which collapses and buries them.

The following recommendations are offered to reduce the risk of grain suffocation:

1. Never enter a grain bin or storage area when it is being unloaded even if the grain is not flowing.
2. Always lock-out the power to unloading equipment before entering a grain storage or holding area to prevent others from starting the equipment while you are in the bin.
3. Never enter a bin or grain holding area that has automatic unloading equipment unless the control circuit is locked-out.
4. Always close access doors and remove ladders to prevent kids from entering grain storage areas.
5. Do not allow kids to play in large grain transport wagons or trucks.
6. Don't depend upon suspended ropes or other devices to rescue yourself from flowing grain.
7. Don't depend upon a second person outside the bin to hear you shout instructions. Equipment noise may block out your calls.
8. Always be cautious when working with crusted or spoiled grain. This grain can result in cavities, blockages and grain avalanches.
9. If you must enter a questionable storage situation use a rope and safety harness with at least 2 people outside with the means to lift you out in an emergency. A third person should be available to go for assistance.
10. If trapped in a bin while grain is unloading, stay near the outside wall away from the center of the grain funnel or cone and keep moving.
11. Talk with your children, other family members, and your co-workers and warn them of the hazards with flowing grain.

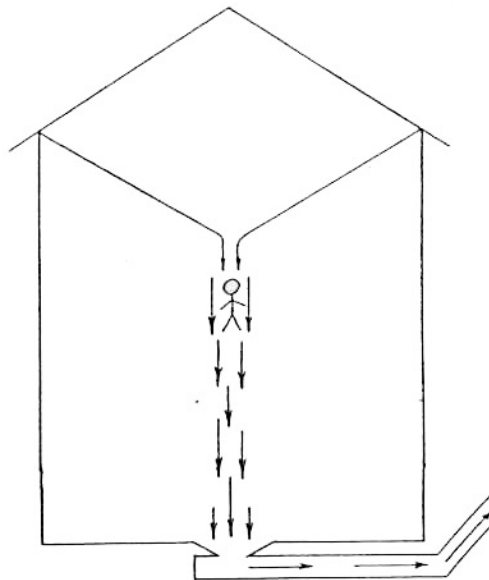


Figure 1.