

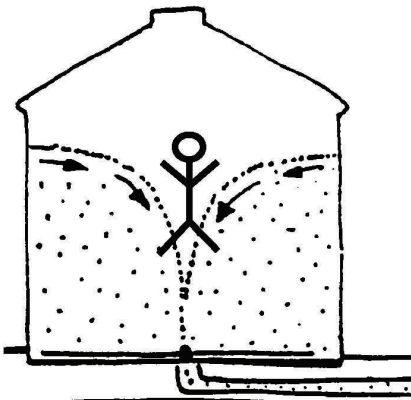
## ***A Potentially Deadly Environment***

Many of today's farms have the capability of storing grain on site. The storage bins save the farmer elevator storage fees and drying charges for grain above the desired moisture content. Farms with livestock usually have some form of storage for silage or other feeds. These storage bins also present a substantial risk to farmers and farm workers. One study of more than 540 farm fatalities provided the following results:

- the second leading cause of farm fatalities was due to buildings and structures, which includes silos and grain bins, on the farm
- 20 of the 60 deaths in this classification resulted from grain suffocation
- Another 8 deaths resulted from exposure to silo gasses

## ***Entrapment and Suffocation***

The greatest risks to farmers and farm workers, when working with storage bins, are entrapment and suffocation. Most grain bins are emptied through the center of the bin floor. Once the emptying process begins, grain flows from the top of the bin to the center and down, creating a funnel-shaped flow pattern. The flow rate increases toward the center of the funnel. The flowing grain acts like quicksand. A person caught in the flow of grain may be buried to the waist in 10 seconds or less. Since the grain is moving around the person, there is no way of regaining stability. Normal unloading rates will completely bury a worker in less than one minute.



Caked or frozen grain may create another potential hazard known as bridging. Bridging occurs when a layer of grain forms towards the top of a storage bin as the bin is being emptied from below. As grain is removed from the bin it creates an air pocket under the top layer. The danger begins when a farmer or worker enters the storage bin and assumes the top layer of grain is stable. As the person walks across the bridge it collapses, potentially crushing or burying the person. To avoid this hazard, it is recommended that a wooden pole be used from outside the storage bin to break up the crust.

## ***Contributing Factors***

The National Institute of Occupational Safety and Health (NIOSH) investigated entrapment and suffocation accidents to determine contributing factors. The investigation indicated the following factors were important:

- Grain became lodged in the bin; workers entered the bin to dislodge it
- Workers entering the storage bin were unaware the grain was unstable or bridged
- Workers were operating below or on top of unstable stored grain
- The equipment moving the grain was not turned off or locked out
- Safety Belts or harnesses were not used
- Emergency procedures were not followed

## ***Hazardous Environments***

Silos or grain bins may be filled with gasses from spoiling grain or fermenting silage. In grain bins the build up of carbon dioxide ( CO<sub>2</sub> ) is hazardous because:

- It is colorless, odorless, and tasteless
- If a sufficient quantity of CO<sub>2</sub> exists it can displace oxygen in the air
- Exposure may cause drowsiness, loss of consciousness, and possibly death

Fermenting silage produces various forms of nitrous oxide. These gasses are respiratory irritants capable of producing the following effects:

- Low concentrations may cause coughing, nausea or difficulty in breathing
- Higher concentrations may cause the lungs to fill with fluid, causing death
- The effects may be immediate or take several hours to develop
- Because silage gasses are heavier than air they may collect in the silo room

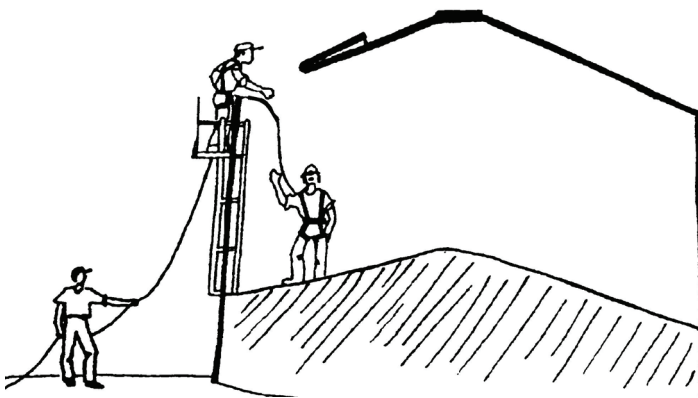
## ***Falls***

Falls from structures are a significant risk with grain bins and silos. An important fact to remember is that even a 12-foot fall can kill a person. Falls frequently occur when workers move from the vertical ladder on the outside of the grain bin or silo to the roof or bin entrance.

## ***Safe Work Recommendations***

NIOSH has developed recommendations or safe work practices designed to reduce the number of fatalities due to storage bins and silos. The following are their recommendations:

- Workers must be taught to assume that all stored materials are bridged and have the potential to trap or suffocate a worker in a very short time
- Workers should not enter a storage area from the bottom when material is stuck to the sides of the bin or bridged overhead



- Workers entering a grain bin must stay above the grain at all times, never stand on top of the grain
- Any time a worker enters a silo or grain bin, the supply or discharge of materials must be stopped and the equipment locked out
- Silos should be vented for at least 30 minutes before entry to discharge nitrous oxide gasses from the fermenting silage
- Silos should not be entered for three to four weeks after silage has been added
- Workers entering storage areas should wear a

safety harness attached to a set anchor point

- Workers should work in at least groups of two
- Permanent ladders should have a locking cover or pull-down section to limit access
- Any permanent ladder more than 20 feet long should be surrounded by a safety cage

Accidents involving grain or silage storage are preventable. Discussing, implementing, and following the recommended practices will help protect you, family members, and workers.

