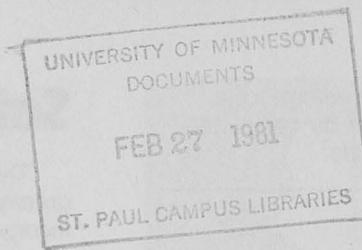
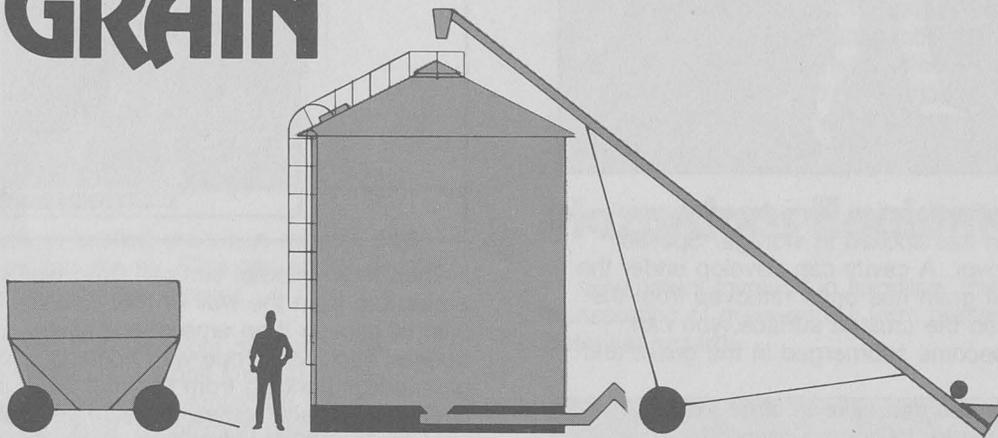


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Safe Storage and Handling of GRAIN



Storing and handling large volumes of grain on the farm are common practices today. The equipment and processes involved appear to be routine and relatively safe; however, a number of potentially dangerous conditions can develop during the harvesting and storage season. Many injuries and fatalities related to storing and handling grain are reported each year. This publication identifies the potential hazards and describes how they can be reduced or eliminated.

Industry Trends

Trends in the grain production and marketing industry continue to intensify potential hazards related to grain storage and handling. Grain production has increased through yield improving technology and additional acreage brought into production. As a result of the increased production, grain is held in storage longer and larger-size grain bins are being constructed. Average-size bin capacity ranges from 20,000 to 100,000 bushels. Grain is handled at a much faster rate today. The larger augers common today can transfer from two to four times as much grain as augers in the past. Use of automated

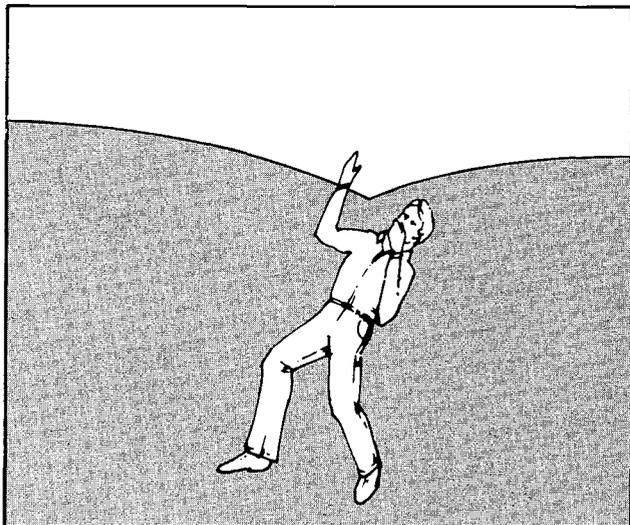
equipment results in a farmer working alone a great deal of the time. Each of these factors contributes to the exposure of potential hazards when storing and handling grain.

Suffocation Hazards

Suffocation hazards in the grain bin are a common and constant hazard. Various unsafe conditions result when safety precautions are not followed.

Drowning in flowing grain. Drowning in a grain bin is perhaps the most common cause of death by suffocation. If you enter a bin of flowing grain, you can be pulled under in a few seconds. Grain flowing against your body creates a strong pull on you. Once the flowing grain is above your knees, you will be unable to free yourself if there is nothing to hold on to. The grain acts like a fluid, contacting all outer surfaces of your body and pulling on it with tremendous force. The typical round, flat-bottom grain bin will draw grain from the top center and form a vertical cone when emptying. A vertical flow pattern is quickly developed. The flow rate from a grain bin is much faster today because 8- and 10-inch augers are commonly used in contrast to the 6-inch augers which handled grain at a slower rate. An 8-inch auger can transfer 3,000 cubic feet of grain per hour

(52 cubic feet per minute). The body volume of a man, which is about 7 cubic feet, can be completely submerged in grain in about 8 seconds.



Other types of suffocation from drowning can occur when grain has spoiled in storage. Spoiled grain can crust over. A cavity can develop under the crusted surface if grain has been removed from the bin. If you walk on the crusted surface, you can break through, become submerged in the grain, and suffocate.

Spoiled grain also can cake in large vertical masses. When you try to get the caked material loose, large sections of grain can break off and cover you in the bin. This risk increases as the capacity of the grain bin increases. When breaking up large masses of caked grain, use a pole (preferably wood) and work from a manhole opening above the grain.

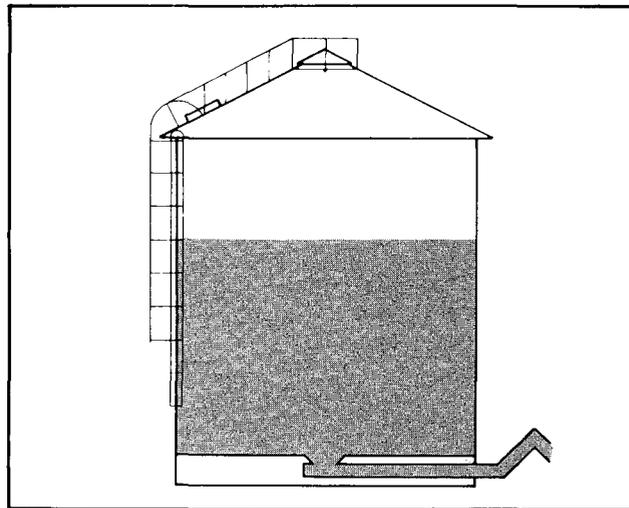
If for some reason you become trapped in a bin of flowing grain and there is nothing to hold on to, stay near the outer walls and keep walking. You can usually walk the bin down until it is empty or flow stops. Also, if you ever are covered by flowing grain, cupping your hands over your mouth and taking small breaths may keep you alive until help arrives.

Carbon dioxide. Suffocation by exposure to carbon dioxide (CO_2) can occur when grain is stored wet and ferments. Fermentation produces CO_2 , which is heavier than air and pushes air out of the bin, resulting in an oxygen-deficient atmosphere. If you enter a grain bin where CO_2 is present, the CO_2 will overload your bloodstream and slow down your breathing, causing drowsiness, headaches, and even death. Carbon dioxide is colorless and odorless.

If you suspect the presence of CO_2 , don't go into the grain bin. Opening manholes and all side door openings supplemented by forced ventilation through the bin will help reduce the hazard. If a rescue is attempted in an oxygen-deficient atmosphere, a self-contained breathing apparatus is necessary. Your local emergency rescue team is trained to help in this type of an emergency and should be called immediately.

Safety Measures

The hazards of storing and handling grain are greatly reduced when safety design features are incorporated into the construction of grain bins.



Ladders. Internal vertical, fixed wall ladders accessible from the wall or roof opening provide a path of escape if an emergency arises. Other safety devices such as a rope with knots or a chain or pipe ladder hanging from the roof peak can provide additional escape routes. Outside vertical, fixed ladders over 20 feet high should be equipped with a cage to reduce the hazard of falling. Rest platforms are recommended for every 30 feet of vertical ladder distance. Climbing on the roof of a grain bin to open and close the center roof cover often is necessary when loading with a portable auger, inspecting, servicing, or determining the amount of grain left in the bin. The roof ladder should be readily accessible from the outside vertical, fixed wall ladder. Hand loop rails at the top of the vertical ladder, hand rails on the roof ladder, and guard rails around the manhole provide desirable safety features for climbing and reduce the risk of falling.

Power off. You should be able to turn off and padlock the power switch so that no one can turn on the power when you or others are working in the grain bin.

Safety decals. On newly constructed grain bins, safety decals placed at strategic locations on the bin alert workers to the dangers of flowing grain, crusted-over grain, and CO_2 .

Emergency Procedures

If a person becomes submerged in grain, rescue operations should begin as rapidly as possible. The most successful way of rapidly removing a victim is

to cut large holes around the base of the bin approximately 5 feet up from the base. This will reduce the volume of grain from the bin in the shortest period of time. Gain access into the grain bin side walls by using the front-end loader of a tractor, an abrasive saw, or an air chisel. A cutting torch should be used only as a last resort, due to the dangers of fire and explosions from dust and fumigant residue.

When a person must enter the grain bin, have enough people assist from the outside. Use a rope and safety harness so the person can be lifted out in case of an accident.

Do not attempt a rescue in an oxygen-deficient atmosphere. Call your local emergency rescue team, which has the training and equipment to do the job safely.

Dust Hazards

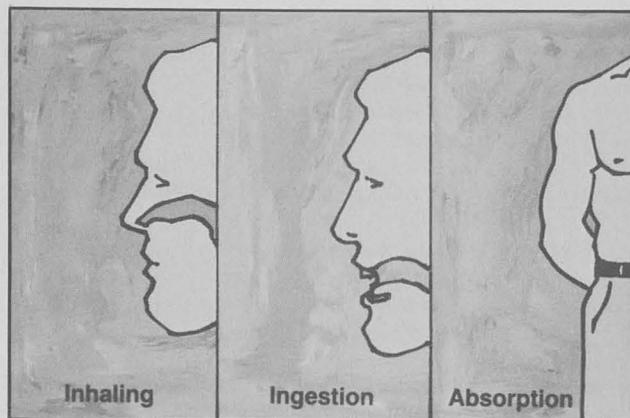
During handling, spoiled grain can release dust and mold spores into the air. This can cause serious respiratory problems for the worker.

Nuisance dust. Particles light enough to be carried by air currents and small enough to be inhaled and deposited in your lungs are called nuisance dust. This dust, a common danger in the air, can accumulate and turn parts of the lung into nonfunctioning, hardened tissue. Inhaled dust also encourages the growth of tuberculosis and bronchitis. Wear a dust mask and ventilate the work area while cleaning out a grain bin or working with dusty grain to protect your lungs.

Allergic reactions. Exposure to fungus from moldy grain can result in allergic reactions characterized by chills, high fever, swelling, vomiting, dizziness, and shortness of breath. The lungs can fill with fluid and collapse. A dust mask that fits tightly around your mouth and nose area will effectively protect you from fungus present in moldy grain. If you choose not to wear a mask, there is a good chance you will have an allergic reaction and have breathing problems the rest of your life.

Fumigating Stored Grain

Special protective precautions are required if grain needs fumigation. Fumigants are toxic to humans when inhaled, swallowed, or absorbed through the skin. Injury or illness to the applicator or other unsuspecting people can be eliminated if safe procedures are followed. Selecting the proper gas mask and canister and using them correctly will protect the applicator. Use only respirators approved

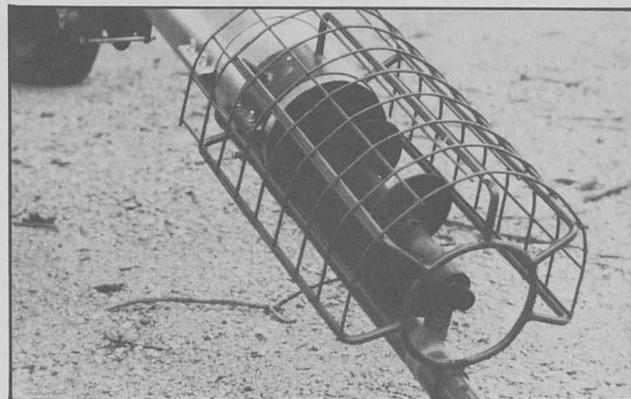


by the National Institute for Occupational Health (NIOSH) or U.S. Bureau of Mines. Post warning signs alerting people to fumigation dangers.

It is often safer and more effective to have your stored grain fumigated by a licensed, professional fumigator.

Hazardous Equipment

Equipment involved in handling, transferring, and transporting of grain on the farm presents many potential hazards.



Grain augers. Portable and stationary grain augers are a major source of serious farm injuries and fatalities. Automated equipment can start and stop without warning. Augers are considered one of the most dangerous types of farm equipment per hour of use.

Workers operating this equipment should take a few minutes to review the operator's manual and examine the equipment to assure it is in safe operating condition.

Wear close-fitting clothing when working near power augers. Loose, floppy clothes can become caught in moving parts and draw you into the auger.

Guards and shields should be maintained in place to minimize the chance of getting caught in moving parts. It is critical that all shields and guards be replaced as soon as repair and maintenance work is completed. A machine that is properly guarded can save your life or the life of a member of your family.

Summary

Children are attracted to the operation of a grain auger. They move in closer to get a better look and can become entangled. It is important that children be instructed to stay away from operating equipment.

Transporting, positioning, and raising a portable auger can be hazardous if safe work procedures are violated. Before moving an auger, lower and secure it in transport position. A check should be made for overhead powerlines before positioning the augers to avoid contacting a high voltage source. The worker could be electrocuted by becoming the direct circuit to ground. If contact is made or a powerline is broken, have someone call the power company. Stay on the tractor or truck unless you can jump clear, and do not touch anything that is in contact with the powerline.

Avoid sharp turns when pulling a portable auger, as the wheels do not follow those of the tractor pulling it. Travel at safe speeds on the highway, and have a flag mark the end of the auger and a slow-moving-vehicle sign on the frame of the auger. Raising an auger too high increases its chances of up-ending. Collapse-type accidents occur when the undercarriage falls. When in use, the upper end of the auger should be resting on the top of the bin and the lower end resting on the ground. Stay out from under an auger while it is being raised.

Transport equipment. Suffocation in a gravity wagon or truck can occur when children or other innocent victims slip and are drawn into the grain during unloading. Do not allow anyone on or in the wagon or truck at any time.

Automated equipment poses a potential danger. It can be fatal for a person to enter a wet holding or storage bin if the power source is not turned off and the switch padlocked. A drowning can result because automatic loading and unloading of grain can start up at any time.

Grain dryers. Grain dryers may reach a maximum temperature of 240°F. during the drying operation. A fire extinguisher should be available. Workers also should be aware of high noise levels created by the high speed, high volume fans used with grain dryers. Wearing ear muffs will protect the worker from permanent hearing damage, which can occur after exposure to high noise levels for long periods of time.

Don't let a grain storage or handling accident happen to you or a member of your family. Discuss with each family member and worker the potential dangers of drowning, suffocation, entanglement, allergic reactions, and the effects they can have on you. Careful observance of accident prevention procedures and installing safety design features in grain bin storage and handling equipment can control injuries and fatalities.

Keep these safety measures in mind when storing and handling grain:

- Do not enter a bin when grain is flowing.
- Do not enter a bin when you suspect CO₂ is present.
- Shut off and secure all power sources before entering a grain bin.
- Maintain protective guards on equipment.
- Install safety equipment on grain bins.
- Wear a dust mask.
- Use correct fumigation procedures.
- Instruct children and others to stay away from powered equipment.
- Be prepared for emergencies.

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