



BURIED ALIVE

GRAIN SUFFOCATION HAZARDS



WSI

North Dakota Workforce
Safety & Insurance

1600 E Century Ave Ste
PO Box 5585
Bismarck ND 58506-5585
(701) 328-3800 1-800-777-5033

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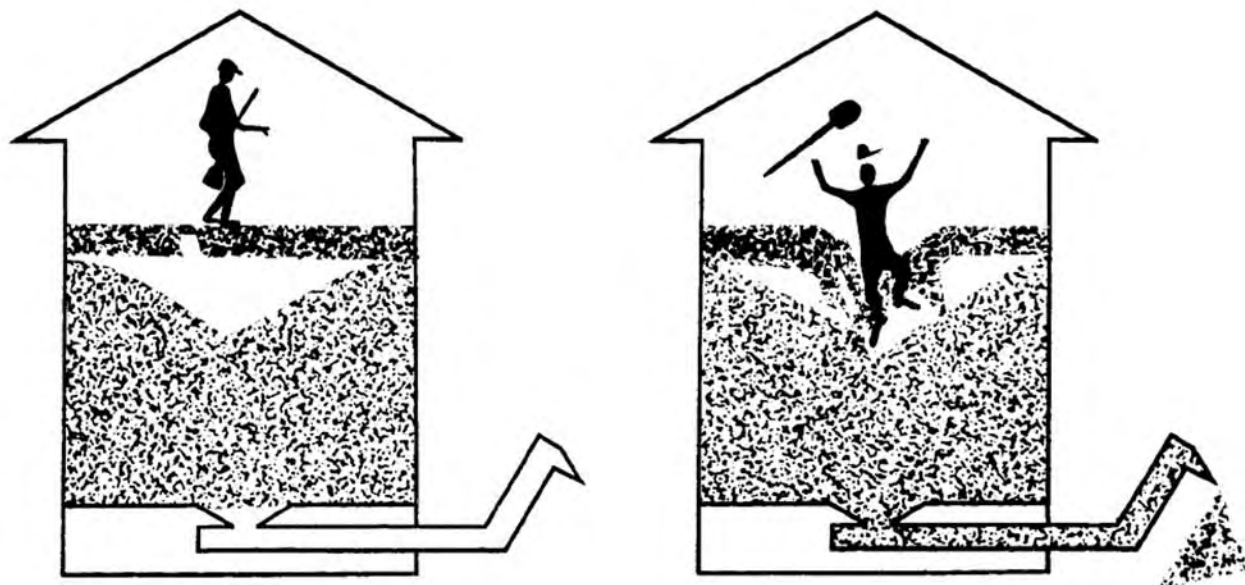
Introduction

Suffocation in flowing grain is the most common cause of death associated with grain storage structures in the United States. The Occupational Safety and Health Administration (OSHA) estimates that 15 to 20 employees each year are suffocated during storage bin and grain elevator accidents, and this, according to OSHA, is a very conservative estimate. Since 1995, three suffocation fatalities have been reported to WSI that were the result of engulfment in grain - with the most recent being in 2002.

The information contained in this publication indicates that suffocations in grain bins are a continuing source of preventable occupationally-related deaths among workers in the agriculture industry. Occupational safety and health training remains a fundamental element of hazard control in the workplace, and there is great potential to reduce these incidents through pre-employment training. Effective pre-employment training should include realistic environments and hands-on exercises.

This publication is designed to engage the learner in recognizing, evaluating, and controlling engulfment hazards associated with grain storage facilities.

Suffocation Hazards In Grain Bins



The number of suffocations in grain storage systems has been increasing over the past several years. There appear to be at least five basic reasons:

1. The increase in harvesting and handling of grains,
2. Grain bins on the farm are getting bigger,
3. Grain handling rates are faster,
4. More operators are working alone due to increased mechanization, and
5. Some operators are not aware of how grain flows from bins and, therefore, do not understand the dangers involved.

Don't make the mistake of your life. Be aware of the dangers of flowing grain.

There are several reasons why you might enter a bin filled with grain...

1. The successful manager of stored grain checks this

investment closely and frequently. You may enter a grain bin to visually check the grain's condition and may probe the bin to determine the grain's temperature and moisture content to ensure that there are no "hot-spots" developing in the center of the bin.

2. Grain being removed from a bin equipped with a bottom-unloading auger may fail to flow because of clogging or bridging. The operator may feel that the only option is to go inside the bin and remove the obstruction or break up the bridged grain.
3. When drying grain, the successful operator will check the incoming grain closely. You may feel that the wet holding bin is the best place to make observations.
4. Children may find that a storage bin filled with grain is an ideal place to play.

... and there are several reasons why you may not come out alive.

Why is flowing grain so dangerous? To better comprehend the hazard, the way in which most farm storage bins unload must be understood. Grain storage structures should be, and usually are, unloaded from the center. When a valve is opened in the center of the

bin or a bottom-unloading auger is started, grain flows from the top surface down a center core to the unloading port or auger. This is called “enveloping flow” and is illustrated in *Figure 1*.

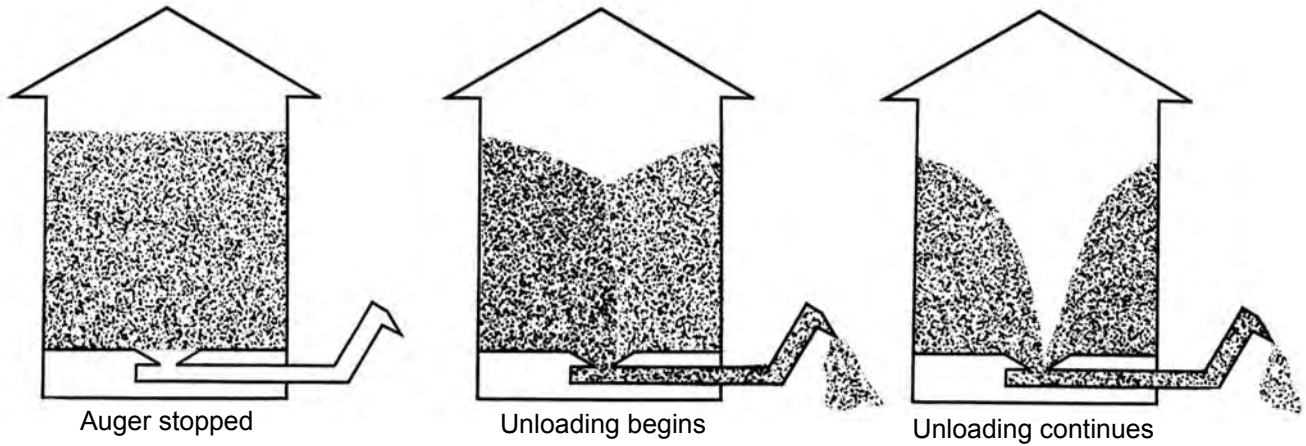


Figure 1. When bins unload, the grain at the top of the bin is removed first.

The grain across the bottom and around the sides of the bin does not move. The rate at which the grain is removed is what makes the enveloping flow so dangerous. A typical rate for a bin unloading auger is 1,000 bu/hr. This is equivalent to 1,250 cubic feet per hour or approximately 21 cubic feet per minute. A person 6’ tall displaces about 7.5 cubic feet,

assuming an average body diameter of 15 inches. This means that the entire body could be submerged in the envelope of grain in approximately 22 seconds. Even more importantly, you could be up to your knees in grain and totally helpless to free yourself in less than 5 seconds (*Figure 2*).

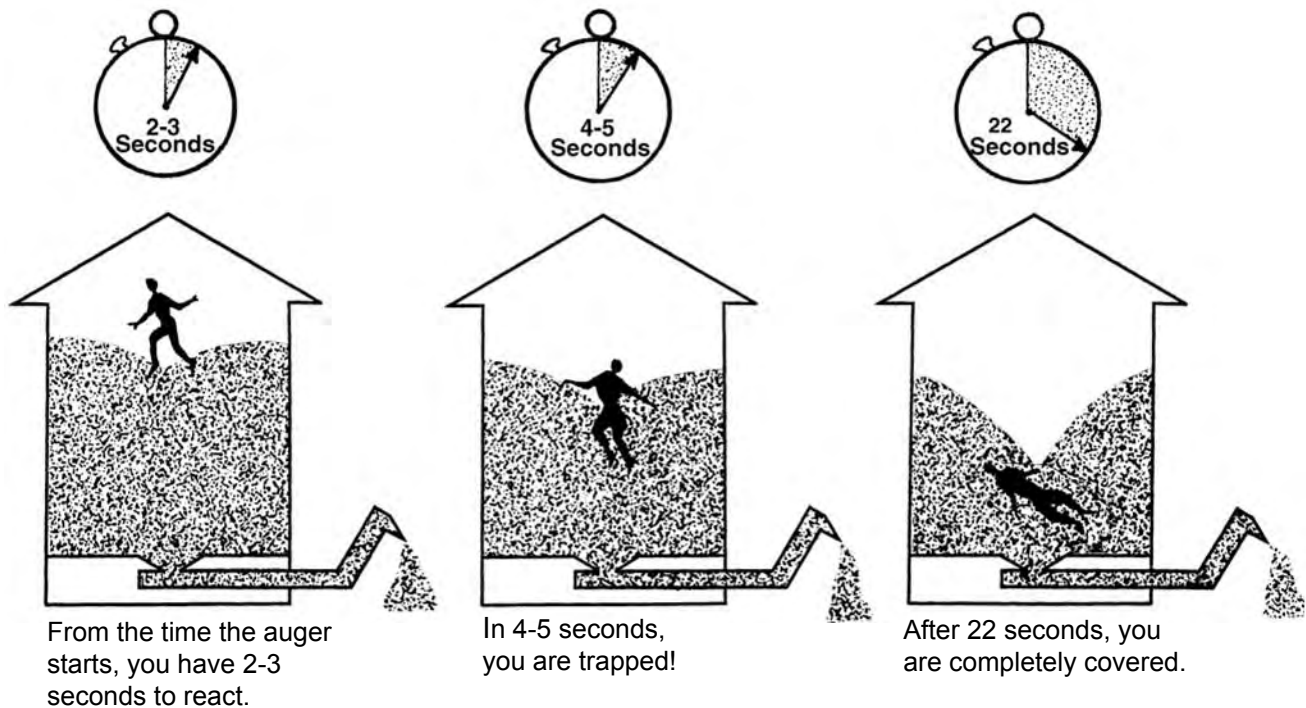


Figure 2. Twenty-two seconds to suffocation.

You must remember that flowing grain is like water in that it will exert pressure over the entire area of any object that is submerged in it. However, the amount of force required to pull someone up through grain is much greater than required in water because grain exerts no buoyant force and has much greater internal friction. People who have helped pull partially sub-

merged children from grain have commented on how hard they had to pull and, frequently, that shoes were pulled off in the grain. This may mean that rescue efforts will fail unless the movement of grain is stopped. Grain that bridges across a bin can be another hazard. Bridging grain may create air spaces in a partially unloaded bin (*Figure 3*).

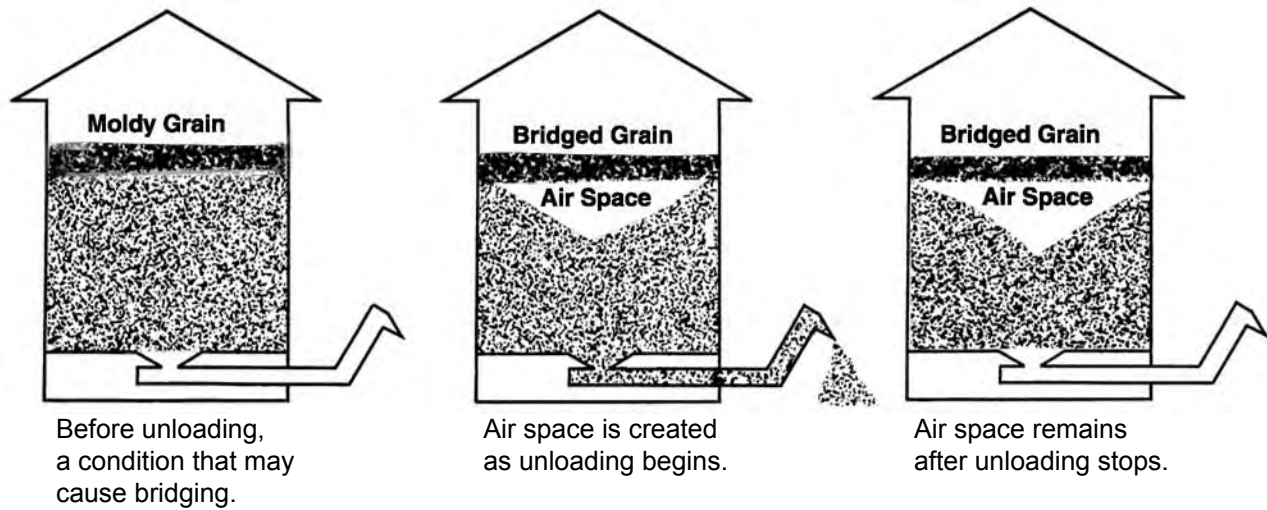


Figure 3. Potential hazard created by bridging. Note also that when the air space becomes large enough, the bin walls may buckle.

This situation presents several dangers. The first is that the person may break through the surface and be

trapped instantly in the flowing grain (*Figure 4*).

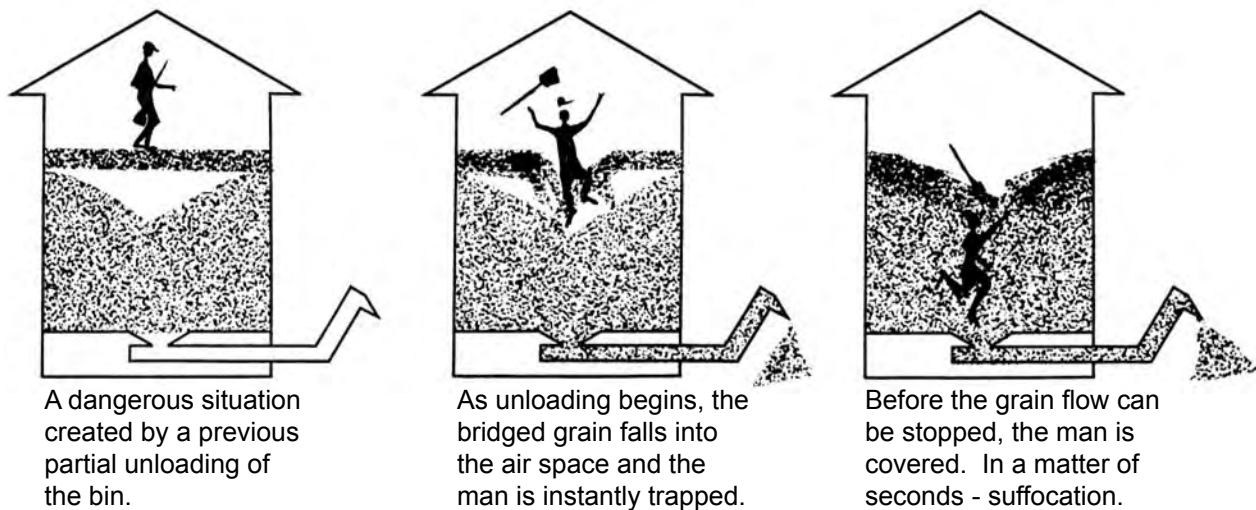


Figure 4. Two basic principles were violated. First, the person entered a bin of grain that was out of condition without seriously considering its previous unloading history. Second, he didn't ensure that unloading could NOT occur while he was inside.

Another danger is that a large void may be created under the bridged grain by previous unloading so that a person who breaks through the crust may be buried

under the grain and suffocate even though the unloading auger may not be in operation at the time (*Figure 5*).

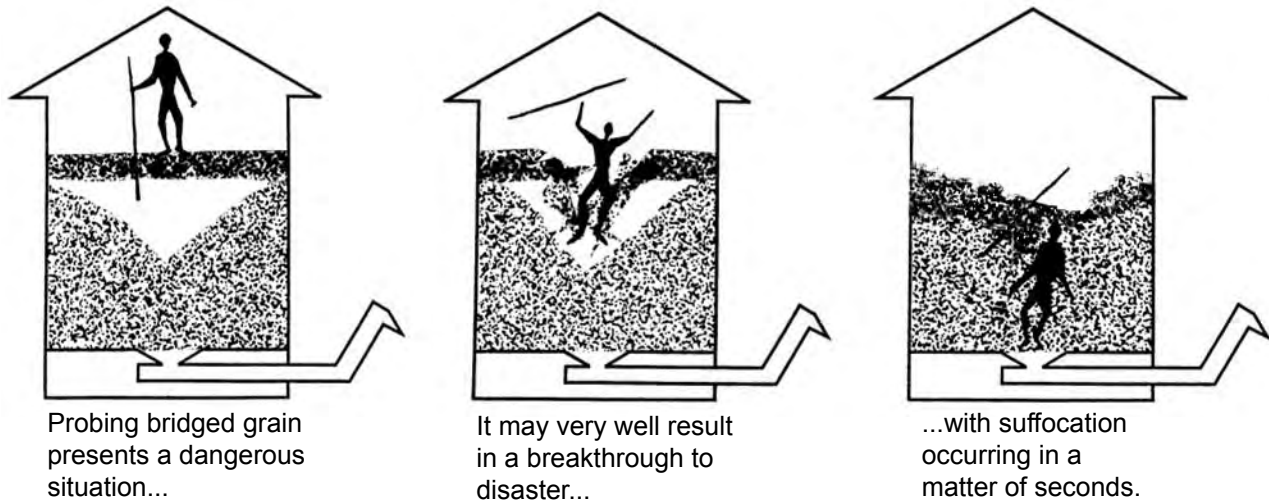


Figure 5. Bridged grain presents a danger, even when the bin is not being unloaded.

A third hazard is that, if the grain is wet enough to mold and bridge across a bin, there may be little oxygen present in the cavity because of microbial action. Therefore, a person falling into this void may be forced to breathe toxic gases and microbial spores even if the head stays above the level of the surrounding grain. Safety hazards in grain bins are not

limited to those with bottom unloading augers. Gravity unloaded bins may present a similar danger through bridging or unloading. A definite danger exists with wet holding bins that feed automatic-batch grain dryers. When the dryer completes its drying cycle and reloads, a person in the wet holding bin can be drawn below the surface of the grain in a matter of seconds (*Figure 6*).

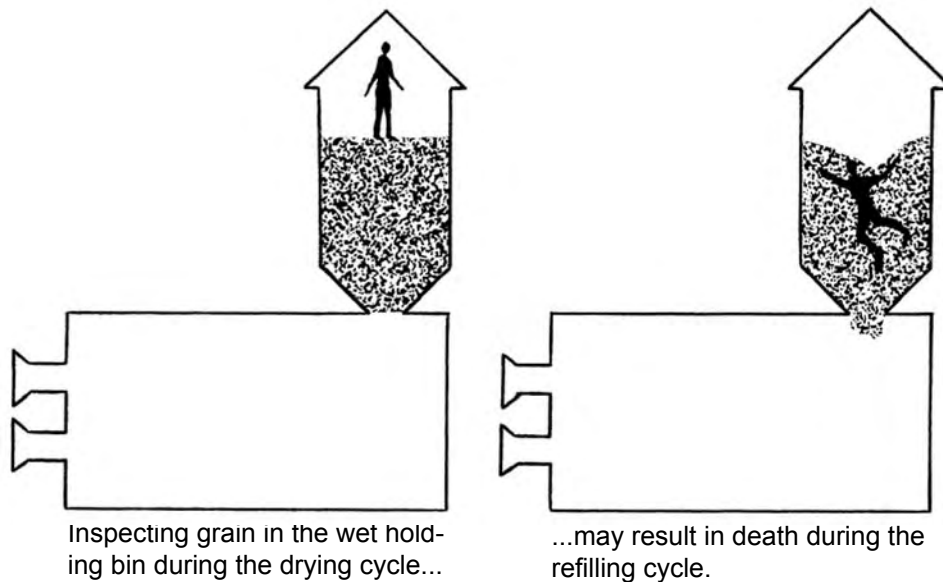


Figure 6. In a modern grain facility, bins may load or unload automatically, thereby adding to the suffocation hazard.

Flowing grain hazards, in addition to mold and dust health hazards, exist when working with grain that has gone out of condition or has built up in a tall pile. A

wall of grain may look perfectly safe, but one scoopful could pry out the “foundation” and start an avalanche or “cave-off” (*Figure 7*).

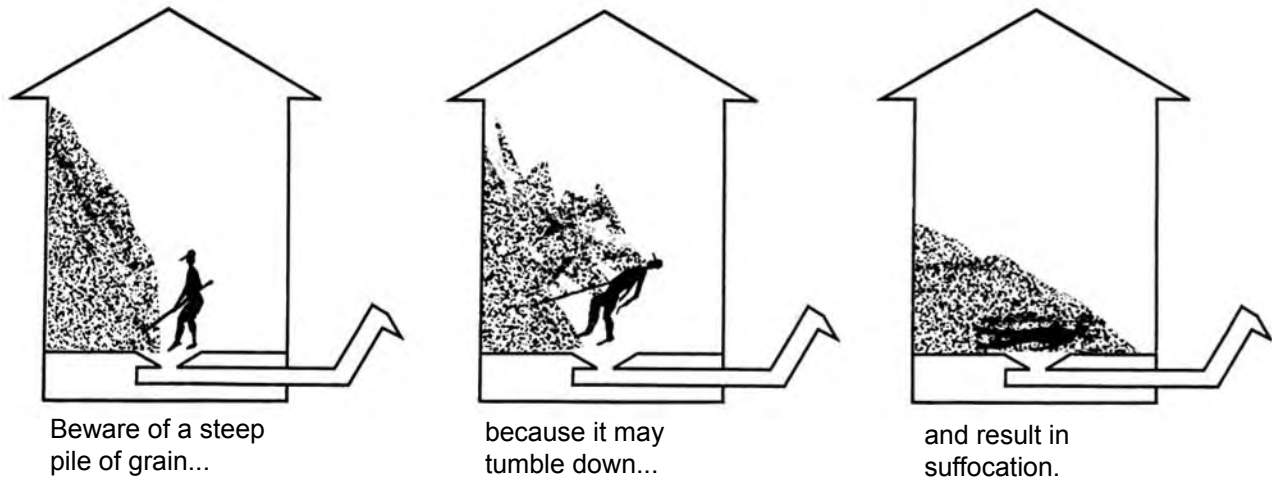


Figure 7. Beware of a tall pile of grain. A person lying prone and covered by 1 foot of grain will be subjected to a force of over 300 pounds.

Grain is heavy. For example, a 6’ tall person, prone and covered by 1 foot of corn, will be under about 300 lbs. of corn. People who hear of suffocations like this are often surprised to learn that the victim was under only a shallow pile.

body harness connected to a mechanical lifting device (hoist, block and tackle, etc.) that is secured outside the structure. Additional people should be involved - a person who can see the person inside the bin, someone who can assist in raising the inside person to safety, and someone on the ground who can quickly go for aid without the danger of falling off the bin in a panic to climb down and will ensure that no one starts the unloading equipment (*Figure 8*).

How to Reduce the Risk

Rule 1:

A person entering a grain bin should have on a full

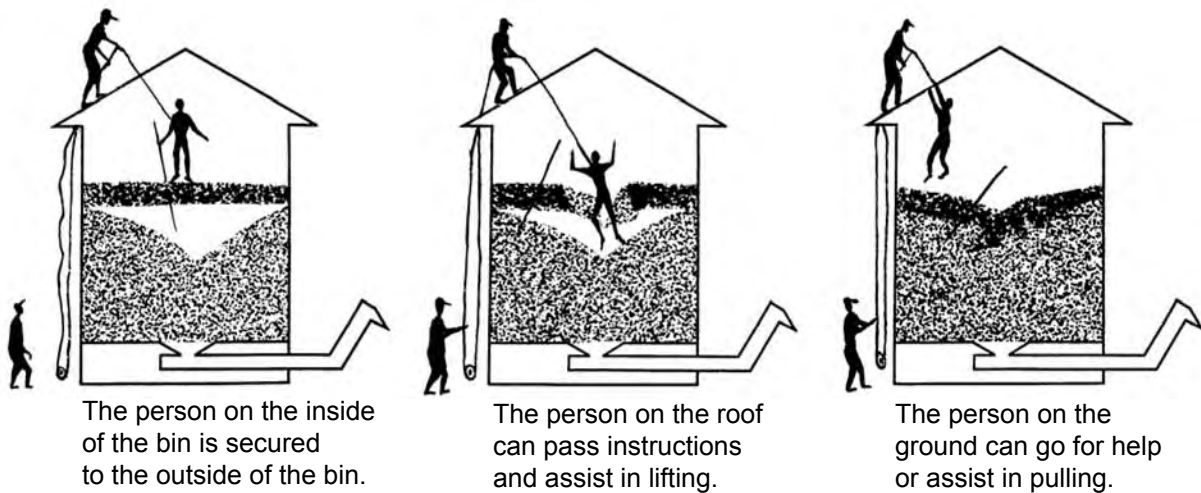


Figure 8. You should use three people when investigating a questionable bin, one inside, one in direct communication with the person inside, and one on the outside to go for help or assist in raising the person inside.

Don't depend on being able to communicate from the inside to the outside of the bin. It is difficult to hear under any circumstances, especially when unloading equipment or drying fans are in operation. The use of prearranged arm and hand signals is suggested under these conditions.

Rule 2:

Never enter a bin of flowing grain. If you drop a grain probe or shovel, first stop the flow of grain, take the precautions given in Rule 1, then retrieve the lost item. Remember, no piece of equipment is worth a human life. (**Figure 9**).

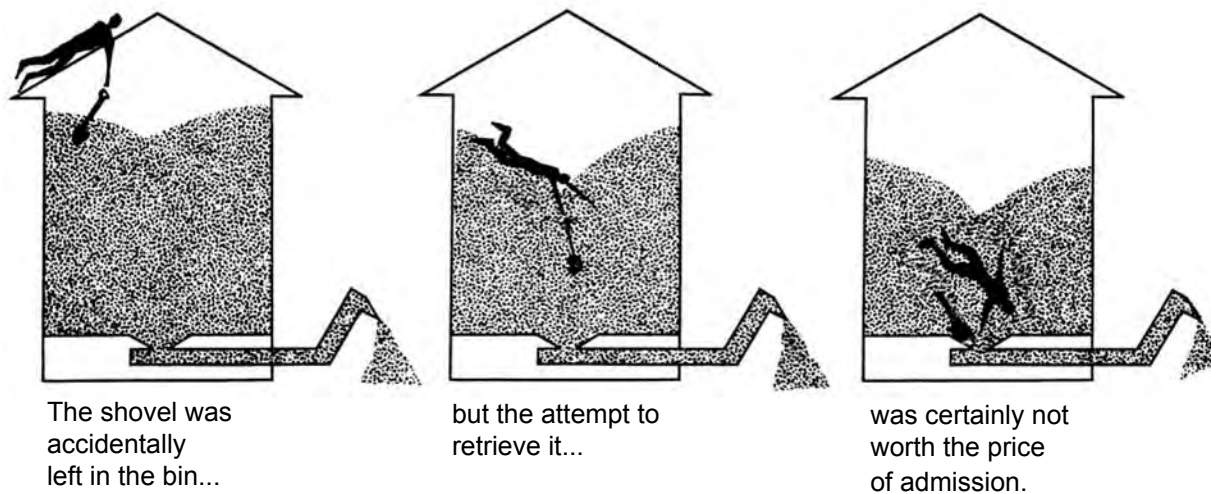


Figure 9. Never enter a bin of flowing grain for any reason. Always stop the flow of grain and “lockout” the unloading system before entering.

Rule 3:

Don't enter a bin without knowing its previous unloading history. This is especially true if the surface appears crusty, because that may mean that the grain has bridged. Always be cautious before walking on any surface crust. If the bin has been out of condition, the air must be tested for oxygen content and the presence of combustibles, gases, vapors, and toxic agents in the atmosphere. Before and during the time the employees are inside the grain bin, there shall be continuous natural air movement or forced air ventilation. Enter slowly and be sure to follow the procedures suggested in Rule 1. (See pages 16-19 on OSHA Requirement 1910-272 - Entry Into Grain Storage Structures.)

Rule 4:

If you feel you must enter the bin alone and the bin has unloading equipment, you should lockout the control circuit, tell someone what you are doing, and post a sign on the control switch informing other workers that you are in the bin. Otherwise, a fellow worker may start the unloading equipment with you inside. Likewise, check each bin before you begin to unload it

to be sure that no one is in the bin.

For bins that unload by gravity flow, lockout the control gate and follow the same general procedure as with bins that have unloading equipment.

Rule 5:

Be careful in any rescue attempt to avoid being pulled into the flowing grain and becoming a second accident (**Figure 10**). Likewise, be especially cautious when attempting to rescue someone who has been overcome by toxic gases or by breathing air with a reduced oxygen content. In these circumstances, it will probably be impossible for you to enter the bin and pull the individual to safety without your being overcome in the same way. To avoid placing yourself in this situation, it is imperative that the bin be well ventilated, that you enter cautiously, and that you follow the instructions given in Rule 1.

Rule 6:

Safety measures should include the installation of ladders and ropes on the inside of the bin. Note that you can possibly “walk down” a bin if you stay near the outside of the bin wall and keep moving, although

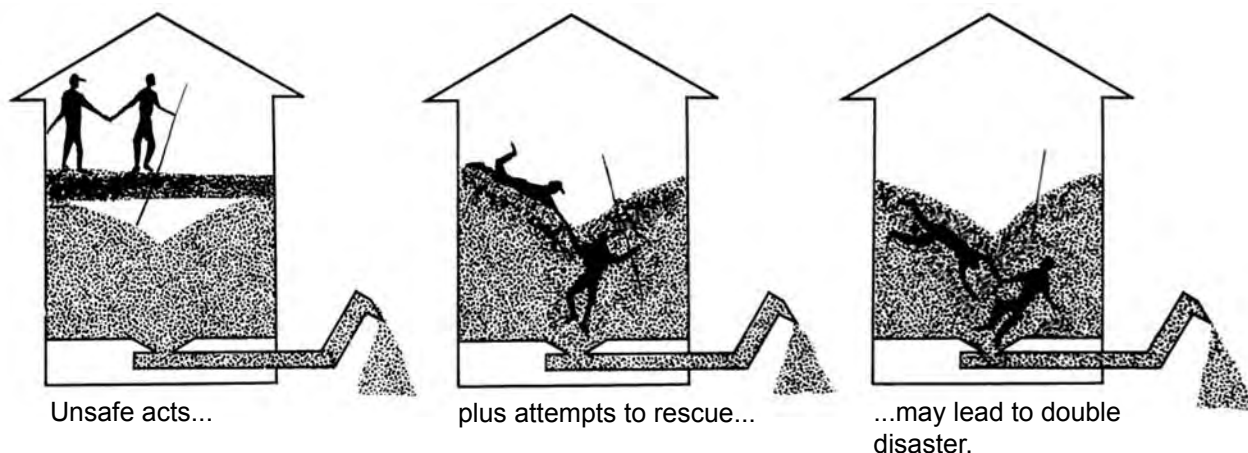


Figure 10. Take the proper precautions the first time. You may not have a second time.

walking in the soft grain will be very difficult. [OSHA prohibits the practice of "walking down grain" for the purpose of making grain flow]. However, the best preventive measure is to avoid being caught in a potentially dangerous situation by practicing the rules of safety when working with grain.

Please - Before It's Too Late

Discuss the safety hazards of flowing grain with your family, employees, or fellow workers. It is the responsibility of each of us to keep informed of possible unsafe situations and take the necessary precautions to prevent their occurrence. The dangers associated with suffocation in flowing grain are no exception.

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Originally Prepared by:

Otto J. Loewer, Jr. and David H. Loewer

Contact:

Samuel G. McNeill, Extension Specialist, Postharvest of Grain Processing, Department of Biosystems and Agricultural Engineering, University of Kentucky, Lexington.

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http://www.osha.gov/Reduction_Act/GRAINSU5.html
[Grain Handling Facilities (29 CFR 1910.272)]

Grain Bin Rescue Procedures

Rescuing a person trapped in grain is a dangerous procedure for both the rescuer and the victim. The following rescue procedures are for someone who has been trapped in a grain bin.

Victim is Visible

1. Shut off and lockout bin unload auger and unloading equipment.
2. Contact an emergency rescue team or fire department.
3. Ventilate the bin with an aeration system, if one is present. Do not activate a heater in front of air stream.
4. Avoid putting additional pressure on the victim. Minimize activity in the area immediately around the victim. Use a ladder, plywood, canvas tarps, or other material to distribute weight. Keep unnecessary personnel out.
5. Protect rescuers. Attach a safety harness and line to each rescuer. Use respiratory protection such as a dust mask, filter respirator, or SCBA (self-contained breathing apparatus) as required.
6. Construct a retaining wall if the surrounding grain slope is above the victim's head. Use plywood sections, sheet metal, large trash cans with the bottoms removed, or heavy cardboard cylinders to keep grain from the victim's chest area or higher. Build a self-supporting box or brace-walls to prevent collapse. You may need a series of retaining walls.
7. Remove grain from around the victim. Attach a harness to the victim to prevent further submersion in the grain, but don't try to pull the victim with a line and a harness before removing the grain as this can cause serious injury. Be careful when parts of the victim are not visible to avoid further injury.
8. Provide for the victim. Assist the victim's breathing by using oxygen or SCBA. Maintain victim's body temperature in cool or cold grain. Communicate with the victim about his/her condition and the rescue activities taking place. Plan ahead for removal of the victim from the bin with harness and hoist system.

Victim is Submerged

1. Perform steps 1 – 3 above.
2. Cut holes in the bin and drain immediately if the victim is completely submersed. Cut at least two holes on opposite sides of bins holding 5,000 to 20,000 bushels; cut three or four symmetrically spaced holes in larger bins.
3. Cut holes in "U" or "V" shape. Make a cut about 30" to 40" across between the bolt lines of a single sheet.
4. Do not cut across or near vertical or horizontal sheet joints. Locate the holes just below the feet of a partially submerged victim or as low as possible if the victim is not visible.
5. Use a cutting torch, air chisel, metal power saw, hydrocutter, tractor loader/fork truck, or drill holes and use a power hacksaw for cutting bin wall drain openings.
6. Time is life! Work as quickly as possible to drain grain from bin. Pry flaps up for high uniform grain flow from each hole. Be prepared to move grain away rapidly to maintain flow from bin.
7. Be ready with resuscitation, oxygen, and an emergency vehicle for transport to a hospital.
8. Be patient and do not give up. Victims have survived complete burial in grain for as long as two hours.

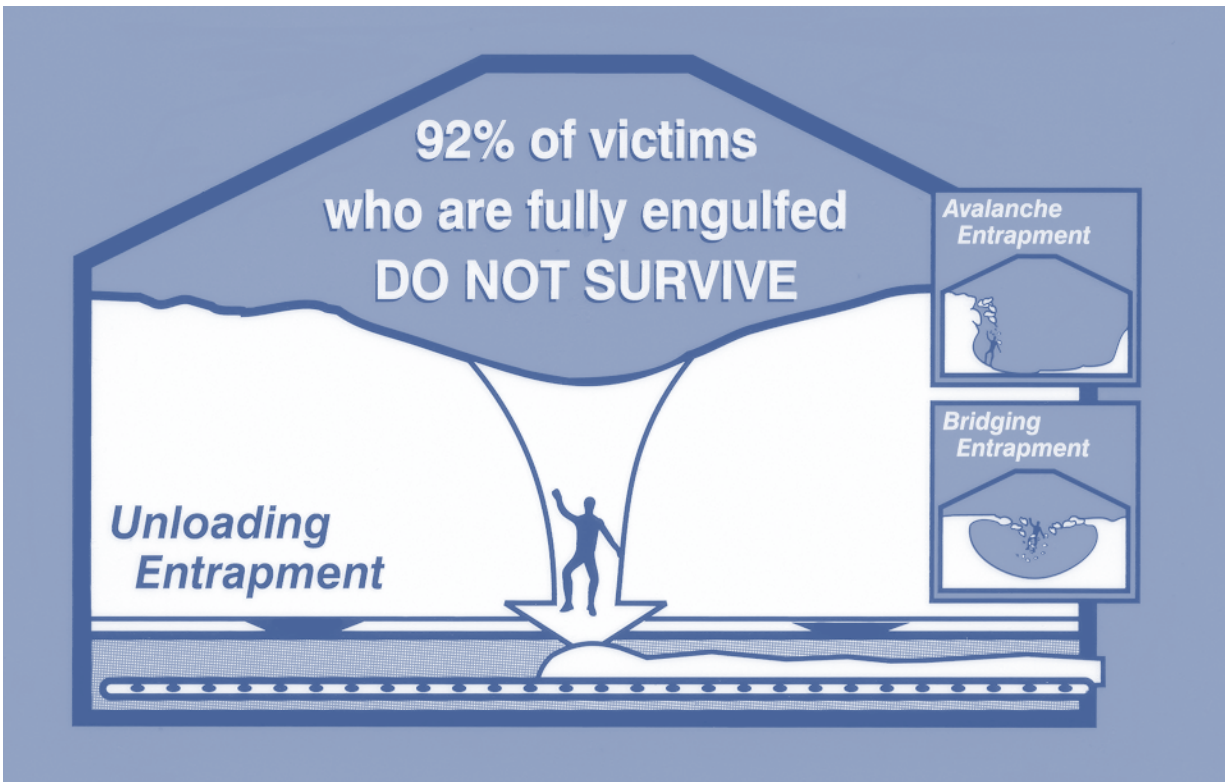
Written by Ronald Noyes, Extension Ag Engineer, and Jim Allen, Extension Engineer, Oklahoma State University, Stillwater, OK. Edited by , and reprinted with the permission of, Ronald Noyes.

If you become trapped...

in a bin of flowing grain with nothing to hold onto, but you are still able to walk, stay near the outside wall. Keep walking until the bin is empty or grain flow stops. If you are covered by flowing grain, cup your hands over your mouth and take short breaths. Try to keep your arms in front of your chest to form a cavity for chest expansion so you can breathe. This may keep you alive until help arrives.

Don't Go With the Flow!

Emergency Response Steps:



1. STOP! Never rush into an entrapment situation in an attempt to rescue the victim.
2. Shut down and lockout all unloading equipment.
3. Activate local emergency fire-rescue services and plant first response personnel.
4. Turn on aeration and roof exhaust fans.
5. Assemble employees at a predetermined location.
6. Assess situation and resources.
7. Implement situation - specific action plan.

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How much do you know about suffocation hazards?

Farm operators often overlook dangers of handling grain. Test your knowledge with this quiz:

1. How long does it take for someone to become helplessly trapped in flowing grain?
 - a) less than 6 seconds
 - b) less than 60 seconds
 - c) more than 60 seconds.
2. How much physical force is required to pull out a person buried below the surface of grain?
 - a) less than 400 lbs.
 - b) 400 to 1,000 lbs.
 - c) more than 1,000 lbs.
3. Identify possible way(s) a person can suffocate in grain:
 - a) chest is constricted, breathing is difficult
 - b) grain fills lungs and air passages
 - c) lack of breathable air surrounding a person
 - d) all of the above.

Children never can ride safely in grain wagons. True or False?

Answers on next page.

Handle Your Grain Harvest With Care

Millions of bushels of grain flow safely from field to storage during harvest each year, but one person trapped in grain can stop the flow in a matter of seconds. All too often, farm workers or family members suffocate beneath the surface of grain. In Iowa, newspaper accounts show that this tragedy is repeated several times a year. Poor harvest or storage conditions can increase the risks, such as in 1993, when 10 Iowans died in grain. The real tragedy is that many of these people did not understand the potential danger of handling grain.

Seconds count in entrapments

Grain handling entrapments happen very quickly. Flowing grain can draw in a person within five seconds. That time is decreased with the use of high capacity unloading equipment such as large wagons emptied quickly with large augers or legs. As farm equipment becomes faster, humans have less time to respond before they are helpless to the effects of flowing grain. For example, a high capacity conveyor can move 5,000 bushels of grain an hour. At that rate, a 6-foot tall person would become submerged in only 15 seconds. Children are at an even greater risk around flowing grain. They are shorter and become submerged quicker than adults. They also do not have the physical strength to pull themselves out of grain before they become entrapped.

Grain traps like quicksand

A grain surface may appear solid, but it is not. A small opening in the unloading gate gives the entire surface the quality of quicksand. When a single kernel is removed from the bottom of a wagon, kernels directly above it rush to fill the void, creating a fluid motion. Flowing grain is like a fluid; objects on the surface sink, and heavy objects sink faster than light ones.

Even if grain has stopped flowing, submerged objects or people are difficult to extract. Victims with tremendous upper body strength cannot pull themselves out if they are buried to the chest. The force required to remove someone buried below the surface of grain easily can exceed 2,000 pounds, which is about the same as lifting a small car.

You can test your own strength against the force of grain. As an experiment, fill a large container such as a livestock watering trough with grain. Tie a rope to a plywood disk 2 feet in diameter, about the same diameter as a human body. Bury the disk in the grain at the bottom of the container, leaving the end of the rope above the grain surface. Then try to pull out the disk with the rope. It requires more force to pull out a 165-pound person than a wooden disk.

One devastating example of that force occurred when a man was submerged in grain up to his neck. Rescuers believed ropes would keep him from sinking farther into the grain while they emptied the rest of it from the bottom of the bin.

However, the force on the rope was so great that two men could not hold the man's head above the grain. He was buried deeper and suffocated before the grain was removed.

How suffocation occurs

Suffocation occurs in several ways during grain-handling entrapments. Investigations reveal that some victims ingest grain. During submersion, grain will flow into voids and openings, such as the mouth or nostrils. In some cases, grain has been found in the stomach, lungs, and throat of the victim.

Suffocation also occurs when the victim is no longer able to inhale air. Pressure in a grain mass can restrict a person's ability to breathe. This happens when the chest cavity and diaphragm shrinks as a person exhales, and grain quickly flows around the body, filling any areas that are voids. On the next breath, the person will have less room to expand the chest cavity and inhale air. This is similar to the way a python strangles its prey. Panic hastens the process and, as the capacity of each breath becomes smaller, the person is unable to inhale enough air to survive.

Another factor is lack of a breathable atmosphere in the grain. Typically, a person requires a specific volume of air. In a grain entrapment, grain restricts the airflow to the area surrounding the submerged person. As the person uses oxygen and exhales carbon dioxide, the air surrounding the person is depleted of its oxygen.

How to prevent accidents

The easiest way to reduce risk is to eliminate the situation. **Always** lock all access doors to grain storage structures.

Never allow children to play or ride on grain wagons or be in the work area. With these rules, children are not exposed to suffocation hazards.

Farm workers, however, must be exposed to some risks. To reduce risk, follow these guidelines:

- Lockout power to all types of grain handling equipment. Disconnect power and place locks over operating switches. This also helps discourage grain theft.
- Always use the buddy system when you are unloading or loading grain. Notify a second person where you are at all times, who can get help if needed.
- Never enter a bin when grain is caked or spoiled. Moldy, wet grain clumps and, as it is unloaded, a large air pocket may form just below the surface. This creates a grain bridge that can collapse at any time.

If someone is caught in flowing grain, there are several ways of handling the situation. The action required depends whether the person is in a wagon, grain bin, or other type of storage structure. Check other references for specific rescue procedures.

Farm workers seldom have the strength or reaction time to save themselves once they are trapped in flowing grain. However, all farm workers can recognize the dangers of flowing grain and avoid taking risks in routine tasks.

What can you do to prevent grain suffocation hazards?

The best way to prevent grain suffocation hazards is to avoid dangerous situations.

Lock access doors to grain bins; limit access to the top of grain wagons.

Instruct everyone who operates grain wagons or grain handling equipment about potential suffocation hazards.

Make a commitment to always have an extra person present when you must be in an area where there is a potential grain suffocation hazard.

Answers to quiz:

- 1) a;
- 2) c;
- 3) d;
- 4) True.

Handle Your Grain Harvest With Care

Prepared by Charles V. Schwab, extension safety specialist; Mark Hanna, extension agricultural engineer; and Laura Miller, extension communications, Iowa State University - University Extension.

Lockout/Tagout: An Essential Safety Procedure

Whenever a person enters a grain bin or structure that possesses an engulfment hazard, it is vital that lockout/tagout safety procedures are followed. When a bottom-unloading auger is started or a gravity flow gate of a grain bin has been opened, the grain will flow from the top down towards the opening. Anyone who is standing on the surface of the grain, and is not properly tied off to a lifeline, will begin to flow or “sink” with the grain. As more grain flows out of the bin, the person will continue to be pulled down, and any efforts to climb or swim out will be futile. In a short time, the person will be completely buried and begin to suffocate.

Locking out an auger or gravity flow gate will accomplish two very important things:

1. Stop the downward flow of grain; and
2. Keep the victim from being drawn into the auger or wedged into the opening.

An example of a preventable fatality:

Two workers were cleaning a wheat storage bin by using an auger to remove the grain. One worker was caught in the flowing grain created by the auger and was not able to free himself, even with the assistance of the other worker in the bin. The second worker was unable to communicate with workers outside the bin or to exit the bin in time to get help and save the trapped worker.

Any time a worker enters a storage area (bin, tank, etc.), the supply and discharge of materials must be stopped and the supply and discharge equipment must be locked.

What is lockout/tagout?

Lockout/tagout is an essential safety procedure that protects workers from injury while working on or near electrical circuits and equipment. Lockout involves applying a physical lock to the power source(s) of circuits and equipment after they have been shut off and de-energized. The source is then tagged out with an easy-to-read tag (*examples on the right*) that alerts other workers in the area that a lock has been applied.



When performing lockout/tagout on circuits and equipment, use the checklist below:

- Identify all sources of electrical energy for the equipment or circuits in question.
- Disable backup energy sources such as generators and batteries.
- Identify all shut-offs for each energy source.
- Notify all personnel that equipment and circuitry must be shut off, locked out, and tagged out. (Simply turning a switch off is NOT enough.)
- Shut off energy sources and lock switchgear in the OFF position. Each worker should apply his or her individual lock. Do not give your key to anyone.
- Test equipment and circuitry to make sure they are de-energized. This must be done by a qualified person.*
- Release stored energy by bleeding, blocking, grounding, disconnecting, restraining, or otherwise rendering safe.
- Apply a tag to alert other workers that an energy source or piece of equipment has been locked out.
- Make sure everyone is safe and accounted for before equipment and circuits are unlocked and turned back on. Note that only a qualified person* may determine when it is safe to re-energize circuits.

*OSHA defines a “qualified person” as someone who has received mandated training on the hazards and the construction and operation of equipment involved in a task.

If you would like assistance with developing a lockout/tagout program for your facility or to view sample programs, call the Loss Prevention Education Unit at (701) 328-5913 or 1-800-777-5033.

OSHA Regulations: Entry Into Grain Storage Structures

The Occupational Safety and Health Administration (OSHA) has developed a detailed standard, 29 CFR 1910.272, that covers entry into bins, silos, and storage tanks for a good reason. OSHA estimates that 15 to 20 employees each year are suffocated during storage bin and grain elevator accidents, which they suggest is a conservative estimate. The standard applies to grain elevators, feed mills, rice mills, dust pelletizing plants, dry corn mills, soybean flaking operations, and dry grinding operations of soybean. More specifically, OSHA defines a grain elevator as a facility engaged in the receipt, handling, storage, and shipment of bulk raw agricultural commodities such as corn, wheat, oats, barley, sunflower seeds, and soybeans.

The following is not the complete standard, but rather only those sections that contain requirements that either directly or indirectly relate to grain storage structure entry. The complete standard also addresses the requirements for the control of grain dust fires and explosions and other safety hazards associated with grain handling facilities.

..1910.272(d)

(d)
Emergency action plan. The employer shall develop and implement an emergency action plan meeting the requirements contained in 1910.38(a).

..1910.272(e)

(e)
Training.

(e)(1)
The employer shall provide training to employees at least annually and when changes in job assignment will expose them to new hazards. Current employees, and new employees prior to starting work, shall be trained in at least the following:

(e)(1)(i)
General safety precautions associated with the facility, including recognition and preventive measures for the hazards related to dust accumulations and common ignition sources such as smoking; and,

(e)(1)(ii)
Specific procedures and safety practices applicable to their job tasks including, but not limited to, cleaning procedures for grinding equipment, clearing procedures for choked legs, housekeeping procedures, hot work procedures, preventive maintenance procedures, and lockout/tagout procedures.

(e)(2)
Employees assigned special tasks, such as bin entry and handling of flammable or toxic substances, shall be provided training to perform these tasks safely.
Note to paragraph (e)(2): Training for an employee who enters grain storage structures includes training about engulfment and mechanical hazards and how to avoid them.

..1910.272(g)

(g)
Entry into grain storage structures. This paragraph applies to employee entry into bins, silos, tanks, and other grain storage structures. Exception: Entry through unrestricted ground level openings into flat storage structures in which there are no toxicity, flammability, oxygen-deficiency, or other atmospheric hazards is covered by paragraph (h) of this section. For the purposes of this paragraph (g), the term “grain” includes raw and processed grain and grain products in facilities within the scope of paragraph (b)(1) of this section.

(g)(1)
The following actions shall be taken before employees enter bins, silos, or tanks:

(g)(1)(i)

The employer shall issue a permit for entering bins, silos, or tanks unless the employer or the employer’s representative (who would otherwise authorize the permit) is present during the entire operation. The permit shall certify that the precautions contained in this paragraph (1910.272(g)) have been implemented prior to employees entering bins, silos, or tanks. The permit shall be kept on file until completion of the entry operations.

(g)(1)(ii)

All mechanical, electrical, hydraulic, and pneumatic equipment which presents a danger to employees inside grain storage structures shall be de-energized and shall be disconnected, locked-out and tagged, blocked-off, or otherwise prevented from operating by other equally effective means or methods.

(g)(1)(iii)

The atmosphere within a bin, silo, or tank shall be tested for the presence of combustible gases, vapors, and toxic agents when the employer has reason to believe they may be present. Additionally, the atmosphere within a bin, silo, or tank shall be tested for oxygen content unless there is continuous natural air movement or continuous forced-air ventilation before and during the period employees are inside. If the oxygen level is less than 19.5%, or if combustible gas or vapor is detected in excess of 10% of the lower flammable limit, or if toxic agents are present in excess of the ceiling values listed in Subpart Z of 29 CFR Part 1910, or if toxic agents are present in concentrations that will cause health effects which prevent employees from effecting self-rescue or communication to obtain assistance, the following provisions apply.

(g)(1)(iii)(A)

Ventilation shall be provided until the unsafe condition or conditions are eliminated, and the ventilation shall be continued as long as there is a possibility of recurrence of the unsafe condition while the bin, silo, or tank is occupied by employees.

(g)(1)(iii)(B)

If toxicity or oxygen deficiency cannot be eliminated by ventilation, employees entering the bin, silo, or tank shall wear an appropriate respirator. Respirator use shall be in accordance with the requirements of 1910.134.

(g)(1)(iv) *

“Walking down grain” and similar practices where an employee walks on grain to make it flow within or out from a grain storage structure, or where an employee is on moving grain, are prohibited.



* The focus here is to ensure that no employee is exposed to an engulfment hazard. This can be accomplished by:

- providing a harness and lifeline when the employee works atop grain deeper than waist-deep.
- ensuring that the employee works on solid structures, such as the floor, a catwalk, or platform.
- ensuring the grain being worked on is not deep enough to engulf the employee.
- prohibiting employees to work atop grain where an engulfment hazard exists.



* Flat storage is defined as a grain storage building or structure that:

- will not empty completely by gravity.
- has an unrestricted ground level opening for entry.
- must be entered to reclaim the residual grain using powered equipment or manual means.

(g)(2)

Whenever an employee enters a grain storage structure from a level at or above the level of the stored grain or grain products, or whenever an employee walks or stands on or in stored grain of a depth which poses an engulfment hazard, the employer shall equip the employee with a body harness with lifeline, or a boat-swain's chair that meets the requirements of subpart D of this part. The lifeline shall be so positioned, and of sufficient length, to prevent the employee from sinking further than waist-deep in the grain.

Exception: Where the employer can demonstrate that the protection required by this paragraph is not feasible or creates a greater hazard, the employer shall provide an alternative means of protection which is demonstrated to prevent the employee from sinking further than waist-deep in the grain.

Note to paragraph (g)(2): When the employee is standing or walking on a surface which the employer demonstrates is free from engulfment hazards, the lifeline or alternative means may be disconnected or removed.

(g)(3)

An observer, equipped to provide assistance, shall be stationed outside the bin, silo, or tank being entered by an employee. Communications (visual, voice, or signal line) shall be maintained between the observer and employee entering the bin, silo, or tank.

(g)(4)

The employer shall provide equipment for rescue operations which is specifically suited for the bin, silo, or tank being entered.

(g)(5)

The employee acting as observer shall be trained in rescue procedures, including notification methods for obtaining additional assistance.

(g)(6)

Employees shall not enter bins, silos, or tanks underneath a bridging condition, or where a buildup of grain products on the sides could fall and bury them.

..1910.272(h)

(h)*

Entry into flat storage structures. For the purposes of this paragraph (h), the term "grain" means raw and processed grain and grain products in facilities within the scope of paragraph (b)(1) of this section.

(h)(1)

Each employee who walks or stands on or in stored grain, where the depth of the grain poses an engulfment hazard, shall be equipped with a lifeline or alternative means which the employer demonstrates will prevent the employee from sinking further than waist-deep into the grain. **Note to paragraph (h)(1):** When the employee is standing or walking on a surface which the employer demonstrates is free from engulfment hazards, the lifeline or alternative means may be disconnected or removed.

(h)(2):

(h)(2)(i)

Whenever an employee walks or stands on or in stored grain or grain products of a depth which poses an engulfment hazard, all equipment which presents a danger to that employee (such as an auger or other grain transport equipment) shall be de-energized, and shall be disconnected, locked-out and tagged, blocked-off, or otherwise prevented from operating by other equally effective means or methods.

(h)(2)(ii)

“Walking down grain” and similar practices where an employee walks on grain to make it flow within or out from a grain storage structure, or where an employee is on moving grain, are prohibited.

(h)(3)

No employee shall be permitted to be either underneath a bridging condition or in any other location where an accumulation of grain on the sides or elsewhere could fall and engulf that employee.

If you have questions concerning the above regulations set forth by OSHA or would like an interpretation on a specific regulation, contact the Bismarck Area OSHA Office at 1-800-473-7419.



Grain Handling Safety On the Web

If you have ever surfed the web, you know there is an enormous amount of information out there on a wide variety of topics. Sometimes it can be overwhelming trying to find specific, reliable information on a topic such as grain handling safety. The following web sites are just a few of many that offer information on grain handling safety:

Occupational Safety and Health Administration:
www.osha.gov

National Ag Safety Database:
www.cdc.gov/niosh/nasd/nasdhome.html

NDSU Extension Service:
www.ext.nodak.edu/extpubs/safety.htm

Grainnet:
www.grainnet.com/

Grain Handling Safety Videos

Don't Go With The Flow:
Grain Entrapment (guidebook)
*National Grain and Feed Foundation
and Purdue University*

Time: 29 minutes #VIGH001

This video can make a lifetime's difference in grain operations engulfment risk and rescuing entrapped workers. Examine the most common types of grain entrapments at commercial facilities and their causes. Hazards of flowing grain are reviewed, along with effective procedures for rescuing partially and fully entrapped workers from various locations, including the base or top of a silo and flat storage structures.

Grain Elevator Orientation Safety
(guidebook)

Grain and Feed Association-Illinois

Time: 14 minutes #VIGH003

This video is geared toward making elevator employees more aware of safety issues. Topics covered include: safely dumping trucks, cleaning around dumps, explosions, emergency exit plans, bin entry, ladder safety, electrical safety, and equipment safety.

Nightmare on Mill Street
Operations / Maintenance Safety:
Grain Storage and Confined
Space Entry

NGFA and GEAPS

Time: 22 minutes #VIGH002

In true horror-film style, this video is a riveting parody that not only entertains, but helps protect employees from potential hazards when entering confined spaces. It focuses on ensuring safe entry into "permit-required" confined spaces as well as entry into grain storage bins, silos, and tanks.

Video Resource Library

The Loss Control Education Unit at WSI has over 400 videos for employers to borrow and use in their training programs. Any employer who has WSI coverage may borrow videos from our library free of charge. We do not sell any videos; however, vendor information is available upon request for those who wish to buy directly from the vendors.

All requests to borrow videos are handled on a first-come, first-serve basis. We will always do our best to fill last-minute requests, but advance scheduling substantially increases your chances of getting what you want when you want it. A waiting period may occur.

Each employer may check out two videos for a maximum period of two weeks. Borrowers must return the videos by the due date or other borrowers may be affected. A late return may mean a real loss of time and productivity to other borrowers. We provide a return label on the checkout form for your convenience. Borrowers are asked to insure the videos for \$300/video when returning to WSI. Please note: The borrower is financially responsible for any videos that are lost and/or damaged while checked out.

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To check out a video, please call the Loss Prevention Education Unit at (701) 328-3886 or 1-800-777-5033, fax your request to (701) 328-6028 Attn: Video Library, or e-mail us at wsisafety@state.nd.us.

Contact Us For More Information

Please call us at (701) 328-5913 or 1-800-777-5033 if you would like additional information on any topics covered in this publication or if you would like assistance with the following:

1. Developing safety procedures for grain bin entry;
2. Identifying engulfment hazards at your facility; or
3. Training your employees on recognizing, evaluating, and controlling engulfment hazards.

Awareness and education are vital to the prevention of grain-storage-related accidents. Please take the time to properly train and educate your employees on the hazards of grain storage.

*“The Harvest should yield life,
not take it away.”*

Dr. J. Donald Millar
Former NIOSH Director



WSI

**North Dakota Workforce
Safety & Insurance**

1600 East Century Ave Ste 1, PO Box 5585
Bismarck ND 58506-5585
(701) 328-3800 1-800-777-5033
www.WorkforceSafety.com