

# Toolbox Talks

## Entering and working in grain storage structures

### Introduction

Entering grain bin storage structures (grain bins) is one of the most hazardous activities performed by agricultural workers.

Hazards can be minimized or eliminated when workers take the time to learn about the hazards and take proper precautions to prevent accidents.

### Hazards of grain storage structure entry

There are many hazards that may be encountered when working in grain storage structures.

These are the five “E’s” of grain storage structure entry.

- **Exposure** to hazardous atmospheres. Air within the grain storage structure may contain toxic gases or vapors from fumigants, pesticides, and other chemicals that may have been applied to the product. Various gases may also be present as a result of biological activity, or there may be inadequate oxygen concentration in the air (less than 19.5%).
- **Explosion** and fire. Dust particles from food grains may form explosive concentrations in the air. These dusts may explode when an ignition source is present.
- **Entanglement.** Workers may become entangled with moving equipment—such as

sweeps, augers, and fans—within the grain bin structure.

- **Electrocution.** Employees in and around the grain storage structure may be electrocuted by defective or damaged electrical equipment, or, more commonly, by portable grain augers making contact with overhead power lines.
- **Engulfment.** By far, the most important hazard of grain storage structure entry is engulfment. This occurs when employees inside the structure are captured and “swallowed up” by the grain inside the bin. Employees can suffocate within minutes. There are three types of scenarios that lead to engulfment.

The first occurs when workers are standing on material when the auger is on. This causes material to flow downward very quickly, pulling the worker into the material. The worker is helplessly trapped within 4-5 seconds, totally engulfed in 22 seconds, and will immediately begin to suffocate.



The second type of engulfment occurs when an invisible void is created in the

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material, just under the surface of the grain. This surface may only be a few inches thick, creating a “bridging condition.” When a worker steps on what appears to be the stable surface of the material, the surface immediately collapses and the worker falls into the void, where he or she is immediately engulfed.



The third type of engulfment scenario occurs when material builds up along the interior walls of the grain storage structure and employees enter the bin to remove it from the walls. The material may then fall on the worker, engulfing him or her.



All three of these engulfment scenarios are very likely to cause fatal injuries!

## Permits

A permit must be completed prior to entering any grain storage structure. The permit has two purposes:

- To explain the required precautions for entering grain storage structures.
- To provide a method for documenting that the precautions have been taken.

A sample permit is found at the end of this tool box talk.

## Atmospheric monitoring

The atmosphere within the space should always be checked for the presence of toxic gases or vapors, and to ensure that enough Oxygen is present (at least 19.5%).

Some of the gases to be checked in grain storage structures are:

- Oxygen (O<sub>2</sub>)
- Carbon dioxide (CO<sub>2</sub>)
- Methane
- Oxides of nitrogen

An approved, properly calibrated instrument must always be used, and the results must be documented on the permit.

## Bridging and material build up conditions

Employees may not enter storage structures if bridging or material build up conditions are present.

These conditions must be eliminated prior to entry, by breaking up unsafe material with a long pole, from outside the storage structure.

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## Mechanical equipment

All mechanical hazards within the grain storage structure, such as augers, sweeps, and fans, must be turned off and locked and tagged out, or otherwise positively controlled, prior to allowing employees to enter the grain storage structure.

## Lifelines and harnesses

If employees enter the storage structure at a height at or above the surface of the material, a full body harness and lifeline, attached to a fixed point outside the grain storage structure, must be worn.

The lifeline must be positioned/rigged, and of sufficient length, to prevent the employee from sinking further than waist-deep.

The harness and lifeline are not required if the depth of the material does not pose an engulfment hazard.

**The practice of “walking down the grain” is strictly prohibited!!!!**

## Attendants and monitors

When employees are inside storage structures, an attendant must be posted outside the space. The attendant is responsible for maintaining contact with the entrant and monitoring conditions inside and outside the space.

Multiple means of communication between the attendant and the entrants should be discussed

before entry. Voice communication alone is likely to be ineffective due to noise.

The attendant also plays a critical role in emergency response and rescue. The attendant must understand emergency procedures, including how to summon help from local emergency management (fire department, etc.).

## Ignition sources

Since the airborne dusts in grain storage structures are potentially explosive, it is critical to prevent the introduction of ignition sources.

No smoking is permitted in or around the storage structure.

No hot work (welding, cutting, brazing, or any other open flame or spark-producing work) is permitted without proper precautions, including completion and approval of a hot work permit.

All electrical equipment and tools must be properly rated for hazardous/dusty environments.

## Questions

If you have questions on this topic, please contact the Office of Occupational Health and Safety at (612) 626-5008 or [uohs@umn.edu](mailto:uohs@umn.edu), or see the website at <http://www.ohs.umn.edu>.

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## APPENDIX C – PERMIT FOR ENTERING GRAIN STORAGE STRUCTURES

This permit must be completed prior to entering any grain storage structure (exception: entry into flat storage structures in which there are no toxicity, flammability, oxygen-deficiency, or other atmospheric hazards, or other hazards, do not require a permit if entry is made through unrestricted, ground level openings).

Date and time of entry:	Expiration date and time (One shift max.)
Storage structure to be entered:	Reason for entry:
Name(s) of entrant(s):	Name(s) of attendant(s):

### Rules for grain storage structure entry:

All mechanical, electrical, hydraulic, and pneumatic equipment locked and tagged out or otherwise positively controlled (shutting of switches is not positive control).	<input type="checkbox"/> Done Init. _____
Prior to entry, the space is visually inspected from the outside to identify hazards within the space, such as bridging, or material buildup. Entry is not permitted if present.	<input type="checkbox"/> Done Init. _____
Atmospheric testing, including flammable, toxic, Oxygen deficiency, etc. must be conducted if there is reason to believe that hazardous atmospheres are possible. If hazardous atmospheres are detected, continuous forced air ventilation must be provided until the hazardous atmosphere is eliminated and there is no possibility of reoccurrence. Initial and continuous readings must be recorded at end of this form.	<input type="checkbox"/> Not req.d Init. _____ <input type="checkbox"/> Done Init. _____
Workers are reminded that "Walking down grain" and similar practices are prohibited.	<input type="checkbox"/> Done Init. _____
Body harness and lifeline or approved boatswain's chair provided if entrant enters a structure from a level at or above the level of the stored material, or when an employee walks or stands on or in stored grain of a depth which poses an engulfment hazard.	<input type="checkbox"/> Done Init. _____
Attendant is stationed outside the space, and communications (visual, voice, or signal line) are maintained between the attendant and employees within the space, and between attendant and emergency responders.	<input type="checkbox"/> Done Init. _____
Equipment for rescue operations provided?	<input type="checkbox"/> Done Init. _____
Attendant is trained in rescue procedures, including notification methods for obtaining additional assistance.	<input type="checkbox"/> Done Init. _____

### Initial pre-entry atmospheric check

Person conducting test	Time	To be measured:	Acceptable range
Instrument(s) used		Oxygen (O <sub>2</sub> ): _____	19.5%-23.5%
		Hydrogen Sulfide (H <sub>2</sub> S): _____	Less than 10 ppm
		Carbon Monoxide (CO): _____	Less than 35 ppm
		Lower Explosive Limit (LEL): _____	Less than 10%
		Other _____ : _____	_____ ppm
		Other _____ : _____	_____ ppm
		Other _____ : _____	_____ ppm



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## Atmospheric monitoring during entry

		Time						
Oxygen	19.5%-23.5%							
Hydrogen Sulfide	<10 ppm							
CO	<35 ppm							
LEL	<10%							
Other								
Other								
Other								