

GRAIN BIN SAFETY

Working around grain bins presents unique, and sometimes fatal, hazards which are often overlooked even by the most seasoned farm workers. This SOP highlights hazards that are of greatest concern and guidance for minimizing those hazards.

Grain bin safety starts with maintaining grain quality in storage. With proper aeration and cooling of stored grain, workers can help prevent the formation of clumps, crusts or grain bridges that can interfere with grain flow and lead to dangerous grain bin entry.

Plan ahead for bin entry. Most grain bin accidents occur when untrained or inexperienced workers or someone in a rush enters a grain bin without following proper grain bin entry procedures. Written instructions should include: shutting off all powered equipment such as sweep augers and stirrers inside the bin, monitoring the air for potentially hazardous atmospheres and wearing a safety body harness secured to a lifeline to prevent falls or engulfment in flowing grain. It is also important to make sure that all grates and protective guards over floor openings or moving equipment are replaced before leaving the bin each time.

Develop grain bin rescue plans and post information in the area to inform first responders. Information should include: Exact street address of the bin's location. Location of any emergency shut offs for all grain-moving equipment such as augers, electricity, gas, etc. Instructions on how to turn on aeration or drying fans to push air into the grain. Location of any rescue equipment that is kept onsite.

Common Grain Bin Hazards and Safety Considerations

Hazardous Atmospheres (oxygen deficiency, toxic gases, allergens)

The atmosphere inside of a grain bin can be hazardous in a number of different ways. Microbial action (i.e., decay of grains by bacteria, growth of mold, fungi, etc.) can result in production of metabolic gases (i.e., carbon dioxide, nitric oxide, nitrogen dioxide, nitrogen tetroxide, etc.) and consumption of oxygen. Contact with mold and fungi can result in lung ailments and allergic reactions, such as Organic Dust Toxicity Syndrome (ODTS) and Farmer's Lung.

- Store only adequately dried, top-quality grain to reduce spoilage.
- Keep insect and animal infestations to a minimum.
- Regularly clean the bin and seal penetrations between uses.
- Conduct fumigation only if properly trained, and always in accordance with label directions. Observe all restricted entry requirements.

Fire/Explosion

Accumulations of grain dusts can create flammable/explosive atmospheres. Grain bin fires are often difficult to fight and result in an explosion. Grain dust explosions often have a cascading effect that causes a secondary explosion after an initial and often smaller explosion. Dust from corn, mixed grains and wheat are all considered to have strong explosive properties. Four conditions must be present for an explosion to occur. First, dusts in the atmosphere must be combustible. Secondly, particles must form a cloud exceeding the Lower Explosive Limit (LEL) concentration. Thirdly, dusts must be confined. Lastly, an ignition source must be present. Welding and the operation of a bucket elevator, which may create static electricity or sparks, are often the direct cause of an explosion.

- Make sure the ventilation system is in good working order.
- Ensure that grain dust accumulations, especially on horizontal surfaces, are kept to a minimum ($<1/8$ "") with regular cleaning, especially near ignition sources (e.g., fans, blowers, motors, etc.). Remove accumulated dusts with a vacuum. Avoid sweeping.
- Ensure that all electrical connections meet code requirements.
- Do not smoke or conduct other open flame operations when there is potential for suspended grain dusts at or above the LEL.

Falls

Working at heights in and around a grain bin poses a fall hazard.

- Steps leading to the top grain bin hatches are preferred.
- Ladders more than 20 feet high require caged steps.
- When performing tasks at elevated heights, an employee may need fall protection. See EHS SOPs, **Personal Fall Arrest Systems** and **Elevated Work Surfaces**.

Electrocution

Electrocution is an often overlooked hazard with grain bins. An auger may come into contact with overhead wires while being moved, causing the electrocution of an employee. Poles used to dislodge crusted grain can contact overhead power lines. The National Electrical Safety Code (NESC) sets standards for the location and heights of electrical supply lines and equipment around grain bins. Figure 3 shows the distance requirements between power lines and a grain bin.

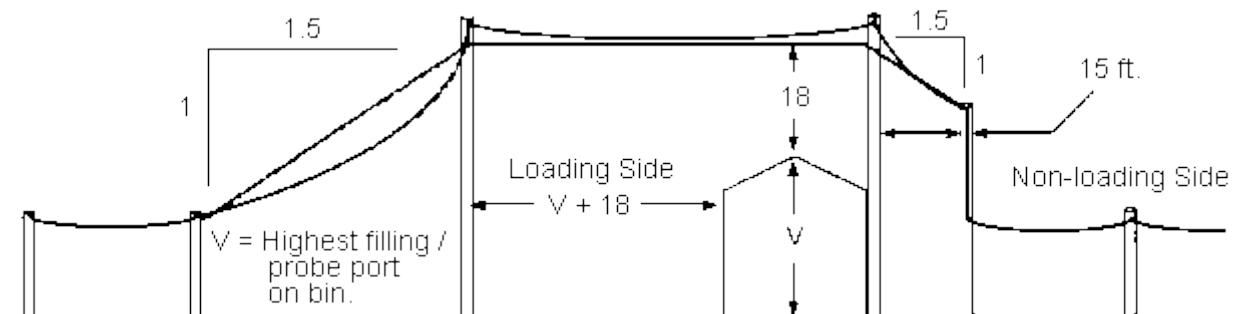


Figure 3

Entanglement

Unguarded augers, PTOs, and other moving parts present an entanglement hazard, as does the sweep auger inside the bin. To avoid these hazards, ensure that all equipment is properly guarded, covers are replaced after servicing equipment, avoid loose-fitting clothes, and do not operate the sweep auger, downward augers or stirrers while inside the bin. Consult the National Grain and Feed Association publication titled “*Guidance for Sweep Auger Operations in Grain Bins*” available on the NGFA website.

Engulfment/Entrapment

While loading and unloading operations present an obvious engulfment/entrapment hazard, stored grain is also dangerous. Air pockets or voids can shift and cause stored grain to flow. Do not enter grain bins during active loading/unloading or while grain is stored within. Entry in the presence of grain should be conducted only when there is no other alternative, and then only in conformance with the following conditions and/or procedures:

1. Grain is less than waist deep, and applicable lockout/tagout procedures have been implemented to prevent grain addition, removal, or other movement.
2. The atmosphere in the bin is not hazardous, adequate ventilation has been established, and no work to be conducted in the bin has the potential to create a hazardous atmosphere.
3. A co-worker is present outside of the bin, verbal communication is maintained, and the co-worker has a readily available means of summoning emergency responders.

If these conditions cannot be met, consult with EHS to develop appropriate entry procedures that conform to UNL’s Confined Space Entry and Lockout/Tagout Programs.

Other Safety Considerations

- Do not alter the structure. Alterations may impact the structural stability of a grain bin. Adhere to all manufacturer’s recommendations and specifications.
- Ensure adherence to the manufacturer’s base foundation and installation specifications when erecting a bin.
- Arrange for prompt evaluation of potential structural damage by a structural engineer or manufacturer’s representative.
- Observe uniform, center-filling to avoid uneven sidewall stresses.
- Observe the manufacturer’s limits on unloading rates/equipment to avoid creating a vacuum within the bin.
- Ensure that roof vents are unobstructed and operational.