

**LEARN
& LIVE**



Grain Handling Safety Coalition



DECKER

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Safe Practices For Entrapment/Engulfment Prevention!

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DCII – President

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Grain Bin Entry Safety Starts with GRAIN QUALITY MANAGEMENT

Is this a good place to be?



Two workers breaking up crusted grain

Will you let this change your life?



Don't Let This Happen Where You Work!



Safety

Prevention! – Prevention! – Prevention!
Lockout / Tagout – IS A MUST!

**DANGER**

 <p>Rotating flighting will kill or dismember.</p>	 <p>Flowing material will trap and suffocate.</p>	 <p>Crusted material will collapse and suffocate.</p>
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**Keep clear of all augers.
DO NOT ENTER this bin!**

If you must enter the bin:

1. Shut off and lock out all power.
2. Use a safety harness and safety line.
3. Station another person outside the bin.
4. Avoid the center of the bin.
5. Wear proper breathing equipment or respirator.

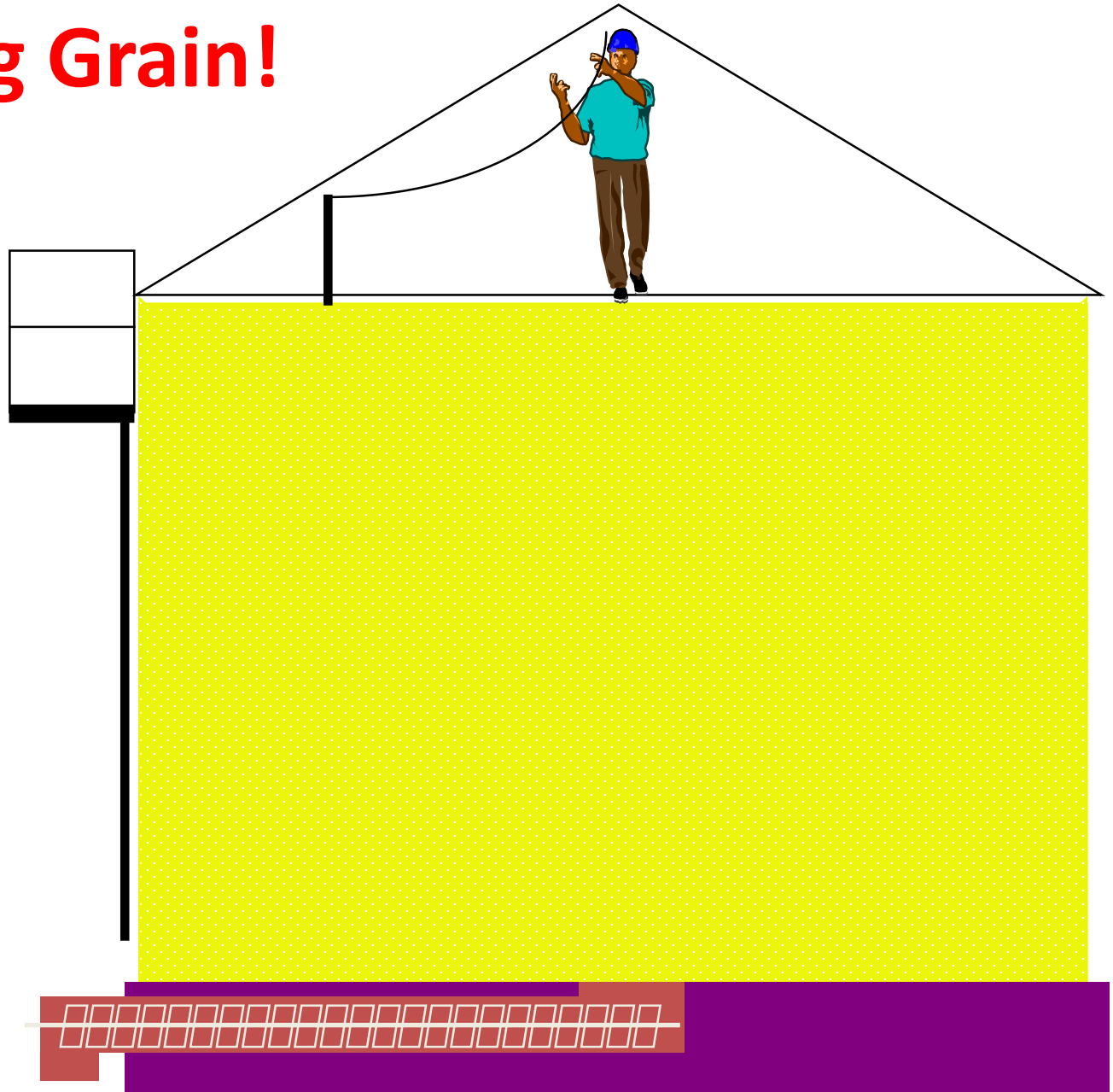
Failure to heed these warnings could result in serious injury or death

DC-GBC-1A

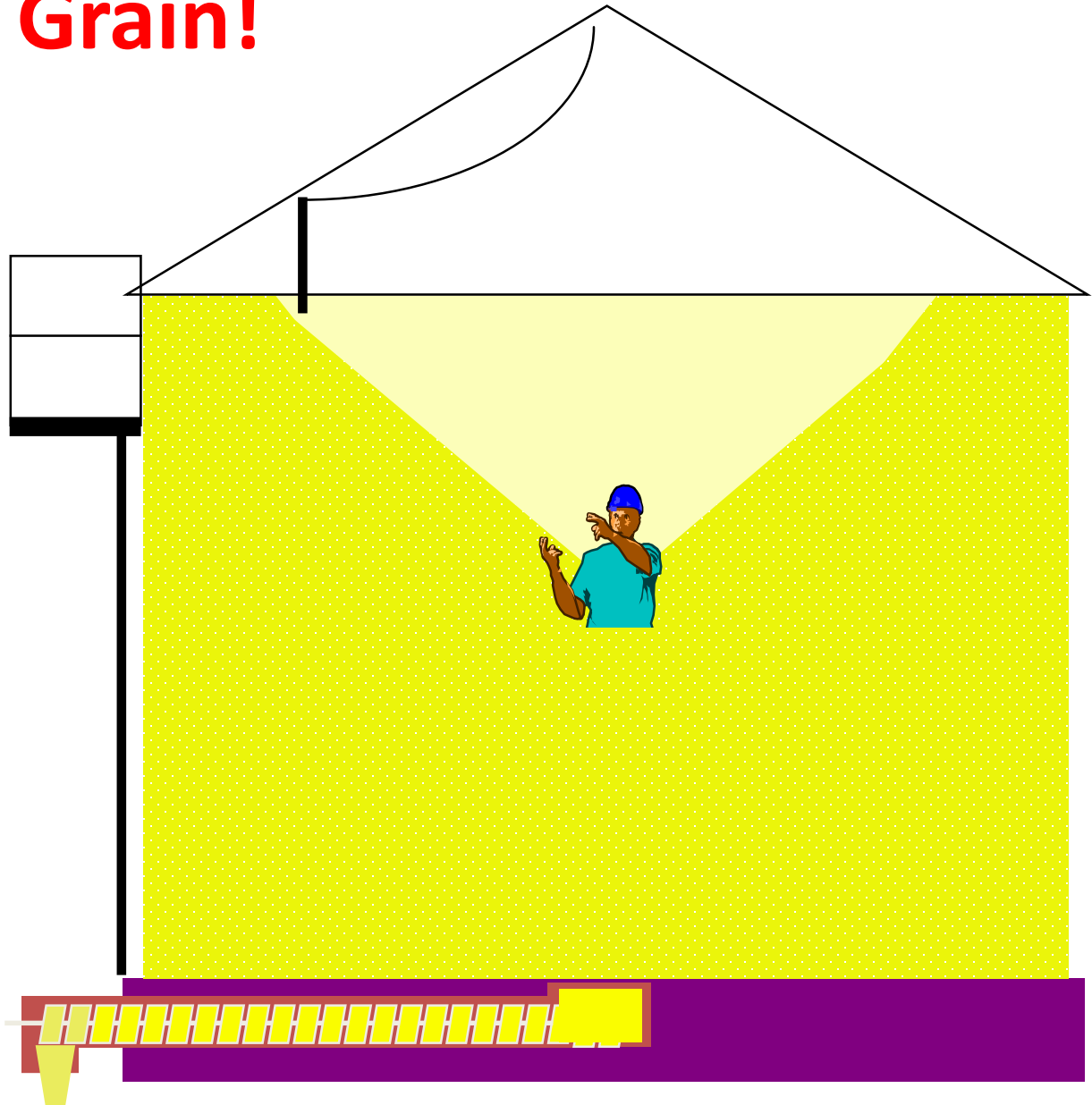
#1 Cause – Rodding With Unload Conveyor Running



Flowing Grain!

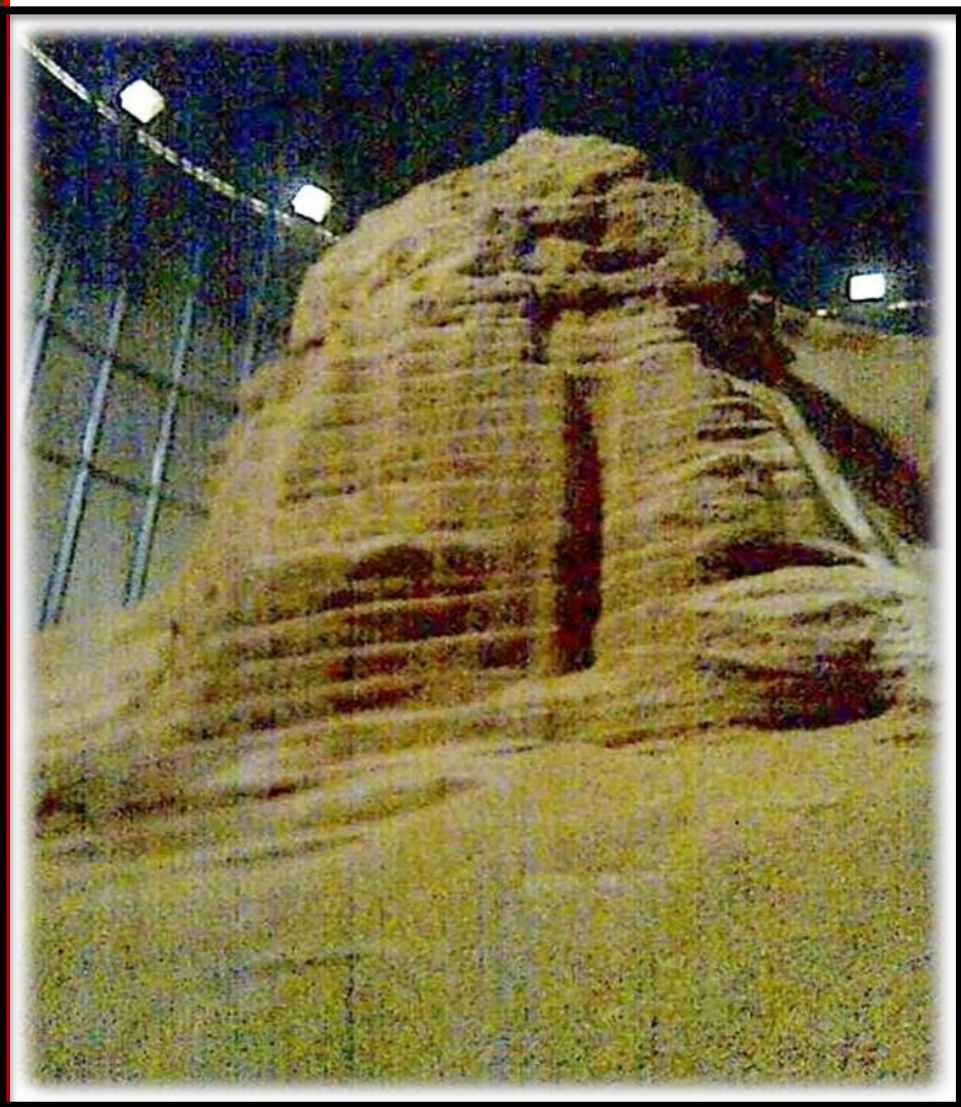


Flowing Grain!



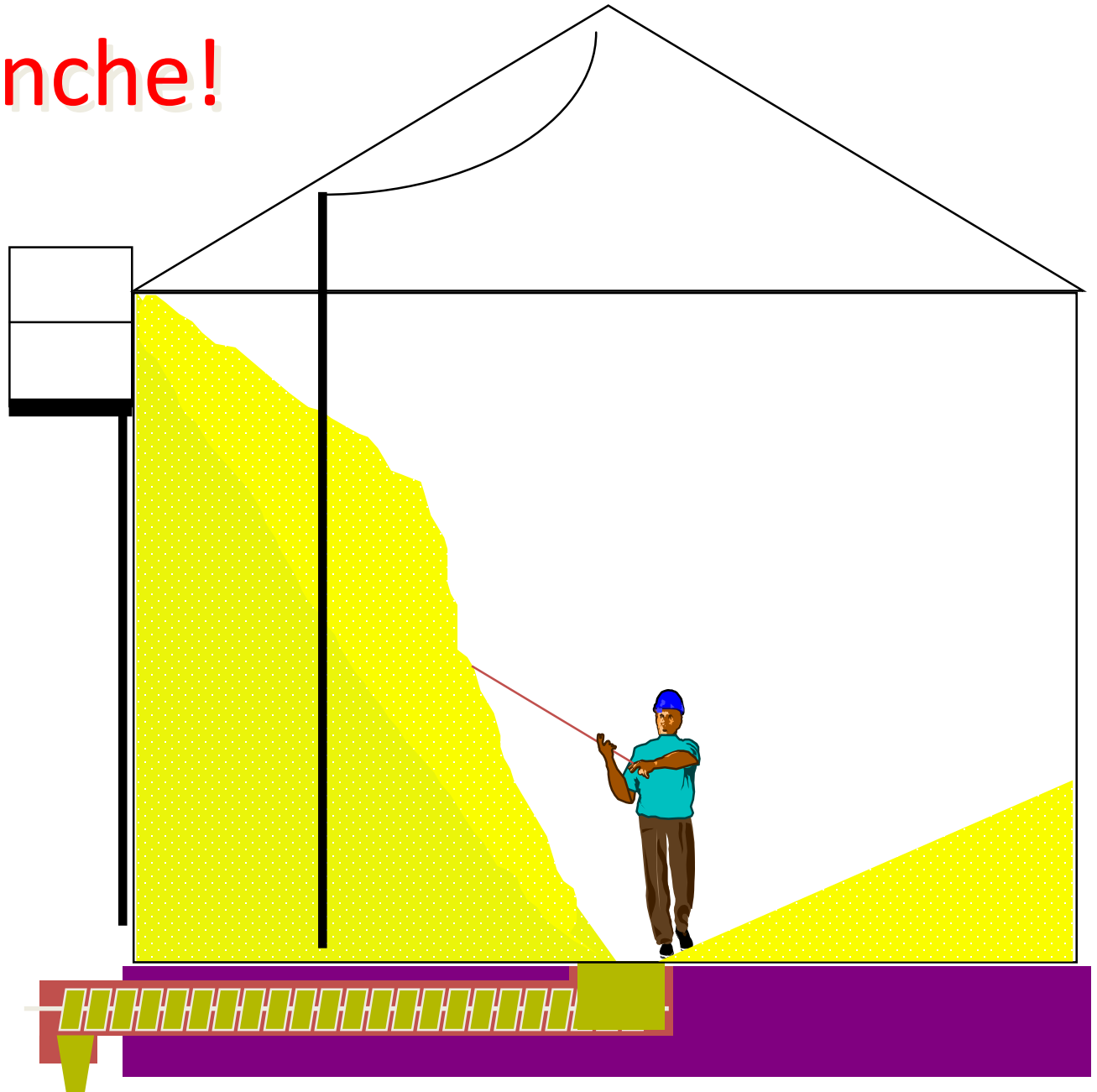


Towers/Columns
Grain

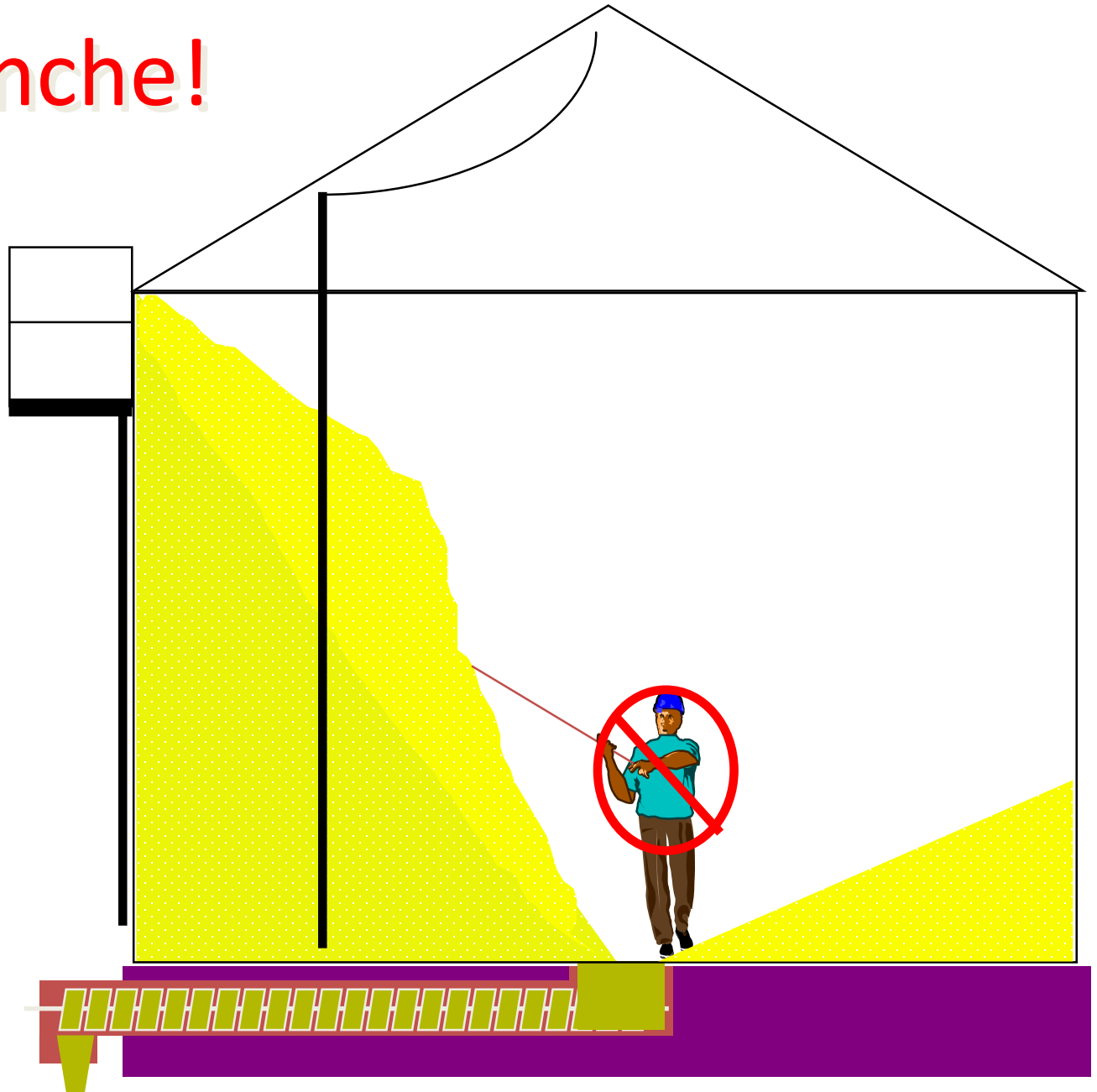


Grain Tower
(65')

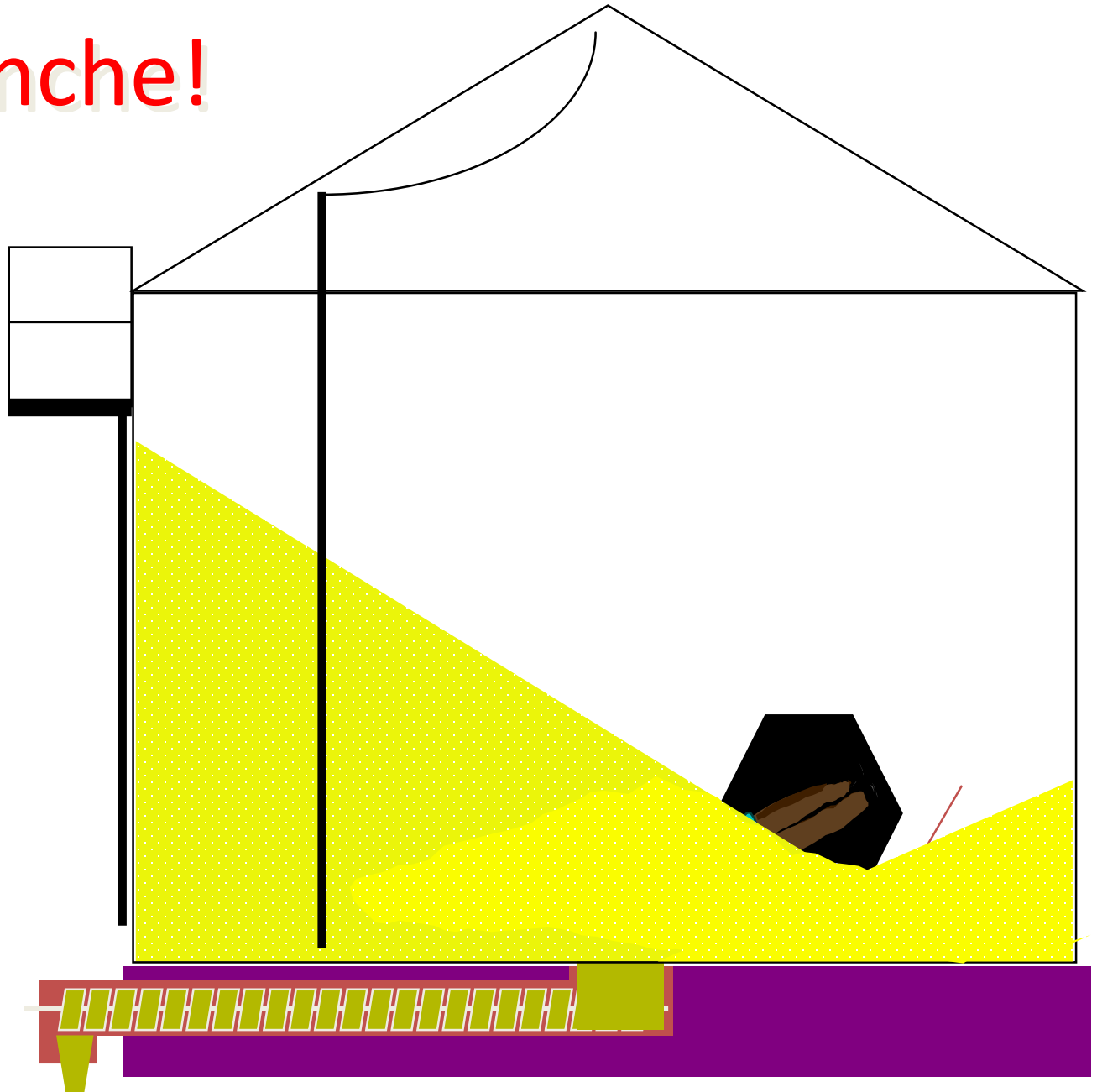
Avalanche!



Avalanche!



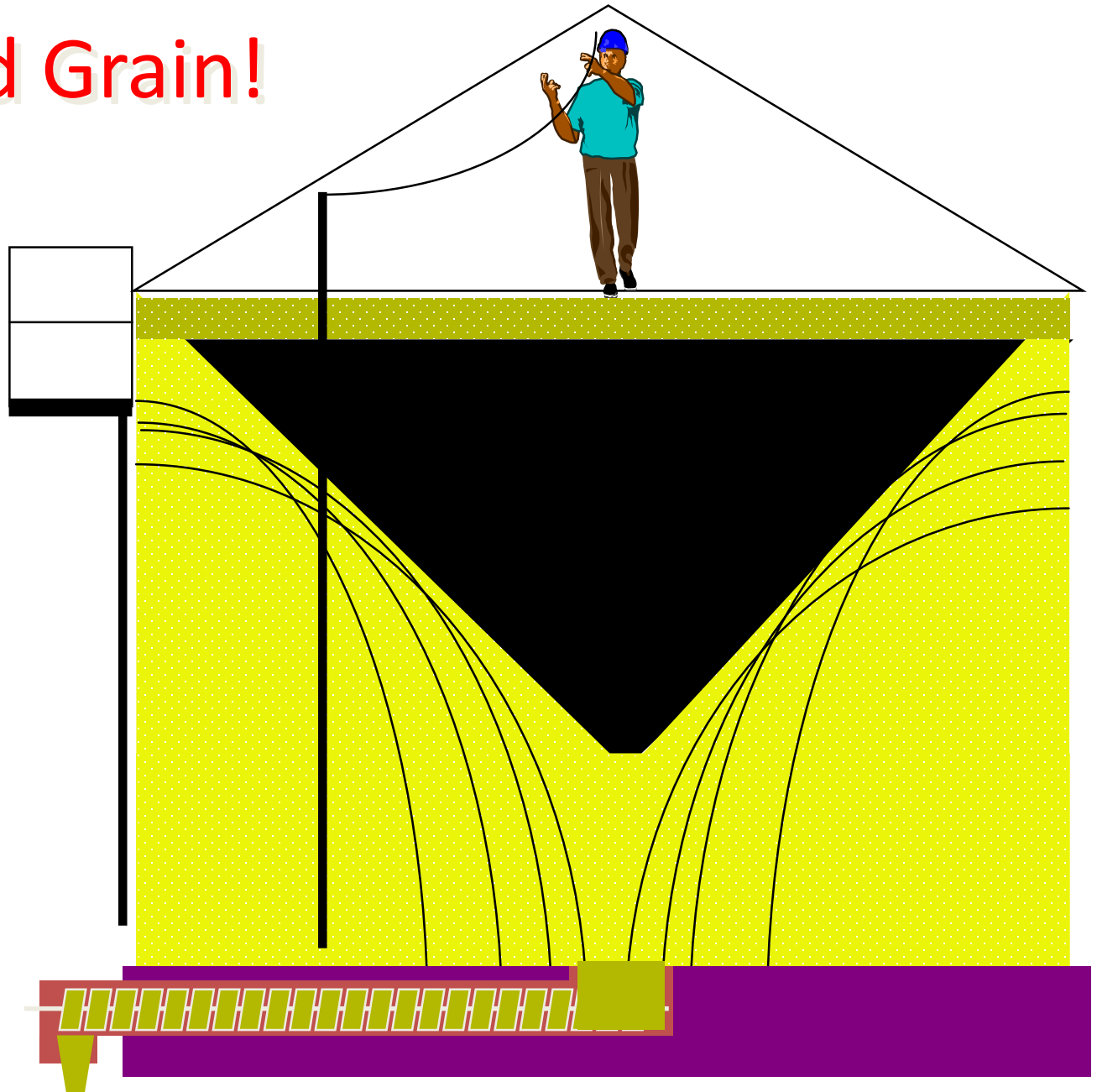
Avalanche!



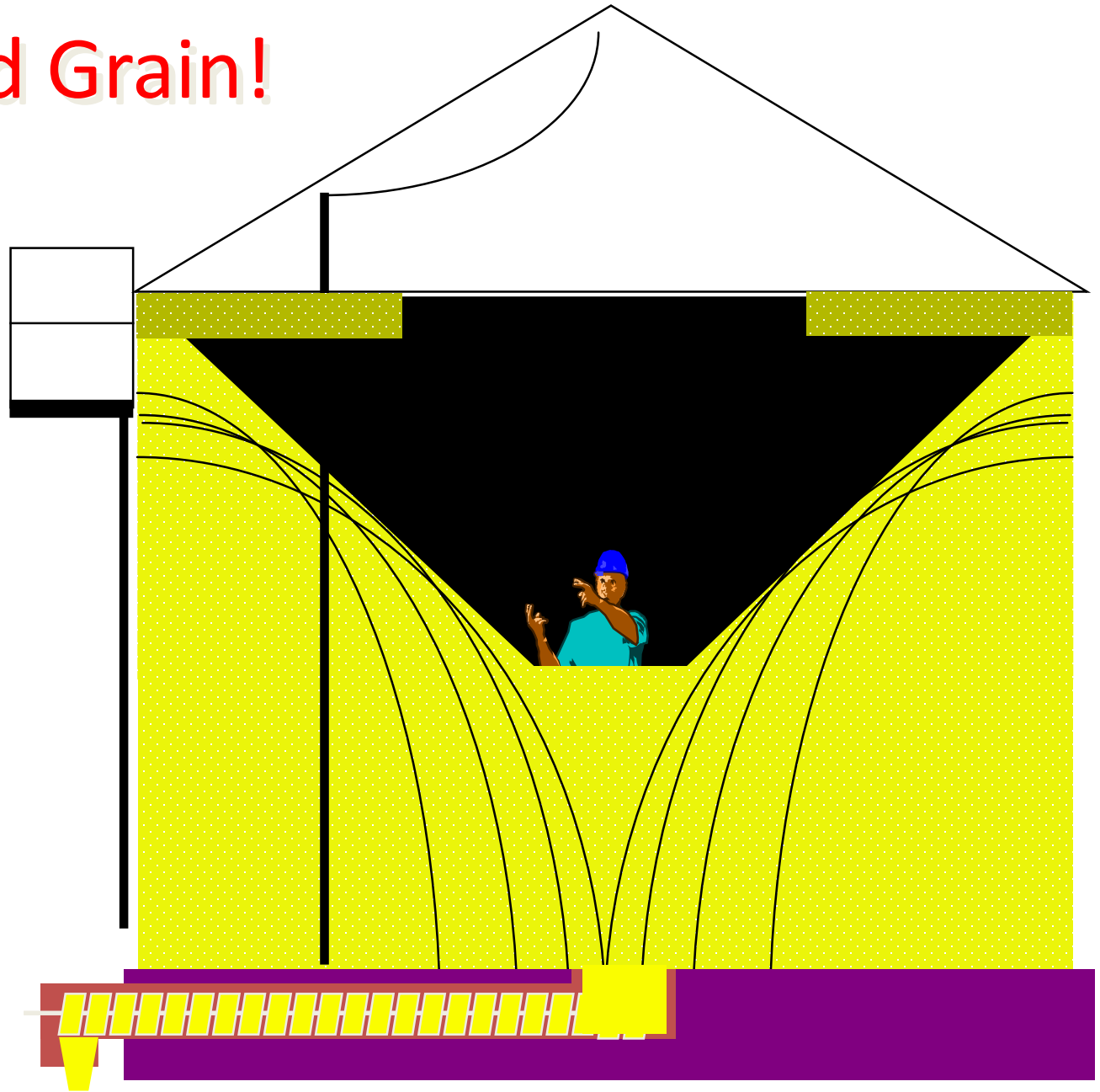
Bridging Condition



Crusted Grain!



Crusted Grain!



Rodding the Grain - SAFELY



Reclaim Tunnels

Opening for rodding grain

- Use extendable utility pole to reach/knock down grain
- Repeat as needed

Built-in Rodding Pins



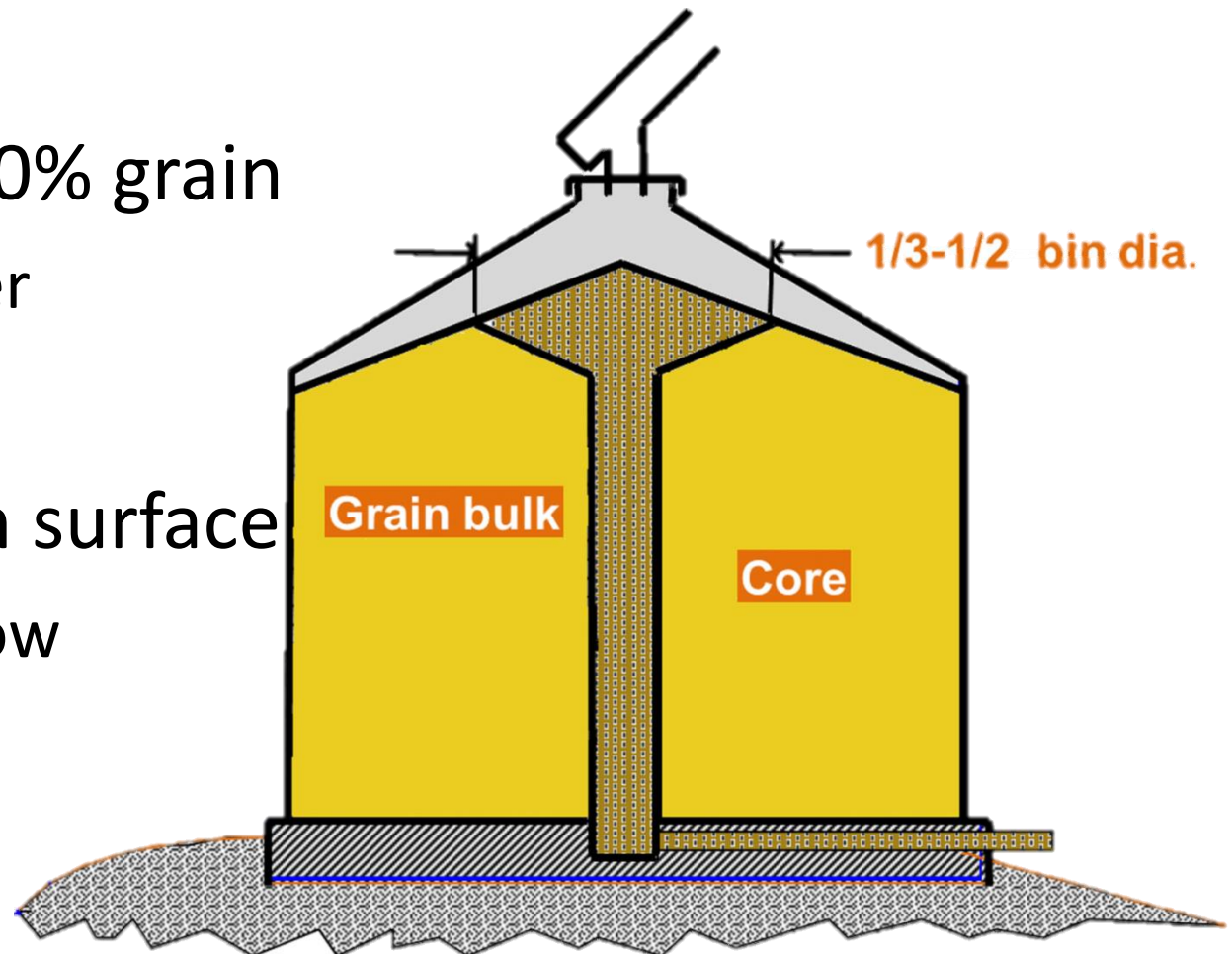
Slide gate with
rods

Sump "Fingers"



Core bin to redistribute fines

- Remove 5-10% grain
 - From center
- Add it back
- Flatten grain surface
 - Assist airflow

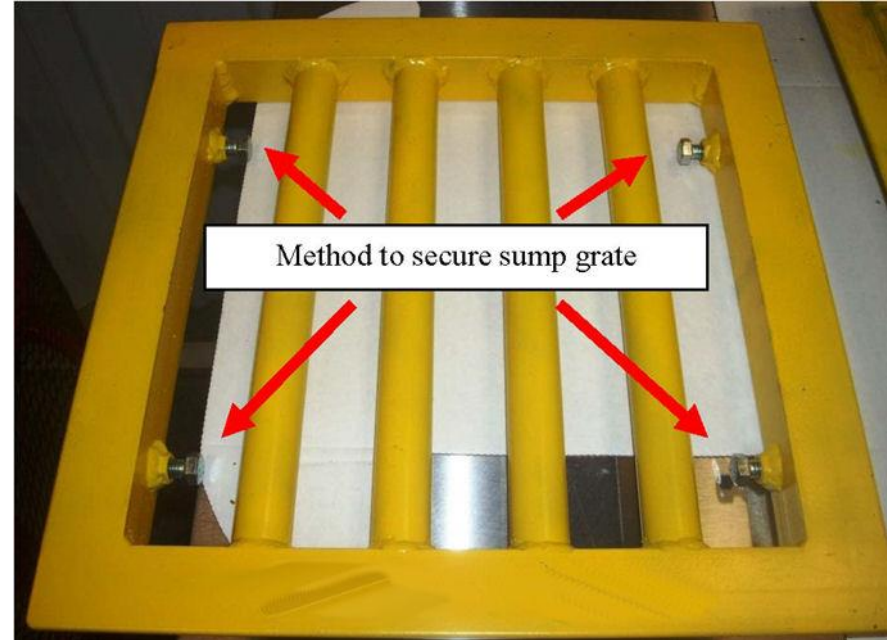




Zero-Entry Sweeps

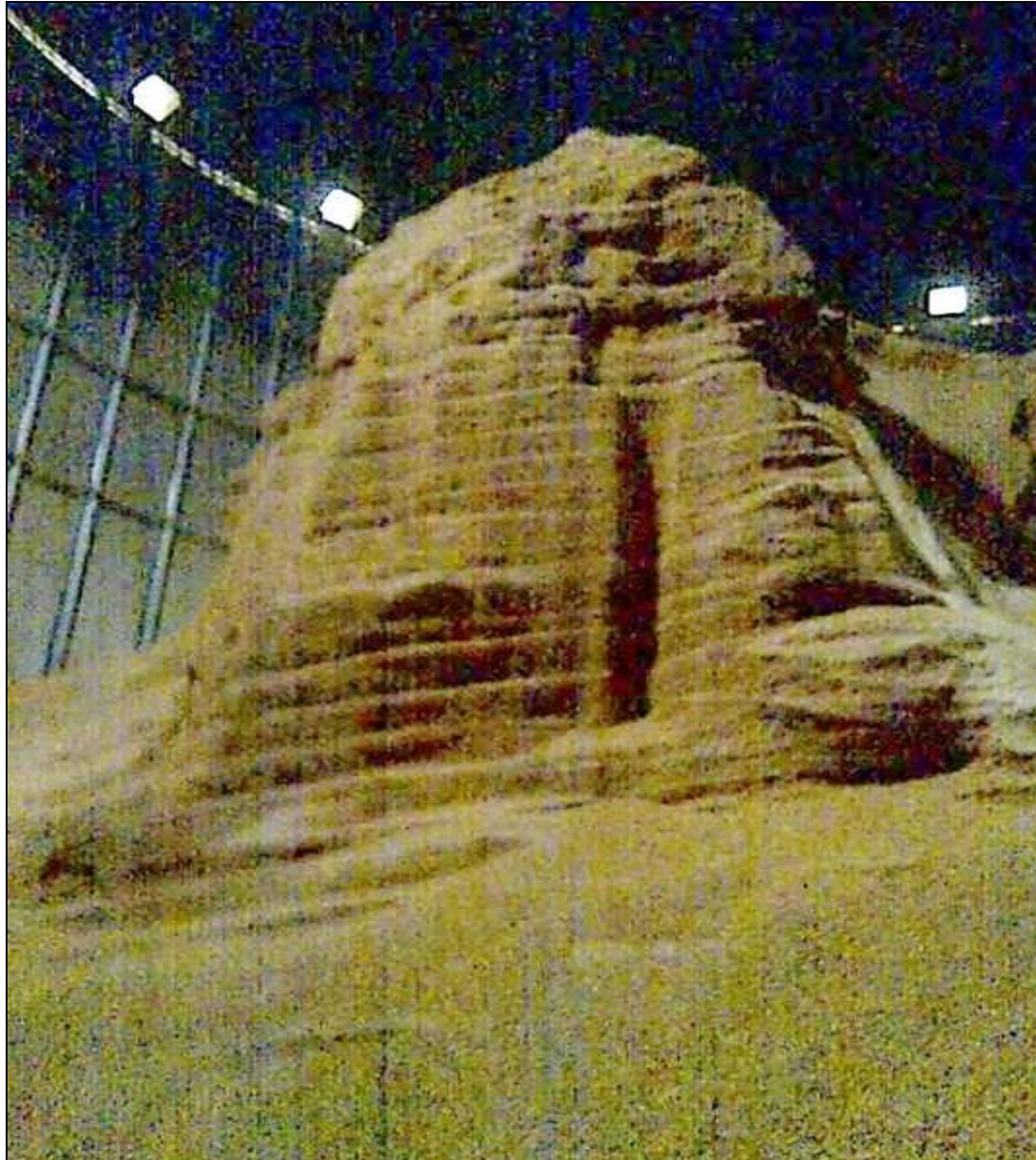


Sump/Well Guards



Custom made sump guards

Compressed air

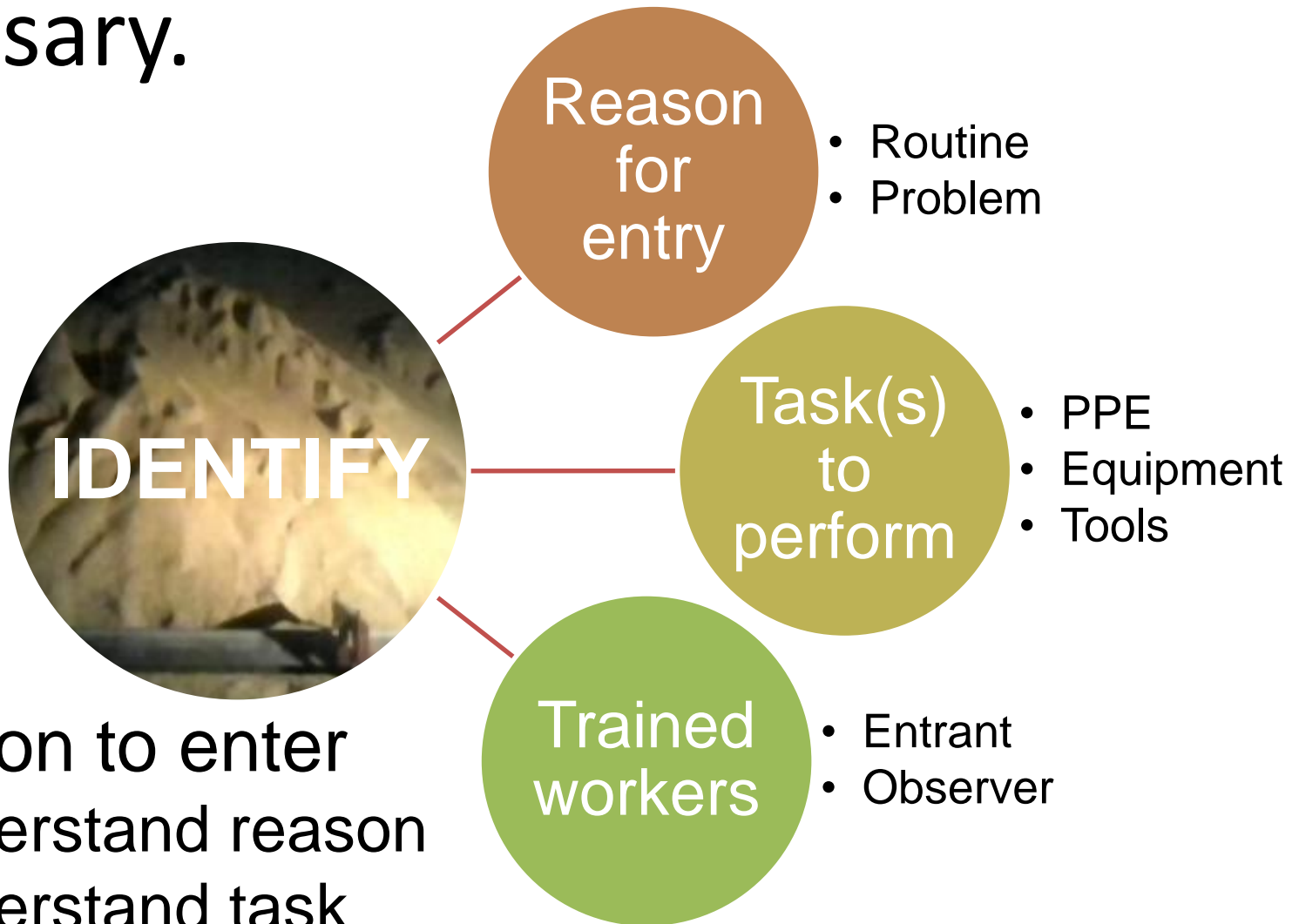


Avoiding Entry Using Grain Vac



- PPE
- Communicate to person operating
- Assess Grain Condition
- Do NOT Vac Grain From below a Person

Understand **reason** bin entry is necessary.



Decision to enter

- Understand reason
- Understand task

Identify & address **ALL** hazards.



- Entrapment & engulfment
- Atmosphere
- Entanglement
- Falls
- Electrical
- Dust

Prepare - BEFORE entry.



**Complete a Bin Entry Permit
or Checklist**

Each time – Every time!

- Understand reason for entry
- Permit or Checklist
 - Safety check
 - Provides written record
 - Commercial - when employer or management not present

Permit addresses **ALL** critical safety issues.

Bin, Silo and Tank Entry Permit and Checklist

Bin Identification: _____ Date: _____ Time: _____

Work Required: _____

This permit signifies that all safety precautions have been complied with for the job described and will be kept on file until work is completed.

**Personnel shall not enter a bin from below bridged or hung-up material!
Before entering the bin, silo or tank, complete the following checklist:**

- | | YES | N/A |
|---|-------|-------|
| 1. Lock-out and tag of conveying equipment | _____ | _____ |
| 2. Atmosphere of the bins, silo or tank: | | |
| a. Oxygen content: | | |
| (1) Oxygen level is 19.5 percent or more (determined through testing); or .. | _____ | _____ |
| (2) Ventilation (natural or forced air) provided before and during entry; or .. | _____ | _____ |
| (3) Self-contained breathing apparatus provided | _____ | _____ |
| b. Combustible gases, vapors and toxic agents - if believed to be present: | | |
| (1) Atmosphere tested for suspected gases; or | _____ | _____ |
| (2) If testing indicates: | | |
| (a) Ventilation (natural or forced air) provided before and during entry, and atmosphere monitored during entry | _____ | _____ |
| (b) Appropriate personal protection provided | _____ | _____ |
| 3. Body harness and lifeline, or boatswain's chair and lifeline provided | _____ | _____ |
| 4. Person performing entry: | | |
| a. Instructed on bin entry hazards | _____ | _____ |
| b. Trained on safety equipment operation | _____ | _____ |
| c. Trained on use of respiratory protection (if provided) | _____ | _____ |
| 5. Observer: | | |
| a. Communications provided (voice, signal line, sight, walkie talkie, other | _____ | _____ |
| b. Trained in rescue procedures | _____ | _____ |
| c. Knows how to obtain additional emergency help | _____ | _____ |
| 6. Rescue equipment available | _____ | _____ |

*Not to be signed unless all lines of the checklist have been marked.
All equipment used for this job has been checked for performance and/or defects.*

Signature _____ Signature _____
(Person entering bin) (Observer)

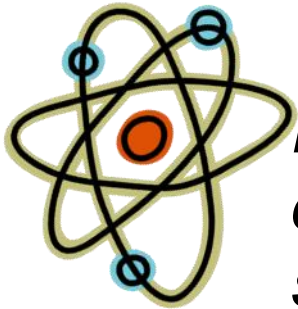
Signature _____ Completed _____
(Manager or authorized rep.) (Date & Time)

- **Hazard Assessment & Correction**
 - grain condition
- **LOTO**
- Atmosphere
- Lifeline use
- Entrant training
- Observer training & role
- Rescue Availability

LOTO - Each Time, Every Time!

Lock out/Tag out

- ALL energy sources
- All equipment
 - Fill/empty bin
- Control energy
 - Prevent unexpected start-up

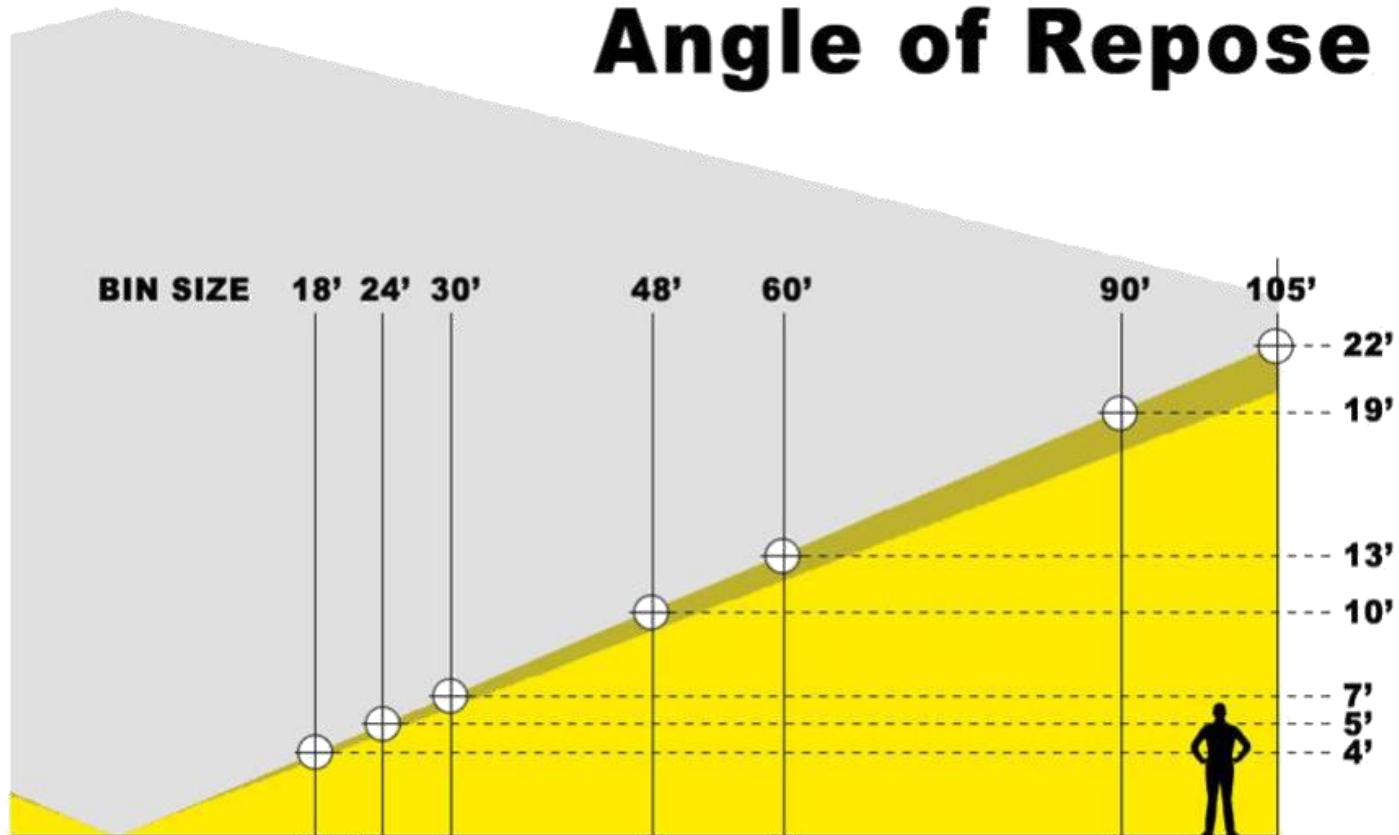


Electrical, mechanical, hydraulic, pneumatic, chemical, thermal, gravitational, kinetic, stored/residual, others

Use LOTO Standard for Policy, Program, Procedures



Angle of Repose



CORN 21° to 23°

Bad atmosphere can be fatal.

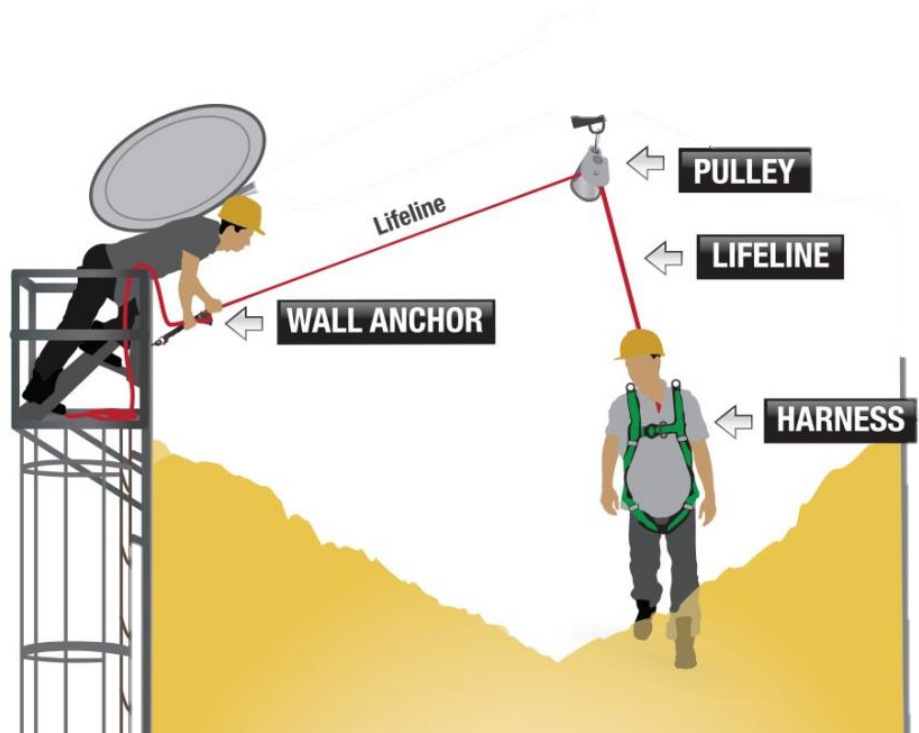
Atmosphere

- Oxygen Normal 20.9%
 - Minimum 19.5%; Maximum 23.5%
- CO2 displaces Oxygen
 - Engine Exhaust
 - Fermented/Spoiled grain
- Toxic gases – Fumigation
- Test if potential exists.
- Ventilate or continuous ventilation as needed.

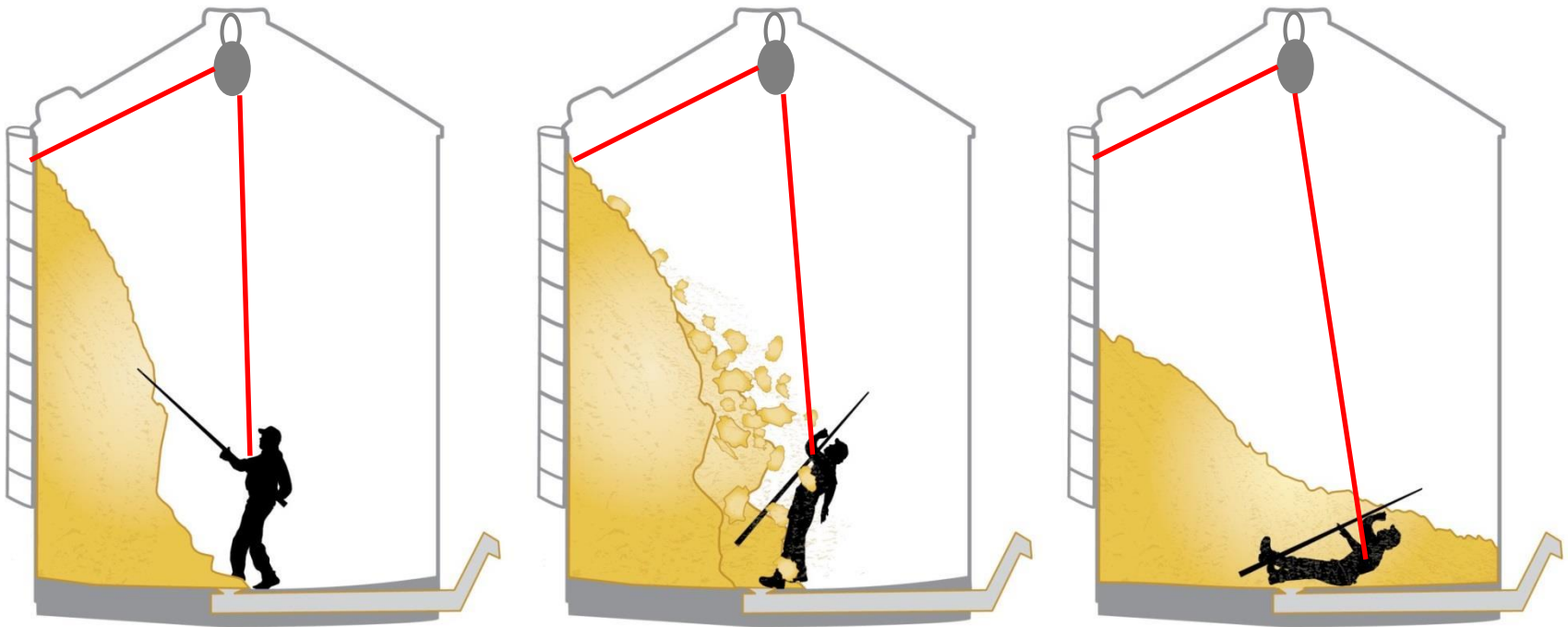


Lifeline must be secured.

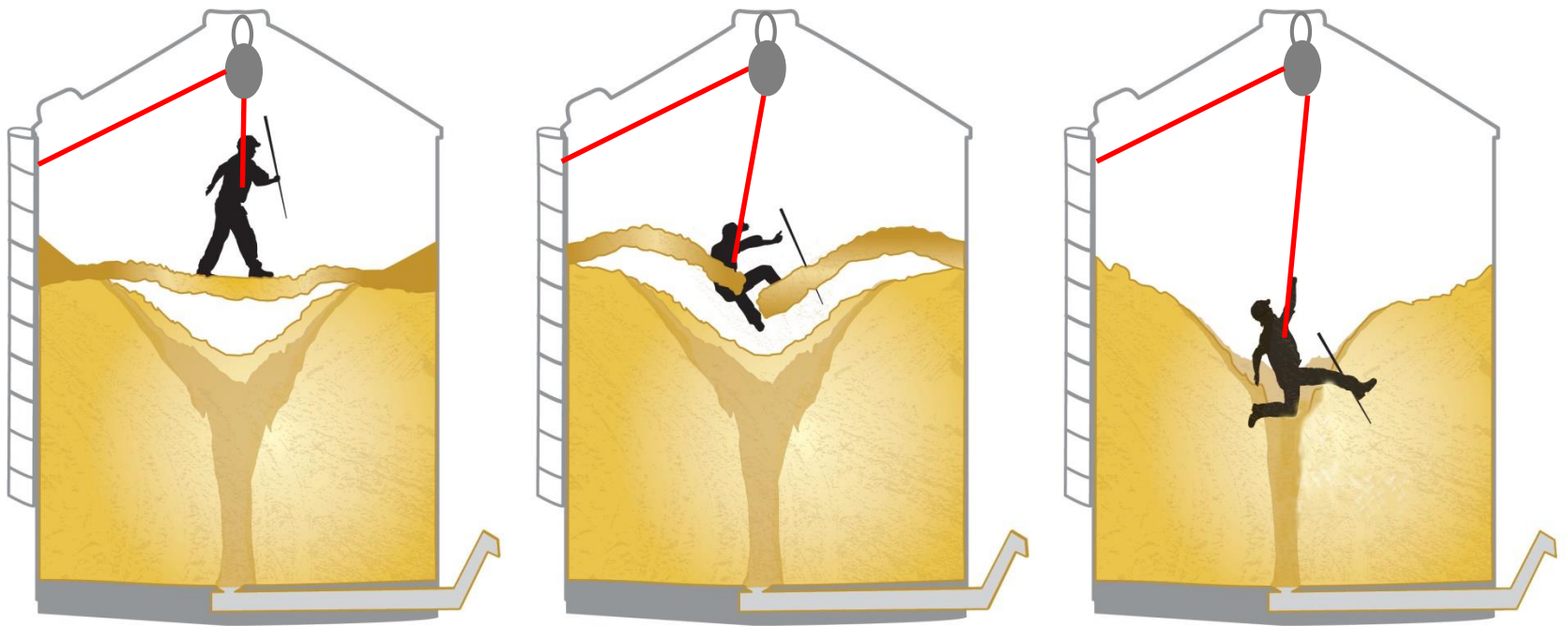
Holding lifeline or tying lifeline to bin is
NOT effective & does NOT protect.



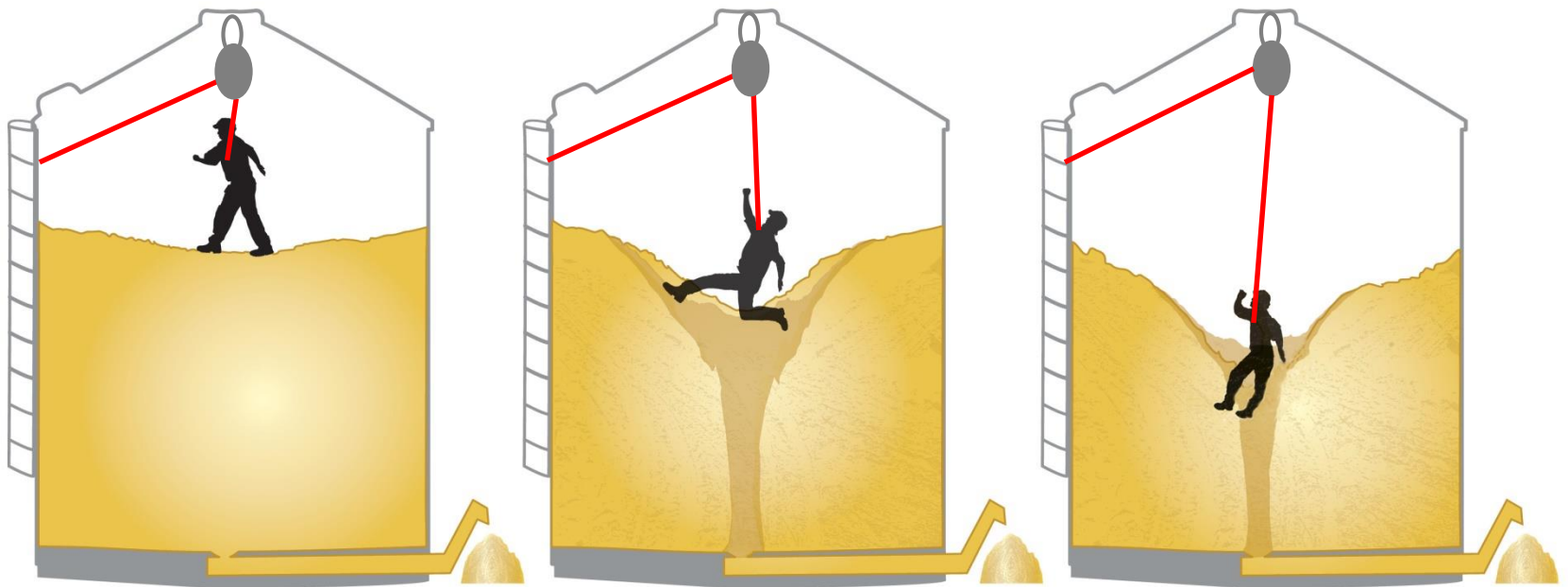
- Anchor Points
 - Top
 - Side
- Slack Control
 - Observer manages
 - Mechanical device



Ineffective protection when worker is below the level of the grain.

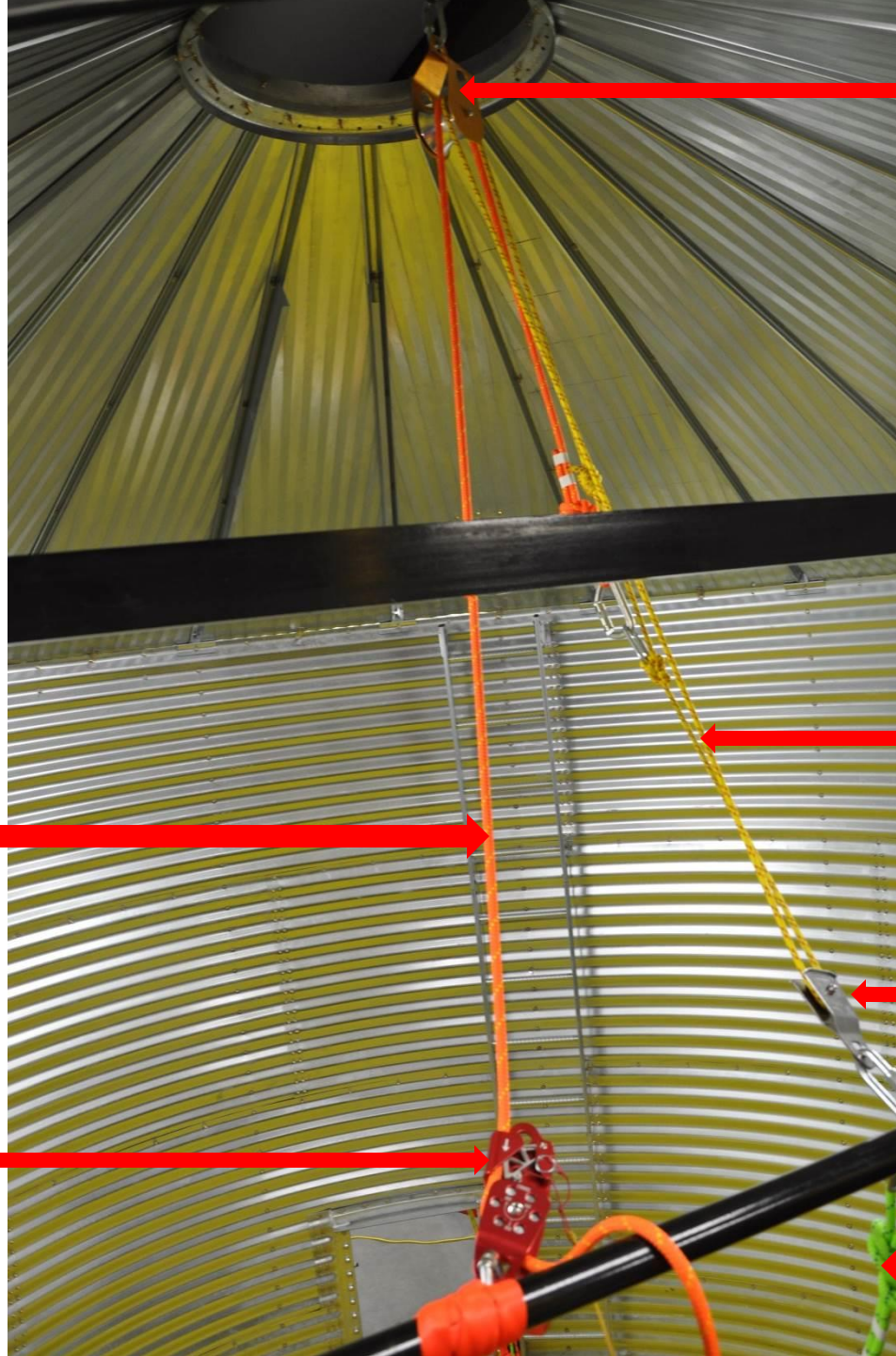


Effective protection



Effective protection

Components of Grain Engulfment Prevention System



Kootenay
SS Pulley
(Knot-Passing)

1/2" Lifeline

Clothesline -
8mm Prusik
Chord

SS Prusik
Minding
Pulley

Extractor
CSR Hauler

Belay Line

Grain Engulfment Prevention / Retrieval System - Lifeline



ASABE S624

ANSI/ASABE S624 AUG2018
Grain Bin Access Design Safety



American Society of
Agricultural and Biological Engineers

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ANSI/ASABE S624 AUG2018
Approved August 2018 as an American National Standard

Grain Bin Access Design Safety

Developed by members from the ASABE Structural Engineering technical committee, GEAPS (Grain Elevator and Processing Society), academic researchers and safety experts. Approved as an ASABE Standard and an American National Standard August 2018.

Keywords: Entrapment, Flowing grain, Safety

1 Purpose and Scope

- 1.1 This standard provides recommendations for design parameters in new grain storage bins.
- 1.2 This standard applies to new corrugated and smooth wall steel bins used to store various types of free flowing grain.
- 1.3 Excluded from this standard are any steel bins that meet **both** of the following criteria:
 - a. The bin has no roof or sidewall access doors
 - b. The center fill opening cover has a warning label stating that it is not a personnel access point.
- 1.4 These engineering parameters assist with safe entry into and exit from steel bins.

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies unless noted. For undated references, the latest approved edition of the referenced document (including any amendments) applies.

ASAE S412, Ladders, Cages, Walkways and Stairs

ANSI/ASABE AD11604, Tractors, machinery for agricultural and forestry, powered lawn and garden equipment — Safety signs and hazard pictorials — General principles

OSHA 1910.146, Permit Required Confined Spaces, Appendix A, Section B

OSHA 1910.272, Grain Handling Facilities

ASAE S354, Safety for Farmstead Equipment

3 Definitions

- 3.1 **access point:** this may be an opening in the sidewall of the bin or an opening in the roof either of which is designed as to allow a person to enter the structure.
- 3.2 **bin entry lifeline system:** a system to restrain a person in the bin from being entrapped in grain.
- 3.3 **safety decals:** Refers to any safety or warning decals posted at the entry locations. These warning and safety decals are to be made in conformance with ASABE standard ANSI/ASABE AD11604.

ASABE S624

3.4 bin base: the lowest part of the steel bin that sits on the concrete foundation or the intersection of the wall and the hopper.

3.5 anchor attachment point: a location for attaching the bin entry lifeline system anchor to the bin structure.

4 Bin Access

4.1 The primary sidewall access door shall be a minimum of 24 in. (600 mm) wide by 24 in. (600 mm) high.

4.2 The primary sidewall access door threshold shall be located no higher than 54 in. (1350 mm) from the bin base.

4.2.1 When the door threshold is more than 24 in. (600 mm) above the bin base or platform, a step must be provided between the bin base and the threshold of the door frame.

4.2.2 If the door threshold is more than 48 in. (1200 mm) from the ground a work platform with hand rails shall be provided at appropriate entry points into the bins.

4.3 The roof access opening shall be a minimum of 24 in. (600 mm) diameter or minimum linear dimensions 10 in. x 24 in. (450 mm x 600 mm).

4.3.1 There shall be an external platform below the roof access point.

4.3.2 A ladder on the inside of the bin (if provided) shall be directly beneath the roof opening.

4.4 All ladders, cages, platforms and walkways shall meet ASAE S412.

4.5 Provisions shall be made so that all powered and non-powered equipment can be locked out and tagged out to allow for safe bin entry. These provisions shall comply with ASAE S354 Safety for Farmstead Equipment.

5 Anchor Attachment Points

5.1 The bin manufacturer shall provide two anchor attachment points, one near the roof peak and one near the roof access. The anchor attachment point near the roof access shall be accessible from the platform allowing attachment of the bin entry life line system. Anchor attachment point(s) at or near the bin roof peak that comply with the requirements of 5.2 shall be deemed to meet this requirement.

5.2 The anchor attachment points shall each support a minimum ultimate load of 2000 pounds (900 kg). Each anchor attachment point shall be clearly identified on the bin and in the owner's manual and both shall state the maximum working load capacity per anchor attachment point. The design working load for the anchor attachment points shall be a minimum of 1000 pounds (450 kg).

5.3 Both identification on the bin and in the manual shall state that the anchor attachment point is designed for a single entrant.

6 Safety Decals

6.1 All entry points shall have required safety decals prominently displayed. The decal in Figure 1 shall be used for this display.

6.2 All safety decals shall conform to ANSI/ASABE AD11684.

6.3 The access entry decal is illustrated in Figure 1.



Figure 1 – Access entry decal

7 Informative Annex

A4.2.2 If the door threshold is more than 48 in. (1200 mm) from the ground a work platform with hand rails shall be provided at appropriate entry points into the bins.

The responsibility for this platform supply and location shall be the owner(s) or the owner's agent.

The rationale behind this comment placing the responsibility on the owner or the owner's agent is based on the fact that the bin manufacturer does not know at what elevation the bin will be placed on the foundation above grade when the bin is ordered. The manufacturer cannot design the platform or the placement of the platform as they are usually not informed about the bin placement on the site or even on the foundation elevation. Thus, the owner or the installing contractor has to take responsibility for the addition of and placement of this platform.

A4.5 Provisions shall be made so that all powered and non-powered equipment can be locked out and tagged out to allow for safe bin entry. These provisions shall comply with ASAE S354, Safety for Farmstead Equipment.

The responsibility for this provision shall be the owner(s) or the owner's agent.

The manufacturer of the bin does not supply the electrical control system. The owner or his agent (in this case, the electrical contractor) is responsible for providing "lock out/tag out" equipment.

Figure 2 is a sketch of an entry system inside a bin with the loads imposed on the anchor attachment points.

A5.1.1 The 2000-pound rating for the anchor attachment point is derived with the following assumptions and equations.

The weight of the entrant is taken as 250 lbs., as per ANSI A14.3 and ASAE S412. The bin entrant is to wear an approved safety harness and use a bin entry life line that is attached to the anchor attachment points. The bin entry system is to be designed and used in a manner that no more than 24 in. (600 mm) of slack is allowed in the life line at any time.

Using projectile equations, a 24-in. drop under the force of gravity takes 0.35 seconds and results in a velocity of 11.27 ft/s. Using representative values of a 40 ft length and 2% elongation (NFPA 1963) of the bin entry line, the stopping distance will be 0.8 ft. There are many possible combinations of rope length and elongation, however some reasonable values must be chosen for the sake of calculation. Decelerating from 11.27 ft/s to 0.0 ft/s over a distance of 0.8 ft. results in an acceleration of -79.4 ft/s². This is 2.47x gravity and results in a force of 250 lbs. x 2.47 = 617.5 lbs. Applying a 2x safety factor increases the expected load to 1235 lbs. (560 kg). With the change of direction of the center roof pulley from the vertical direction to 30 degrees below the horizontal, following the slope of the roof, the vertical load on the peak anchor attachment point increases to 1235 pounds x 1.5 = 1853 pounds (840 kg) load. In the interest of publishing an easy-to-remember number, some additional safety factor is added and the required anchor attachment point capacity is stated as 2000 pounds (900 kg).

ASABE S624

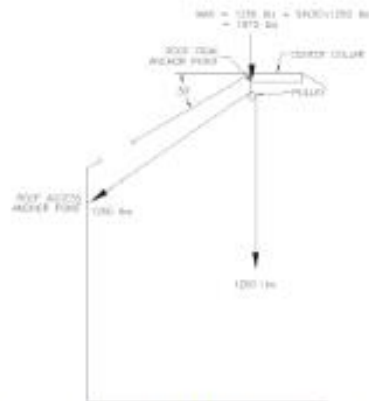


Figure 2 – Entry system inside a bin with the loads on the anchor attachment points

The change in direction of the pulley does not affect the anchor attachment point at the roof access point; its required capacity would be the 1235 pounds (560 kg) defined earlier. However, for simplicity's sake the required capacity of the roof access point will also be stated as 2000 pounds (900 kg).

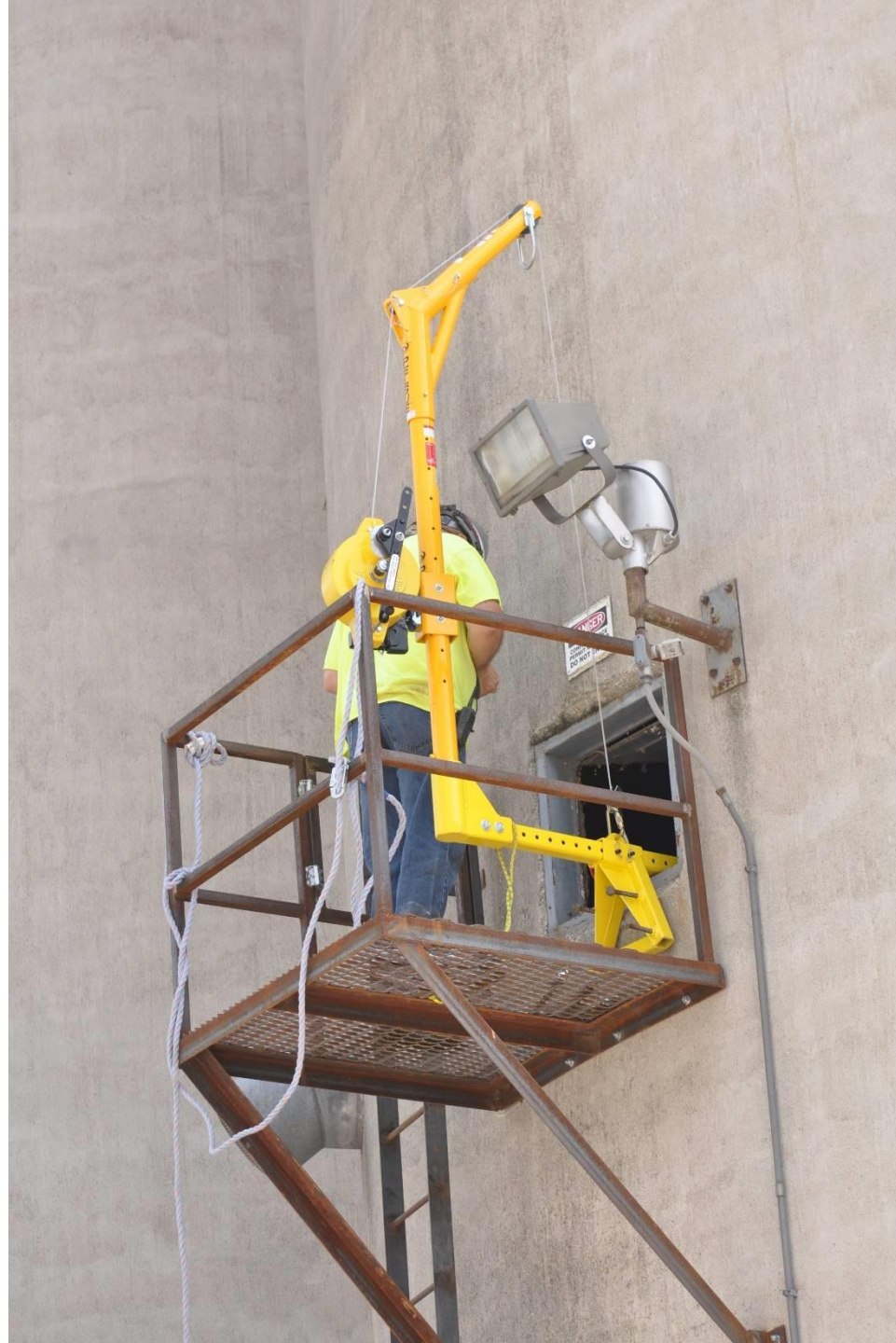
Figure 2 is a sketch of an entry system inside a bin with the loads on the anchor attachment points.

A6 The WARNING decal shown in Figure 3 is a newly developed label. Previously, in use for many years by grain bin manufacturers, this decal had the DANGER heading and language appropriate to the DANGER signal word. The WARNING decal shown in Figure 3 is a safety decal for grain bins that represents a change of the safety decal signal word and content.



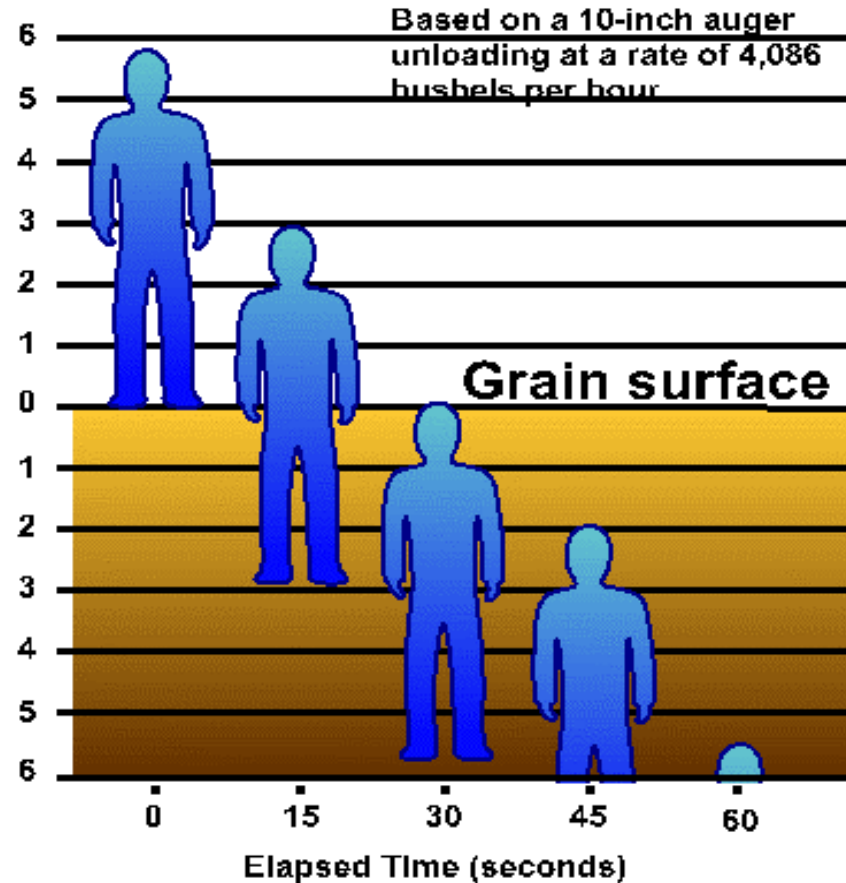
Figure 3 – WARNING decal

Portable Concrete Silo Side Door Lifeline / Retrieval System



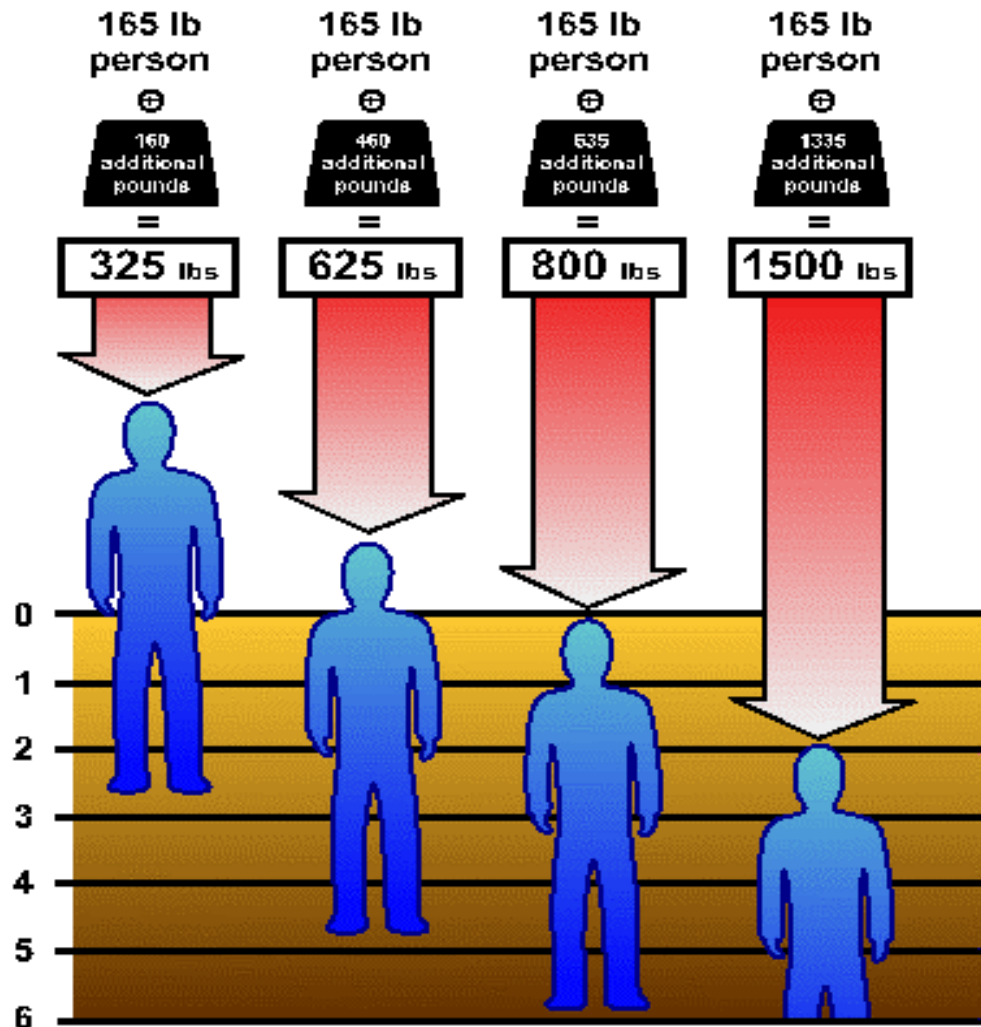
**In an entrapment,
you are in a race you
can't win**

**A flowing column of
grain will pull you
down to knee level in
seconds and bury you
within minutes**



**The effort
required to pull
someone from
grain is a major
hindrance to a
quick rescue**

**Do not use
mechanical
devices to
remove a victim
from grain**

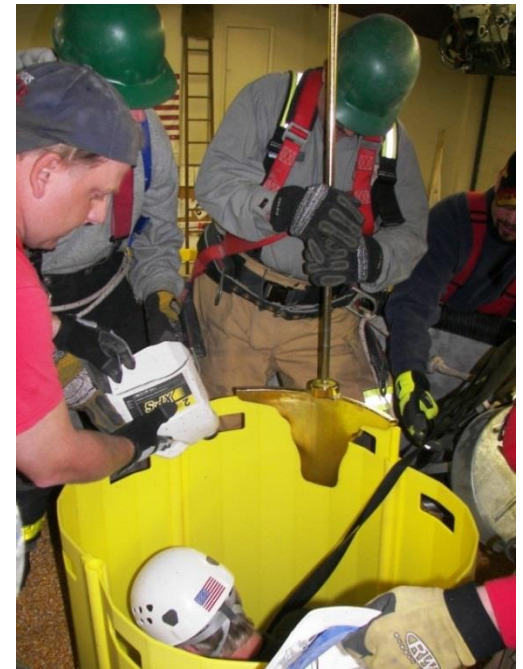


Rescue Equipment

- MUST be available
- Specifically suited for bin, silo, or tank



Grain
rescue
tube



Grain retaining wall

Rescue Tube/Wall



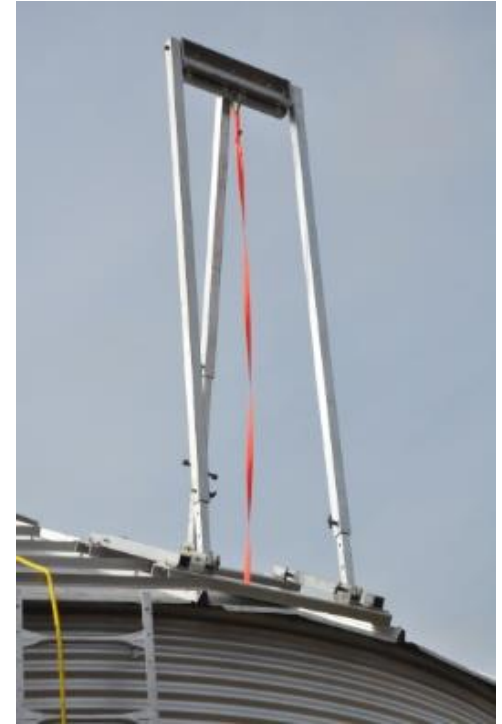
Rescue Auger



Grain Walker Shoes



Sloped Roof Retrieval System – Patent Pending



Advanced Grain Engulfment Rescue Trailer



Safety Is No Accident!

Take the Time!

or

You May Not Have It?

*If a Picture is
Worth a
Thousand
Words - This
Says it ALL!*





THANK YOU!



***Train, Equip, & Execute –
So at the end of each day –
We all go home safe!***

ALWAYS PROTECT YOURSELF FIRST!