

# Reducing Risks of Common Grain Handling Hazards

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**LEARN  
& LIVE**



Grain Handling Safety Coalition

# Employee Rights

## Employees are entitled to:

- Safe & healthy working conditions
- Fair compensation for all hours worked
- Report unsafe conditions without retaliation
  - Call, write or email the OSHA area office within 30 days to report employer retaliation

***Employers are responsible for providing a safe workplace.***

**Information** [www.osha.gov](http://www.osha.gov) &  
[www.whistleblowers.gov](http://www.whistleblowers.gov)



# Learning Objectives

**At the end of this session, participants will be able to:**

- Identify common grain handling hazards.
- Describe ways to reduce hazards & the need for bin entry.
- Explain the steps to a safe bin entry process.





# Rising Need for Best Practices

## Grain storage is changing:

- Greater production
- More volume moved
- Faster fill/unload speeds
- Rising storage capacity
- More, larger on-farm storage



**Increased exposure to risk.**



# WHAT IS SAFE BIN ENTRY



# Plan How Bin Entry is Done

- **Who** can enter bins
  - Responsible for permit/checklist
- **How** entry will be done
- **What** job tasks, equipment to use, PPE
- **When** it can be done
- **Where** – top, side
- **Why** – circumstances someone can enter

**State when entry is prohibited**



# Plan – Safe Bin Entry

- Written & communicated
- Policy & procedure
  - Work instructions
- Assign specific safety functions
- Employer & employee responsibilities
- Plans for:
  - LOTO
  - Bin Entry
  - Emergency action plan
  - Training



# Train Entrant & Observer

- ID/correct hazards
- LOTO
- Guarding
- PPE
- Lifeline use
- Job tasks
- Role & responsibility
- Emergency action plan

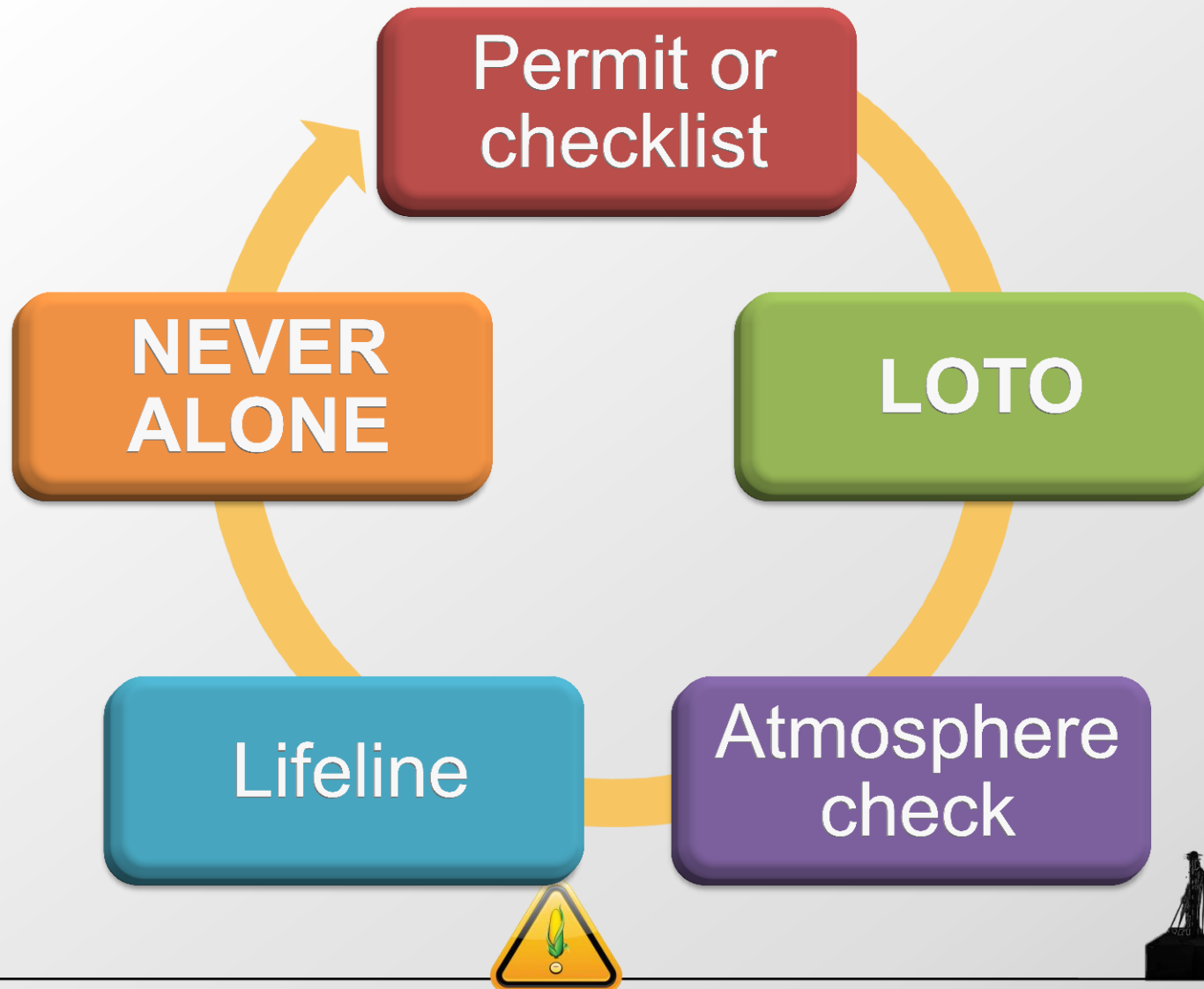
**Entrant** - job tasks, safe entry, stop entry

**Observer** – call help, stop entry, non-entry rescue





# 5 Critical Steps to Safe Entry



# ALTERNATIVES TO ENTRY



# Alternatives to Entry

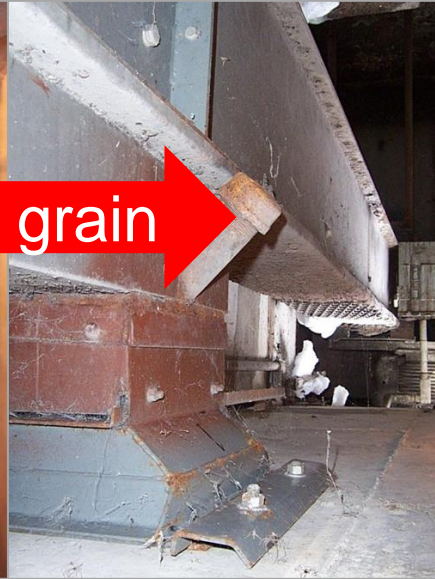
- Clogs
  - Open/close gates;
  - Open 2nd sump
- Wait - fall naturally
- Run fans
- Alternate return & unload grain
  - Expose small portion
  - Break up outside



**Check grain  
frequently  
during  
unloading**



# Rodding Grain - SAFELY



- Tunnel or outside
- Extendable utility pole
- Knock down grain
  - Repeat as needed





# Compressed Air for Pyramids

- Control & safety mechanism
  - Drop <30 psi if flow dead ended
- Control hazards
  - Ignition sources
  - Flying objects
  - Excessive dust
- Long handle
  - Keep out of hazard area
- PPE needs





# Correct Hardware for Air



# Whip Cuts Up Pyramids



Courtesy of  
Pneumat Systems, Inc.

- Usually portable
  - Hydraulic
  - Pneumatic
- No entry
- Other hazards
  - Excessive dust
  - Flying debris
  - Noise
  - Falls
- PPE



# How a Permit Helps **ASSESSING ENTRY HAZARDS**



# Permit - 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)

## “Safe to enter”

- Hazard assessment
  - Grain condition
- **LOTO**
- Atmosphere
- Lifeline use
- Entrant & Observer
  - Training & roles
- Rescue equipment Available



# Hazard Indicators

Moldy, musty,  
high moisture

Angle of  
repose is not  
22-28°

Uneven  
slopes\*

Clumps,  
clogged  
sumps

Surface does  
not show  
prior removal\*

No sinking  
when  
walking\*

Pyramids,  
towers, side-  
wall build-up

Flowing grain  
Use LOTO!

\* Indicates  
potential  
bridging





# Atmosphere Hazards

## Toxic Atmosphere

Above PEL -  
CO<sub>2</sub>, H<sub>2</sub>S,  
methane

Decomposing  
grain, hot work,  
vehicle exhaust,  
chemicals

## Combustible Atmosphere

Exceed 10%  
LFL, LEL

Dust obscure  
vision < 5ft

Respiratory  
health

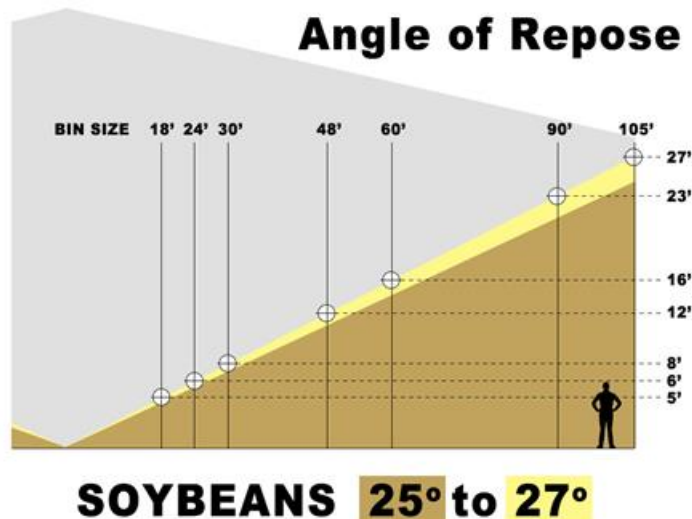
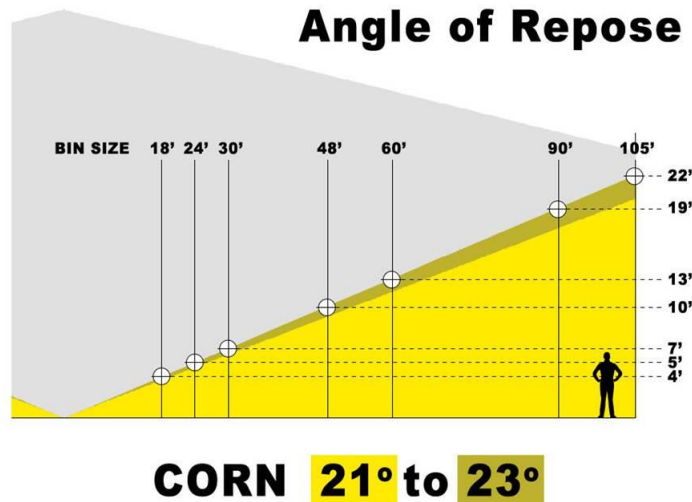
## Oxygen Deficient

O<sub>2</sub> < 19.5%  
Normal 20.9%

16% impaired  
6% instant  
death



# Angle of Repose



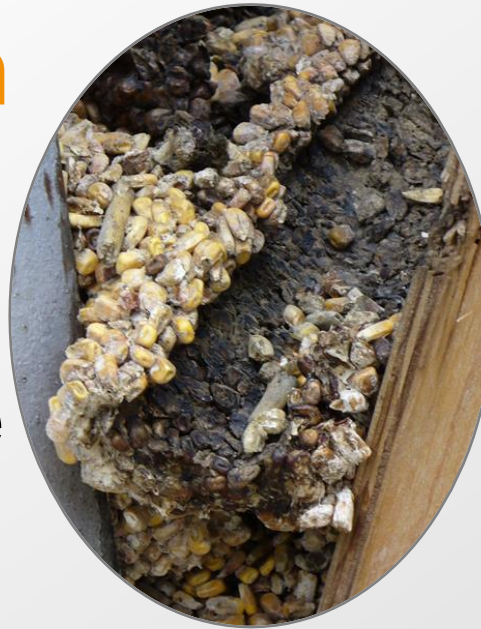
- Natural angle when stored
- Assessment tool
- Normal
  - Corn ~ 21.5°
  - Soybean ~ 25°
- Steep angle
  - Potential hazards
  - Use caution for entry



# Good vs Bad Grain

## Good Grain

- Sweet smell
- Cool temp
- Low moisture
- Rolling movement
- Natural angle of repose  $22^{\circ}$  -  $28^{\circ}$



## Bad Grain

- Moldy, sour smell
- High temp
- High moisture
- Crusty top
- Unnatural color
- Unnatural slope

**Good grain reduces hazards.**



# Reduce Need for Entry

## Prepare Bin



- Clean & sanitize
- Repair/replace
  - Water leaks
  - Deteriorated seals
- Foundation
- Aeration

## Harvest



- Reduce foreign material
- Adjust combine
  - Fan speeds
  - Concaves
  - Sieves
- Screen grain

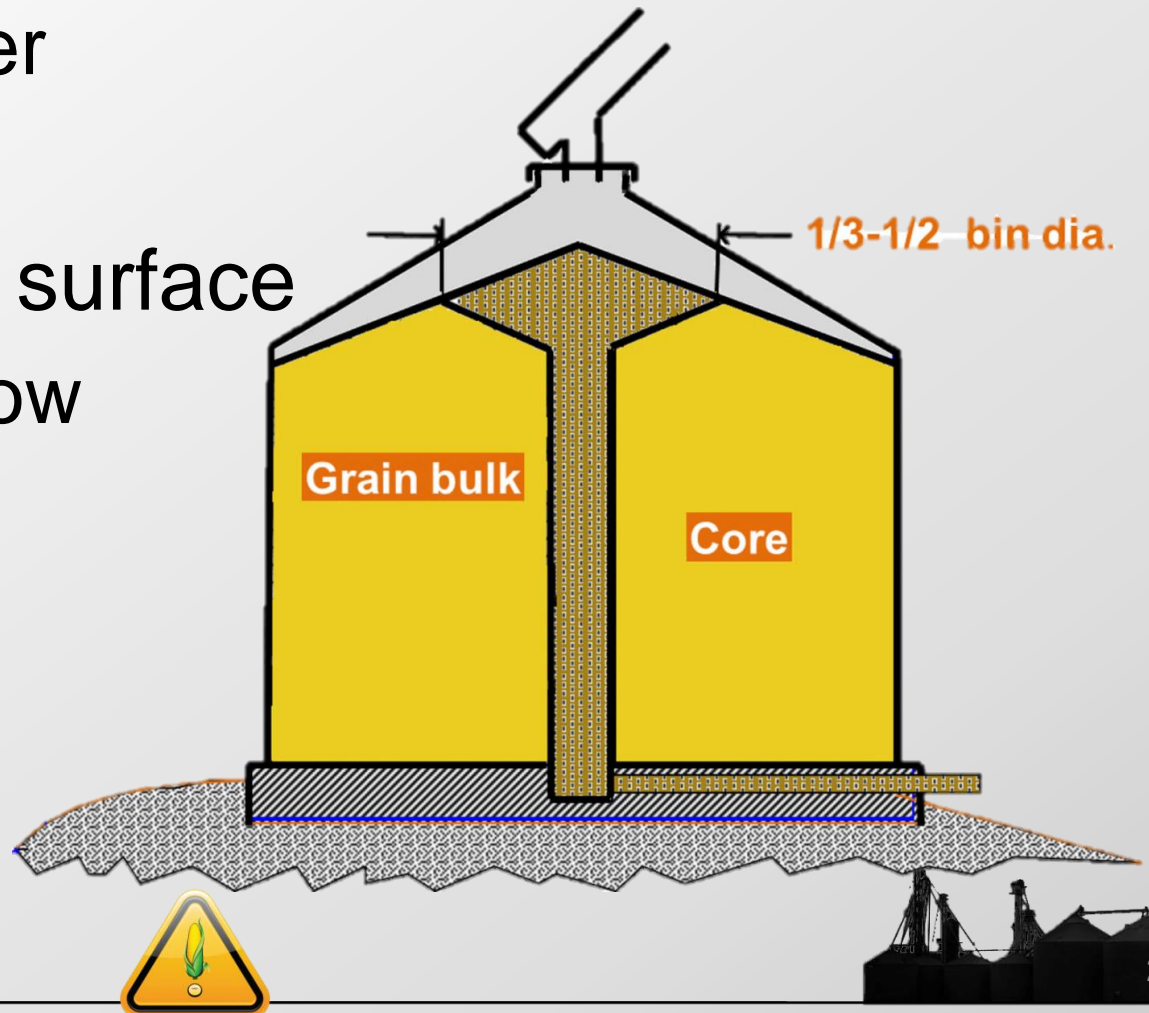
## Properly Store



- Dry < moisture
- Keep cool
  - Temperature cables
- Aerate
- Check often
- Core grain

# Core Bin - Rid Grain of Waste

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





# ENGULFMENT



# Understanding Grain Engulfment

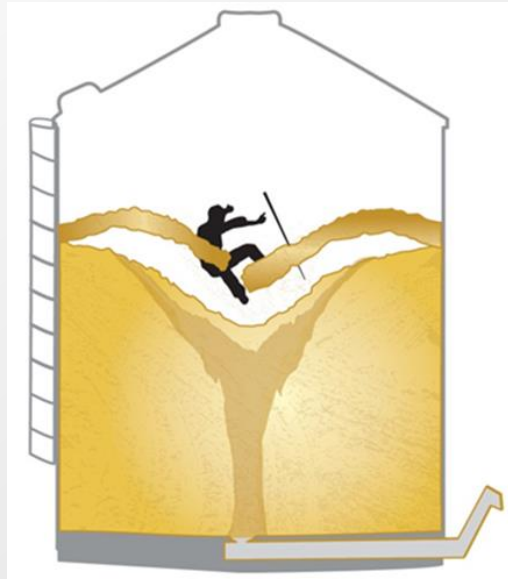
- Entrapment **5 seconds**
  - Knees cannot self rescue
- Engulfment **<60 seconds**



# 3 Ways Entrapment & Engulfment Occur



Flowing Grain



Bridge or horizontal collapse



Avalanche or vertical collapse



# Hazard - Flowing Grain

#1 Cause  
Grain Engulfment

## CAUSE

- Lack of LOTO

## WORK TASK

- Unplugging sump
- “Walking down the grain”

**Never enter bin with  
equipment running!**



# Hazard: Bridged Grain



## CAUSE

- Cavity forms beneath surface during unloading or settling

## WORK TASK

- Could be routine – monitoring grain

**WARNING: Hidden Danger**





# Hazard: Avalanche Conditions

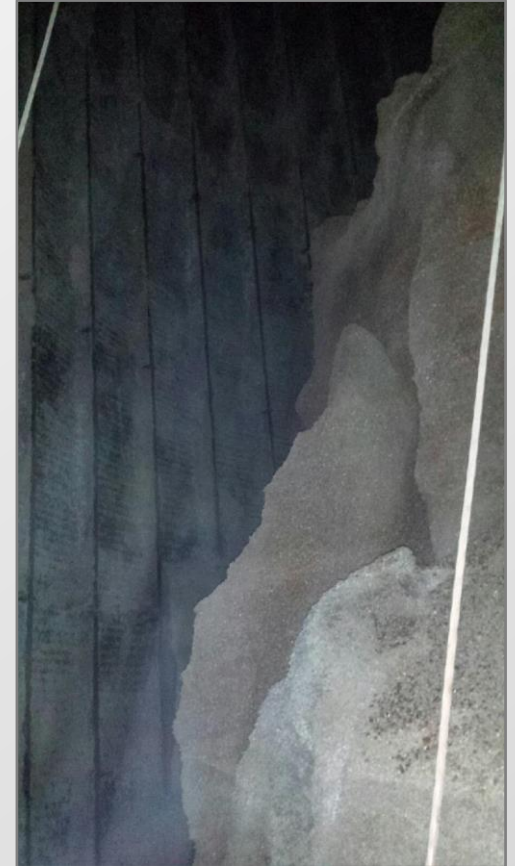
## CAUSE

- Poor condition grain

## WORK TASK

- Breaking up pyramid
- Knocking down grain

07/07/2010



Stay **ABOVE** the grain!



# Lifeline Use & Roles

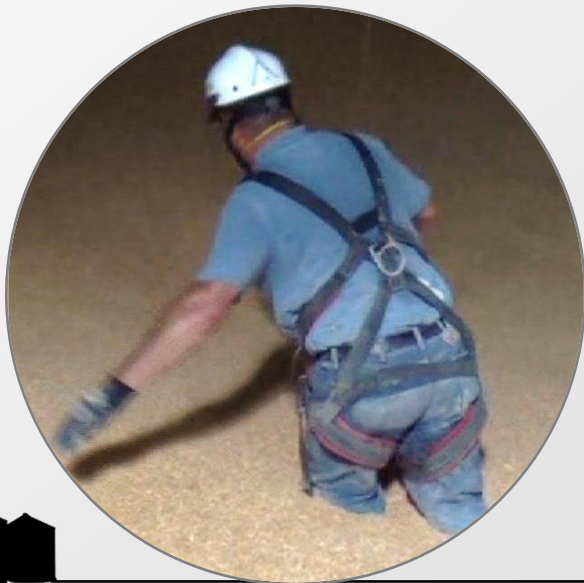
## **BIN ENTRY**



# Constant Contact for Safe Entry

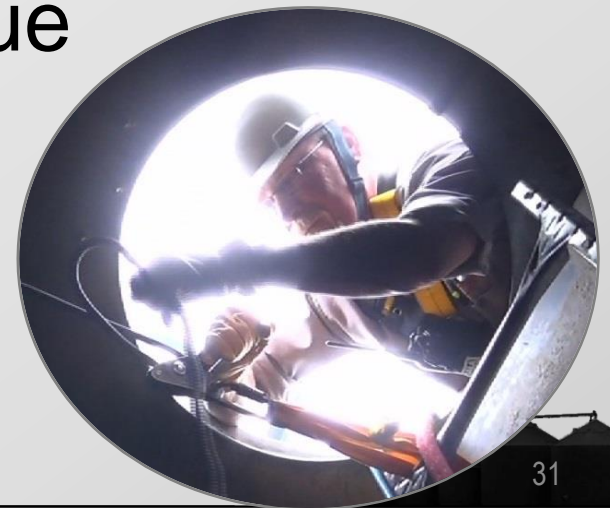
## Entrant

- Continually reassess hazards
- Communicate
- Complete tasks

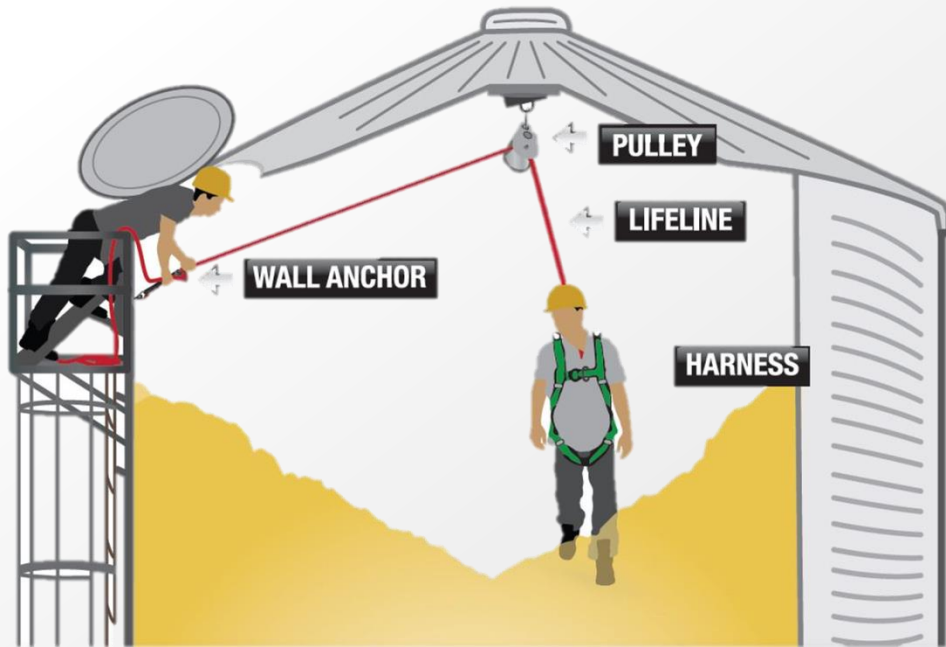


## Observer

- Must not leave
- Constant contact
  - Visual best
- Control lifeline
- Call help & initiate rescue



# Lifeline Must Be Secured



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

## Wrong Way

- Holding lifeline
- Tying rope to bin ladder



# Lifeline Protection System



Maximum  
slack in rope  
is 2 feet

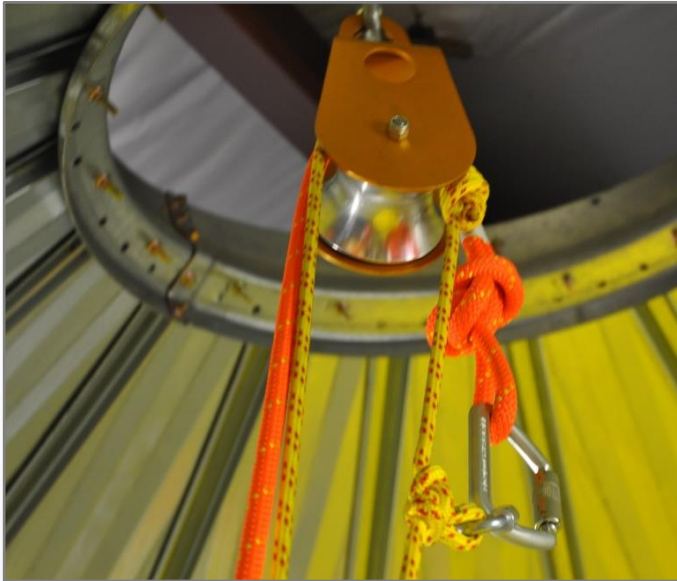
**Entrant has  
1 foot  
“safety  
cushion”**

Distance  
from feet to  
waist ~ 3 feet





# Lifeline Anchors



- Peak anchor - knot passing pulley
- Sidewall anchor - D-ring, swivel,
  - Prusik minding pulley – used for transfer
- Screw link – connects pulley to anchor



# Lifeline Hardware



- Full body harness – Class III D-rings
  - D-rings front & back
- Belay or rope grab
- Lifeline rope – static kernmantle  $\frac{7}{16}$  or  $\frac{1}{2}$ "
- Carabiners – spring loaded gate



# LOTO & ENTANGLEMENT HAZARDS



# Lock Out/Tag Out (LOTO)

- Control energy sources
- Prevent unexpected start-up
- Before
  - Maintenance/service
  - Bin entry
  - Guards removed



**LOTO – Each time, Every Time!**

# LOTO & You

## Train **all** employees on LOTO

- Equipment & machine
  - LOTO procedure
  - Multiple power sources
  - Exclusive possession of power source





# Machine Guarding

## Subpart O

Distance Between Guard & Moving Parts of Equipment	Maximum Vertical Opening (Unlimited Horizontal Openings)
½ to 1 ½ inches	1/4 inches
1 ½ to 2 ½ inches	3/8 inches
2 ½ to 3 ½ inches	1/2 inches
3 ½ to 5 ½ inches	5/8 inches
5 ½ to 6 ½ inches	3/4 inches
6 ½ to 7 ½ inches	7/8 inches
7 ½ to 12 ½ inches	1 ¼ inches
12 ½ to 15 ½ inches	1 ½ inches
15 ½ to 17 ½ inches	1 ⅞ inches
17 ½ to 31 ½ inches	2 ⅞ inches
31 ½ inches to < 7 feet	6 inches
> 7 feet	Guarding optional

- Guard exposed
  - Moving parts
  - Power transmission apparatus
  - Point of operation

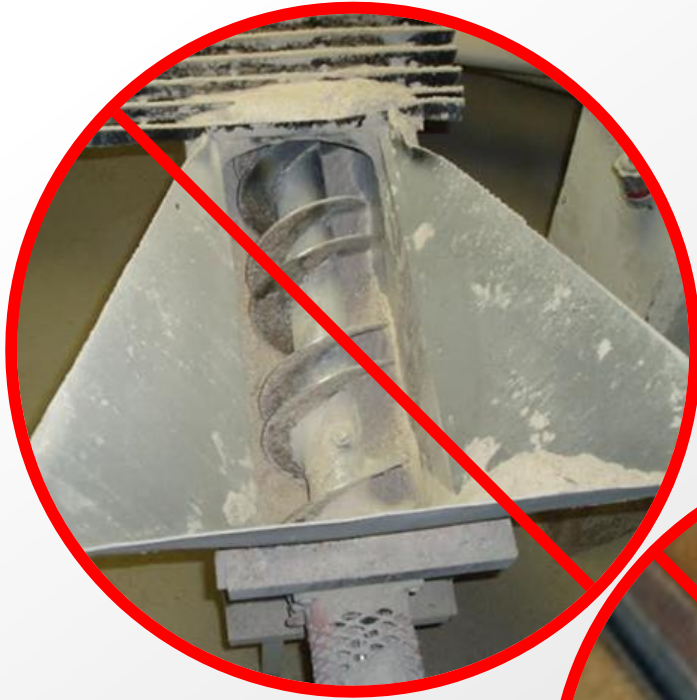
## ■ AUTO

- Around, under, through, over

## ■ Subpart O



# Power & Operation Points



# Secure Sump Guards



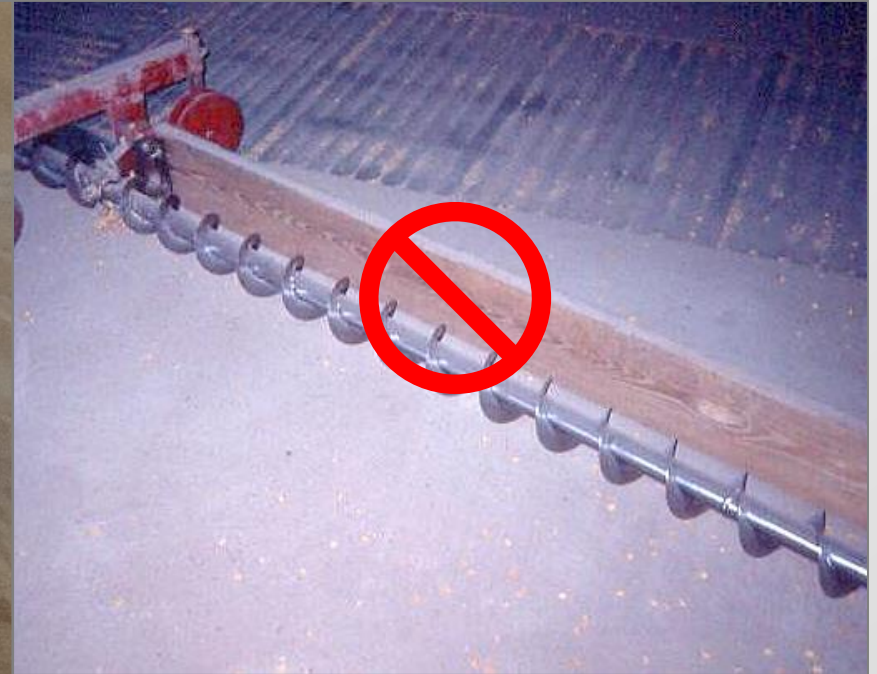
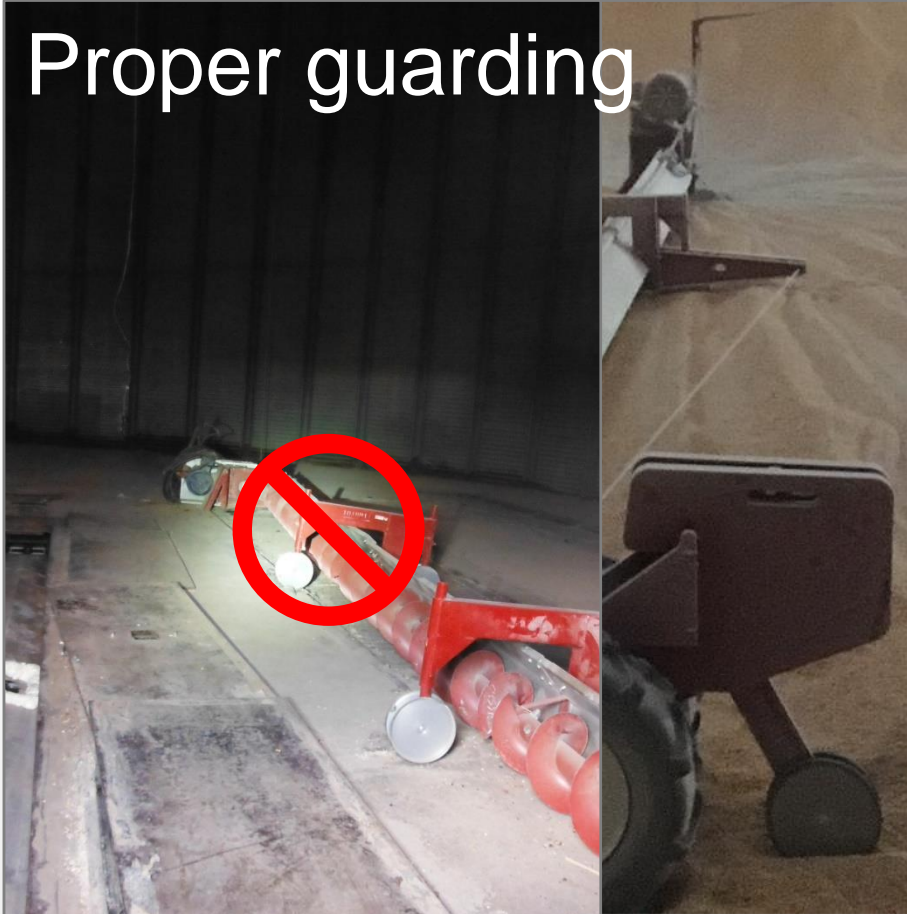
**CLOSE & LOTO sumps BEFORE entering to place/secure guards.**





# Sweep Auger Guards

Proper guarding



**Only** front can be unguarded!



# Engineering Controls





# No Contact Energized Sweep

**No physical contact while sweep is operating.**



**LOTO before adjustment or service.**



# Falls, Electrical, Struck-by **OTHER HAZARDS**



# Fall Protection

**Planned system** – eliminates, reduces or controls risk of injury & death.

## Heights $\geq$ 4 feet

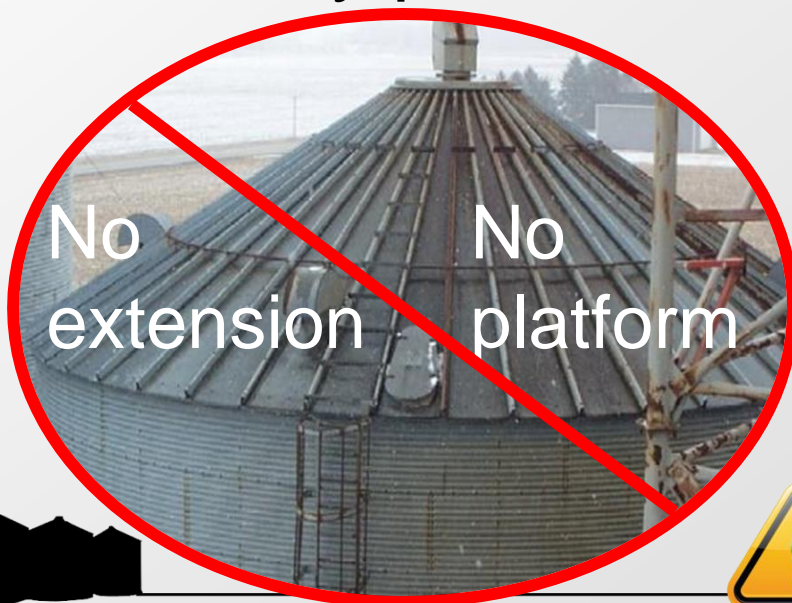
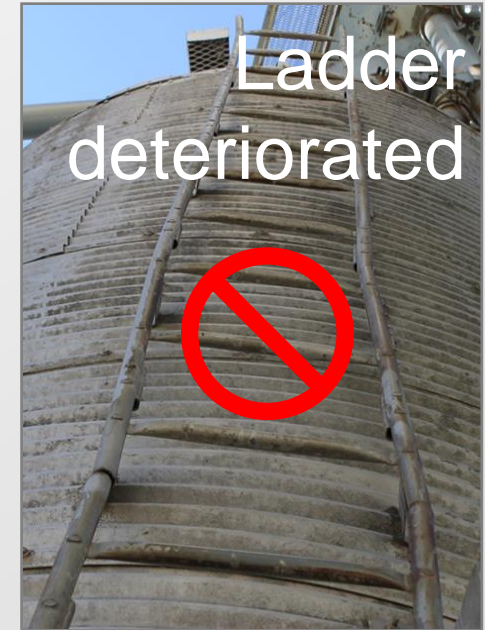
- Above/next to dangerous equipment
- Floor & pit openings
- Stair & ladder openings
- Work platforms



# Avoid Falls During Entry

## ■ Heights & Access

- Ladders & Stairs
- Catwalks & Platforms
- Entry points



## ■ Slips & trips

- Product spills
- Oil, rain, snow, ice





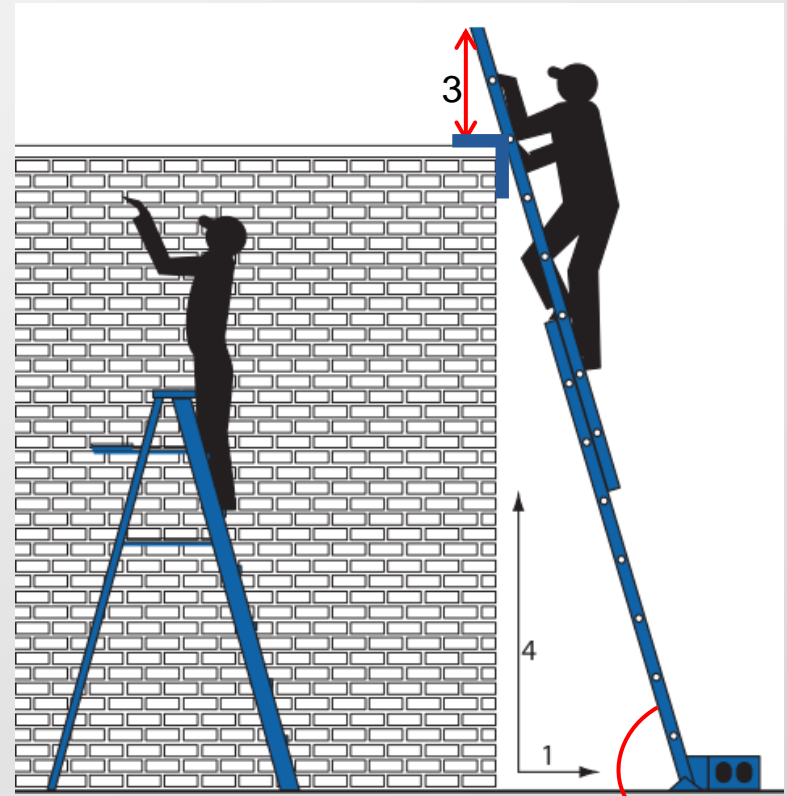
# Correct Ladder Set-up

## Step Ladder

- Fully extend base
- Lock spreaders
- Level support for rails

## Extension Ladder

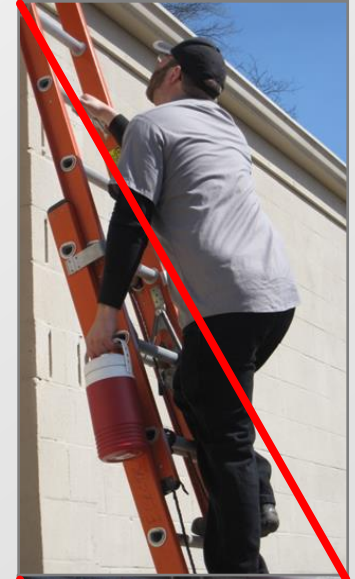
- Extend 3' above surface
- Incline 4:1 ratio – 75.5°
- Secure top & bottom
- 3 feet overlap



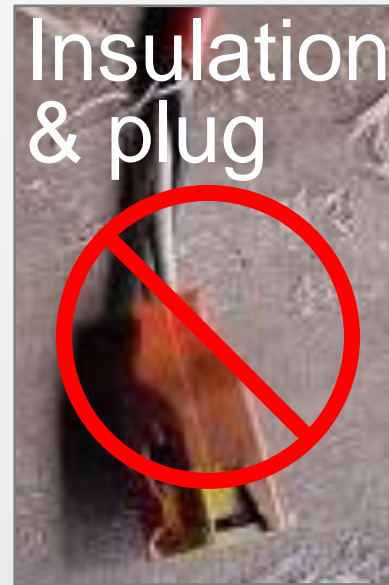


# Ladder Use

**3 points  
contact**



# Exposed Electrical





# Unplugged Holes & Openings



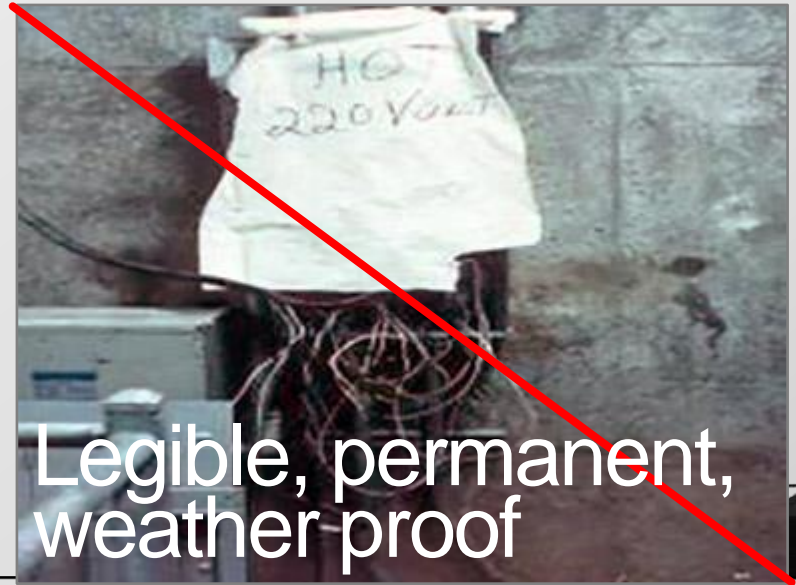
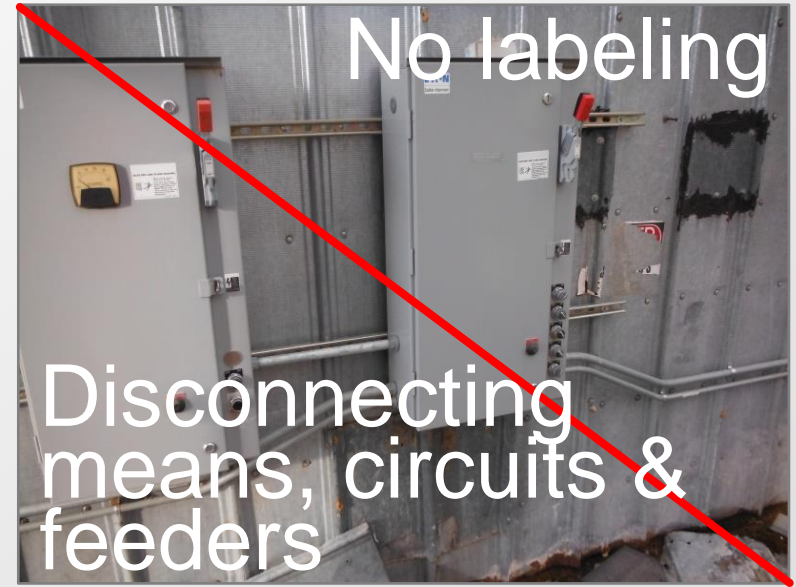
- Dust build up
- Fire hazards



- Contact with Live Electrical



# Improper Use & Labeling



# Power Lines

**Stay 10 feet from power lines**



- Shut off power
- Avoid metal ladders & long tools



- Lower & secure before transporting





# Vehicle: Caught In-between

**Only necessary persons should be in the area of raised vehicles/lifts.**



- **Lock out** lift controls
  - **Before** starting work
- Block tires
- Lower or block lift device
  - Dissipate residual energy



# Vehicle – Run over

- Block work area
- Use back up lights & sounds
- Be alert & aware

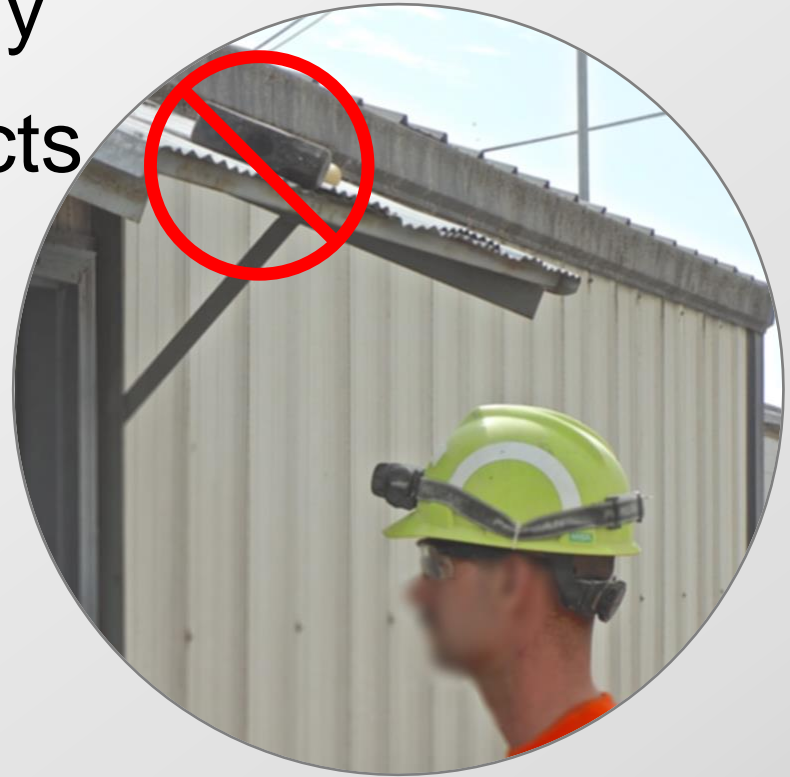


- Stay clear of blind spots
- Wear high visibility clothing
- Avoid distraction



# Falling Objects

- Transport tools securely
- Secure overhead objects
- Post warning signs
- Be aware when under
  - Ladders, scaffold
  - Elevated Work Areas
- Wear PPE
  - Hard hat, safety glasses/goggles, footwear



# Post Polling Questions

1. Lock Out/Tag Out is needed ONLY when entering a bin to clear a clogged sump.

**TRUE** - # who choose \_\_\_\_\_

**FALSE** - # who choose \_\_\_\_\_

2. A lifeline is secured by 2 anchor points.

**TRUE** - # who choose \_\_\_\_\_

**FALSE** - # who choose \_\_\_\_\_





# Polling Question

I learned new information about grain hazards and/or safety strategies today.

Strongly Disagree		Strongly Agree	
1	2	3	4
# of responses	# of responses	# of responses	# of responses
_____	_____	_____	_____



# SUMMARY



# Summary

- Plan for entry
  - Train workers
  - Reduce need for entry
- Follow safe bin entry process
  - Use a permit - Assess for all hazards
  - Lock Out/Tag Out
  - Check Atmosphere
  - Use lifeline
  - Never alone - observer



Protect the most valuable  
resource we have –

**Our Workers!**

**QUESTIONS?**

For more information visit [grainsafety.org](https://grainsafety.org)

