

**LEARN  
& LIVE**



**Grain Handling Safety Coalition**



Zaloudek Grain Co., where Bryce Gannon and Tyler Zander, both 17 years old, **each lost a leg** after they were caught in an auger

A 53-year-old farm worker was **killed** when he became **entangled in a grain bin auger...**

A Fairmount man who was caught waist-deep in a grain auger has **died...became entangled in the equipment after he was crawling over it.**

A 28-year-old man was working on a farm and suffered injury when he stepped over a power take-off (PTO) shaft from which the safety guard had been removed. He caught his coat in the PTO shaft and was pulled into the machinery, resulting in the **degloving of his genital and perineal regions**

# ENTANGLEMENT HAZARDS and GUARDING

A farm owner/operator **died of suffocation when his clothing became entangled** in the machinery he was attempting to adjust. The PTO continued to turn strangulating him.



# Introduction

The Entanglement Hazards module is part of a curriculum series that addresses hazards found in areas of grain handling facilities including grain bins and their surrounding area. It's purpose is to assist participants in identifying and abating hazards in the work place.



# Disclaimers

This material was produced under grant number SH2288SH1 from the Occupational Safety and Health Administration, U.S. Department of Labor. It does not necessarily reflect the views or policies of the U.S. Department of Labor, nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. Government.





# Employee Rights

**Employees are entitled to safe and healthy working conditions which DO NOT pose a risk of serious harm.**

**Workers are entitled to be fairly compensated for all hours worked in accordance with the law.**



# Employer Responsibility

**Employers have the responsibility to provide a safe workplace.**

**More information about employer & employee rights can be found at  
[www.osha.com](http://www.osha.com)**



# Learning Objectives

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

- Identify sources of entanglement found around grain handling environments..
- Explain the types and characteristics of hazards posed by PTOs and how to prevent them.





# Learning Objectives (cont.)

- Recognize & explain machinery hazards that create entanglement risks and provide the best appropriate action(s) to avoid, prevent, or correct the hazards.
- Name the 2 most common causes of entanglement and main characteristics of their corrective action.



# Module Topics

1. Common Sources of Entanglement Hazards
2. Identifying Hazards
3. Preventing and Correcting Hazards
4. Sweep Auger Issue & OSHA
5. Learning Objectives Review
6. Summary



# What is a Hazard?

**Something with the potential to cause harm.**





# Types of Hazards





# Common Sources of Entanglement Hazards

# Common Sources of Entanglement Hazards

- Common Machine Hazards
- Specific Hazards





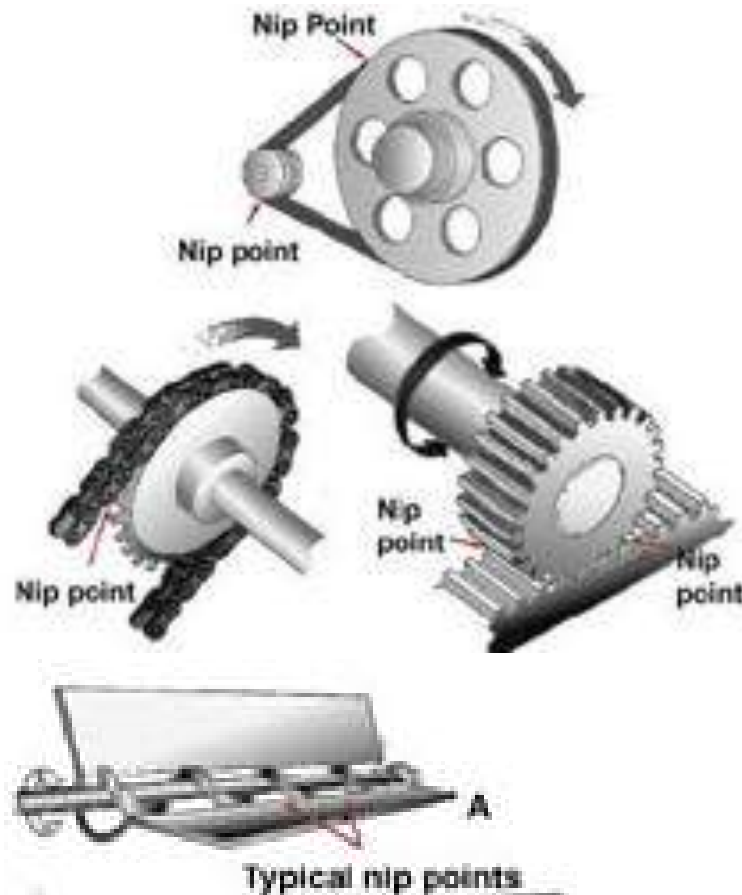
# Common Machine Hazards

- Pinch Points (Nip Points)
- Wrap Points
- Pull-in Points
- Shear/Cutting Points

**Proper guarding of these hazards reduces exposure and injury to workers.**



# Pinch Points/Nip Points



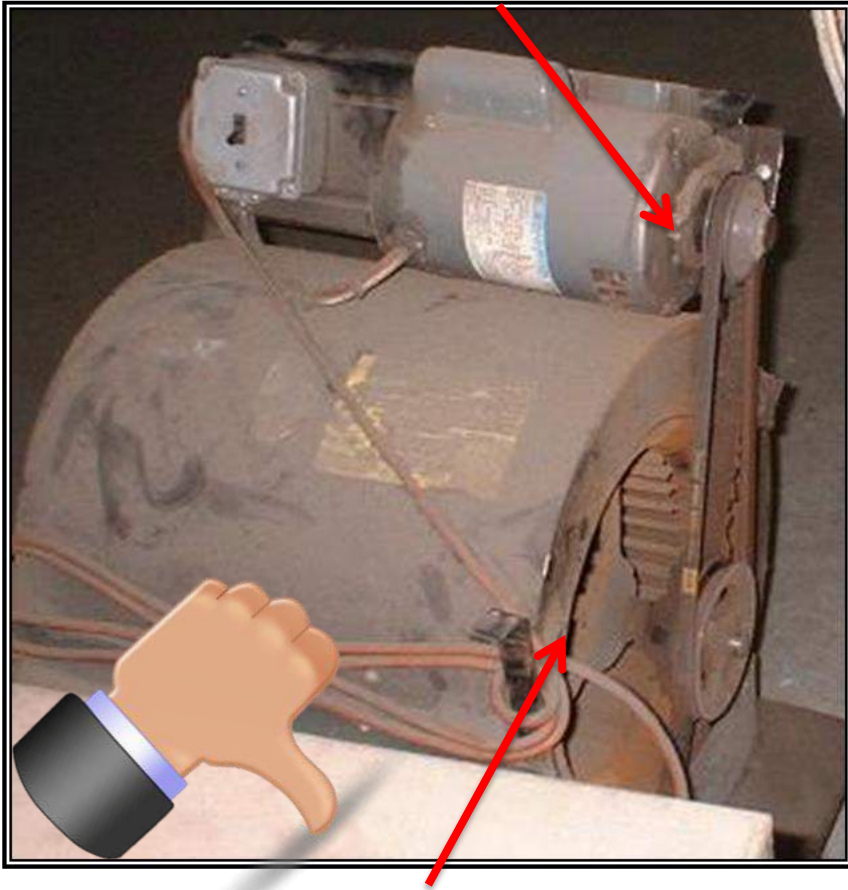
## Examples:

- Elevator leg drive
- Motor
- Elevator leg belt
- Auger drive motors
- Sliding doors for bins
- Pulleys
- Belts
- Gears



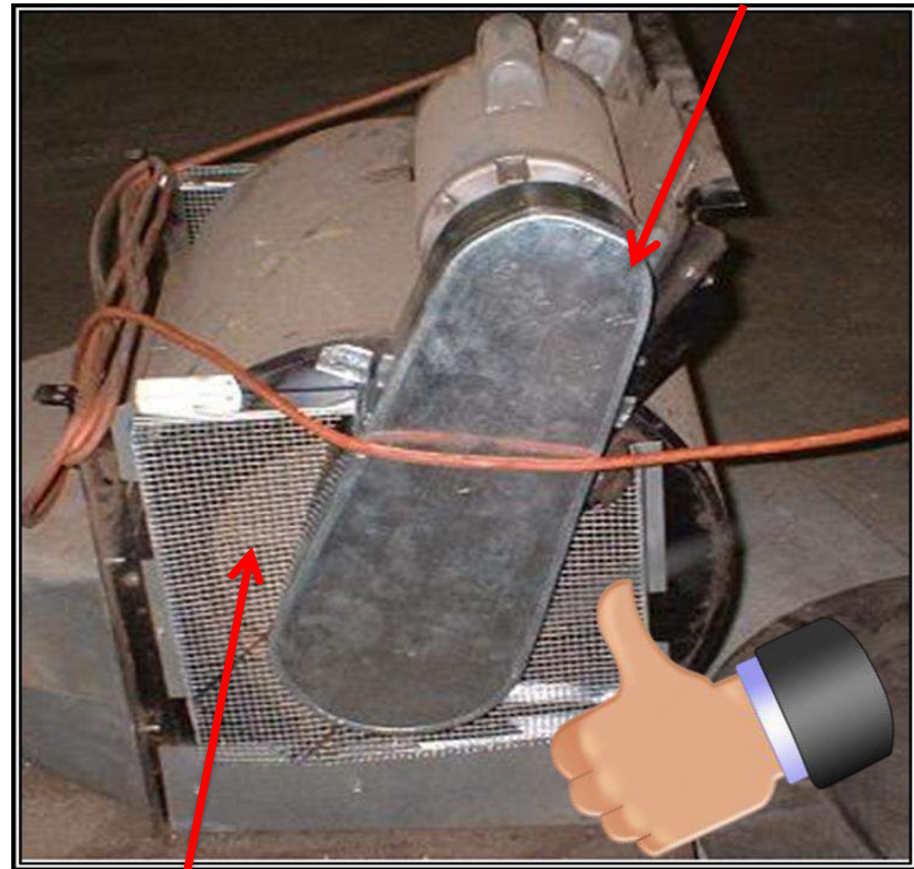
# Unguarded/Guarded Pinch Points

Exposed belt turns clockwise



Fan is exposed

Belt is no longer exposed



Fan is no longer exposed

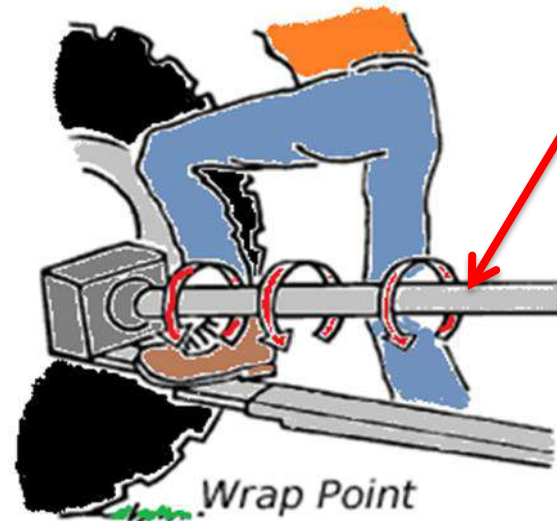




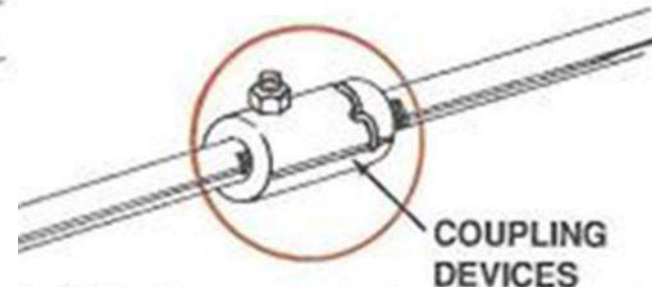
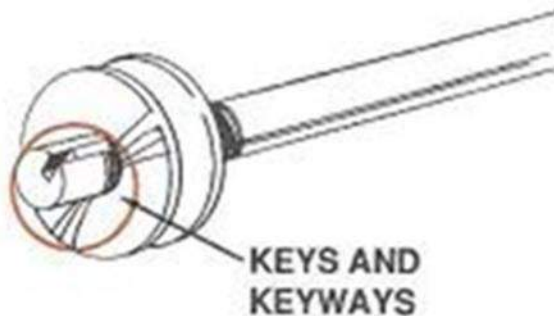
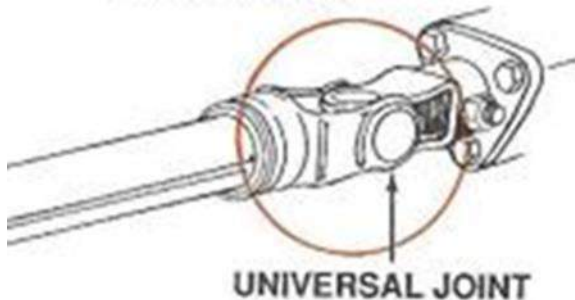
# Wrap Points

## Examples:

- PTO – prime example
- Augers
- Motor drive shafts
- Pulley attachments



Wraps in  
direction  
shaft is  
turning



# Wrap Hazard



# Pull-in Points

## Examples:

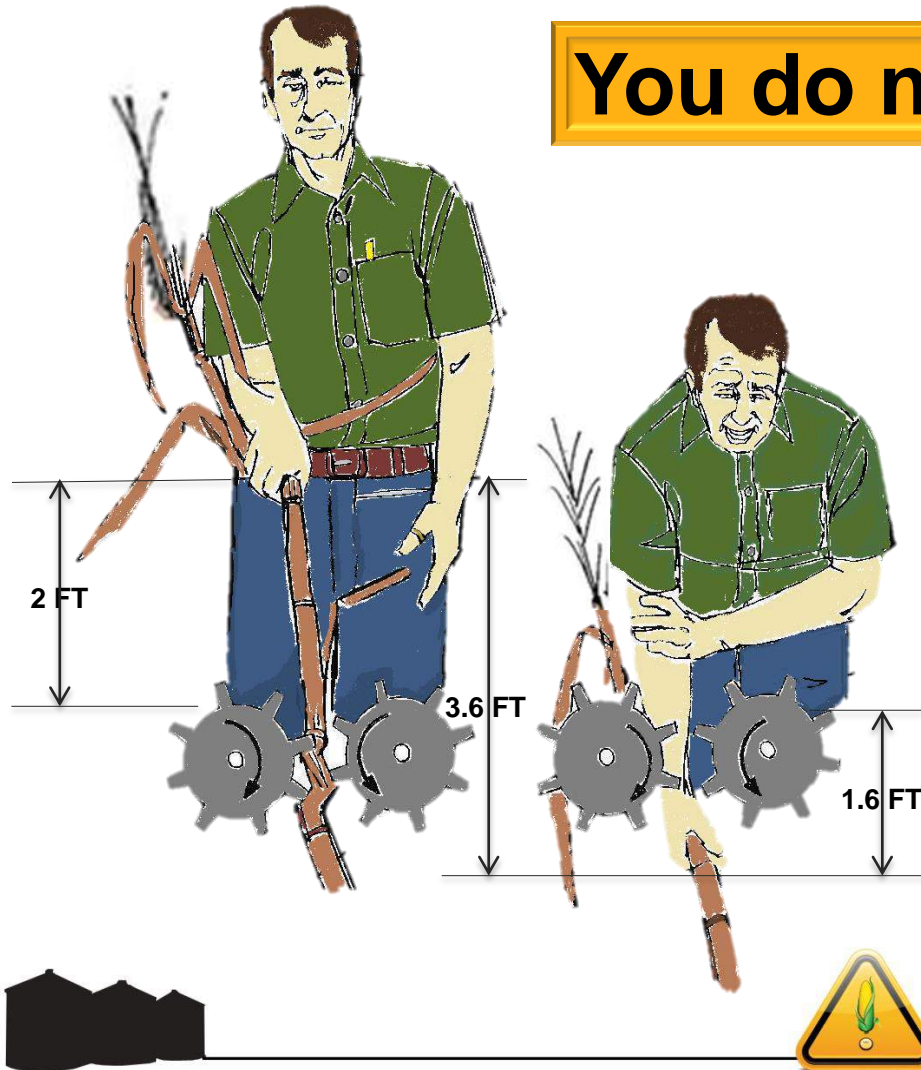
- Forage Harvester (shown)
- Crop Harvesters
- Combine Headers
- Windrow pickups
- Grinders

Operating point -  
catches object &  
drags it in.



# Pull-in Points

**You do not have time to react!**

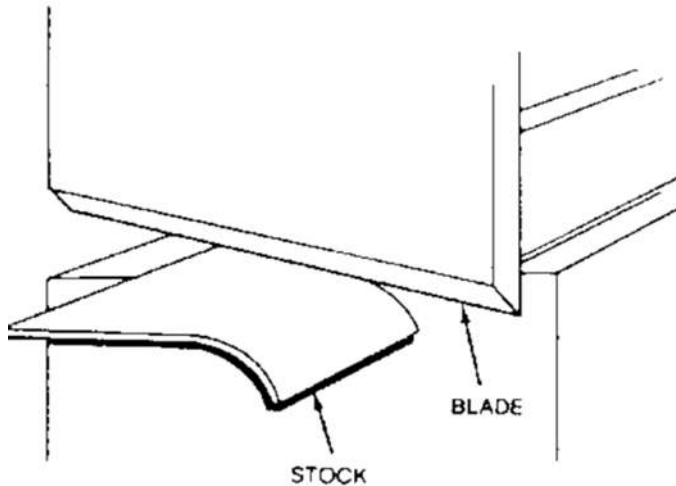


Takes only 3/10 second to react when stalk begins to pull through.

Stalk & hand will travel 3.6 feet before he can react.

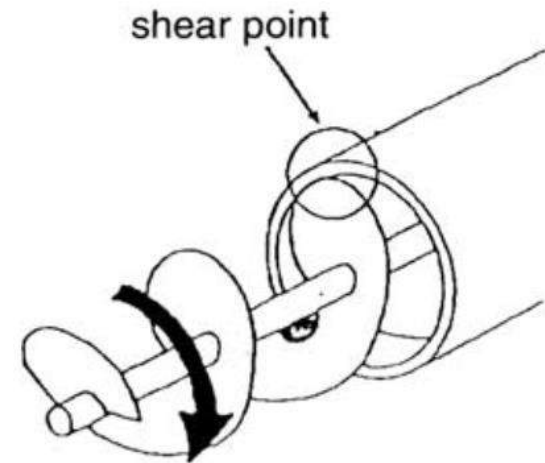


# Shear/Cutting Points



## ■ Cutting points

- Single object
- Cuts from force or speed
- Sickles, Mower blades, Windrower cutter bar



## ■ Shear points

- Two edges
- Cuts soft material
- Augers, Harvesters





# Hazard Reminders

## Shear or Cutting Points

Hazards exist  
due to a  
cutting force.

Object moves  
rapidly - not  
always visible.

Easy to forget  
equipment is  
operational.

Cannot easily  
be guarded or  
protected.

Danger of  
thrown objects





# Specific Hazards

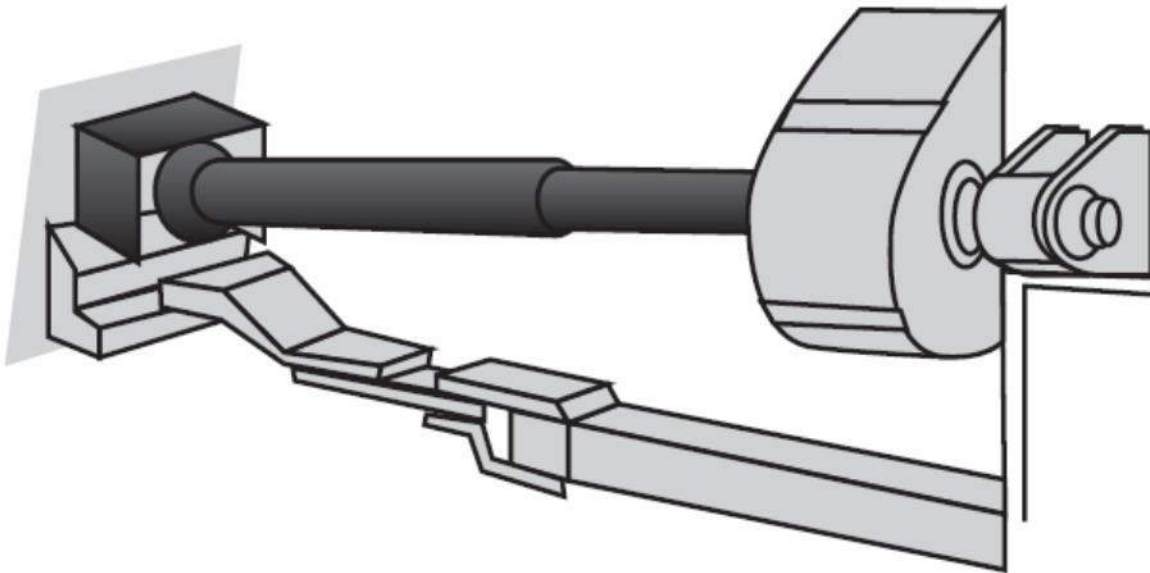
- PTOs
- Conveyors
- Elevator Legs
- Sweep Augers

**NEVER reach over or around rotating parts!**



# Power Takeoff (PTO) Hazards

**PTO (shafts) are among the oldest and most common machinery hazards.**



**Ensure PTO drivelines are fully shielded.**



# Reduce PTO injuries & deaths

**NEVER** attempt to step over rotating PTO drivelines.

**NEVER** operate tractor controls from the rear.

**Stay well clear of rotating PTO drives.**

**KEEP** long hair pulled back.

**NEVER** wear loose, baggy clothes around PTOs.

Bind, tuck, cut -laces, cords, ties, flaps, loose threads.

Avoid jewelry – bind, tuck, hide.



# Power Take Off (PTO) Drives Demonstration



# Reaction Time

Time between when a stimulus occurs and when you respond.

Factors which affect Reaction Time:

- Sleep deprivation
- Age
- General health or physical limitations
- Medication



# Group Exercise





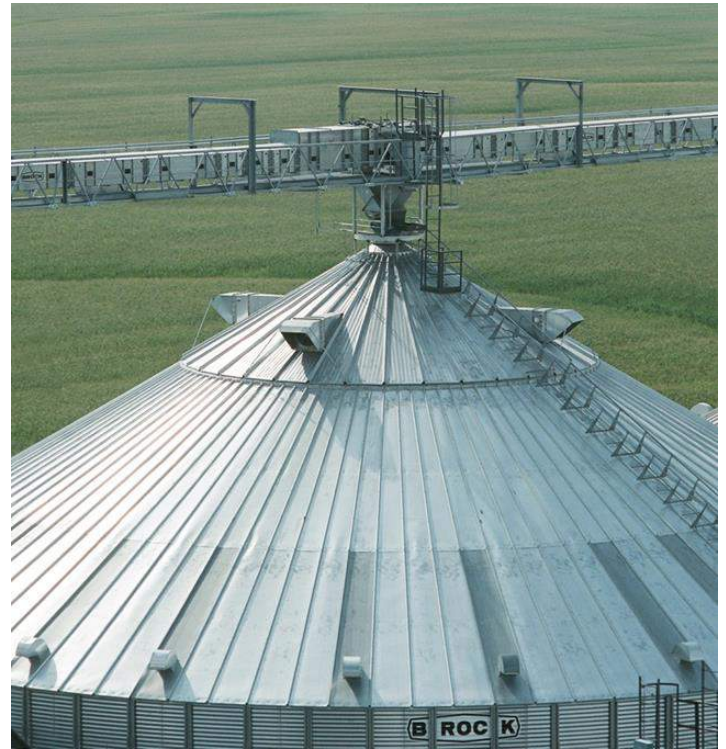
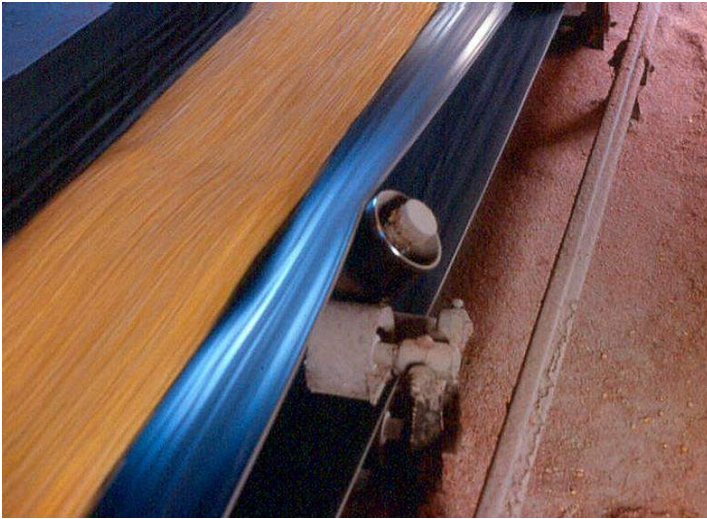
# Table 1: Lapsed Time vs Distance Traveled\*

540 RPM			1000 RPM	
Time lapsed in seconds (100's)	Revolutions turned	Distance Traveled (ft)	Revolutions Turned	Distance Traveled (ft)
0.15	2.3	1.8	4.2	3.3
0.33	3.0	2.4	5.5	4.4
0.40	3.6	2.8	6.7	5.2
0.50	4.5	3.5	8.3	6.5
<b>0.50</b>	<b>4.5</b>	<b>3.5</b>	<b>8.3</b>	<b>6.5</b>
0.70	6.3	4.9	11.7	9.2
0.80	7.2	5.7	13.3	10.5
1.00	9.0	7.1	16.7	13.1
1.50	13.5	10.6	25.0	17.6
3.00	27.0	21.2	50.0	39.3
5.00	45.0	35.3	83.3	65.5
10.00	90.0	70.7	166.7	130.9
60.00	540.0	424.1	1000.0	785.4

\*Based on relationship of Tractor PTO with a shield/shaft diameter of 3 inches.



# Conveyors



## Types

- Tractor Mounted
  - Belt
  - Auger
- Screw
- Drag (en mass)
- Belt

- Primary mechanism to move grain



# Tractor Mounted Conveyor-Belt

Uses a  
PTO

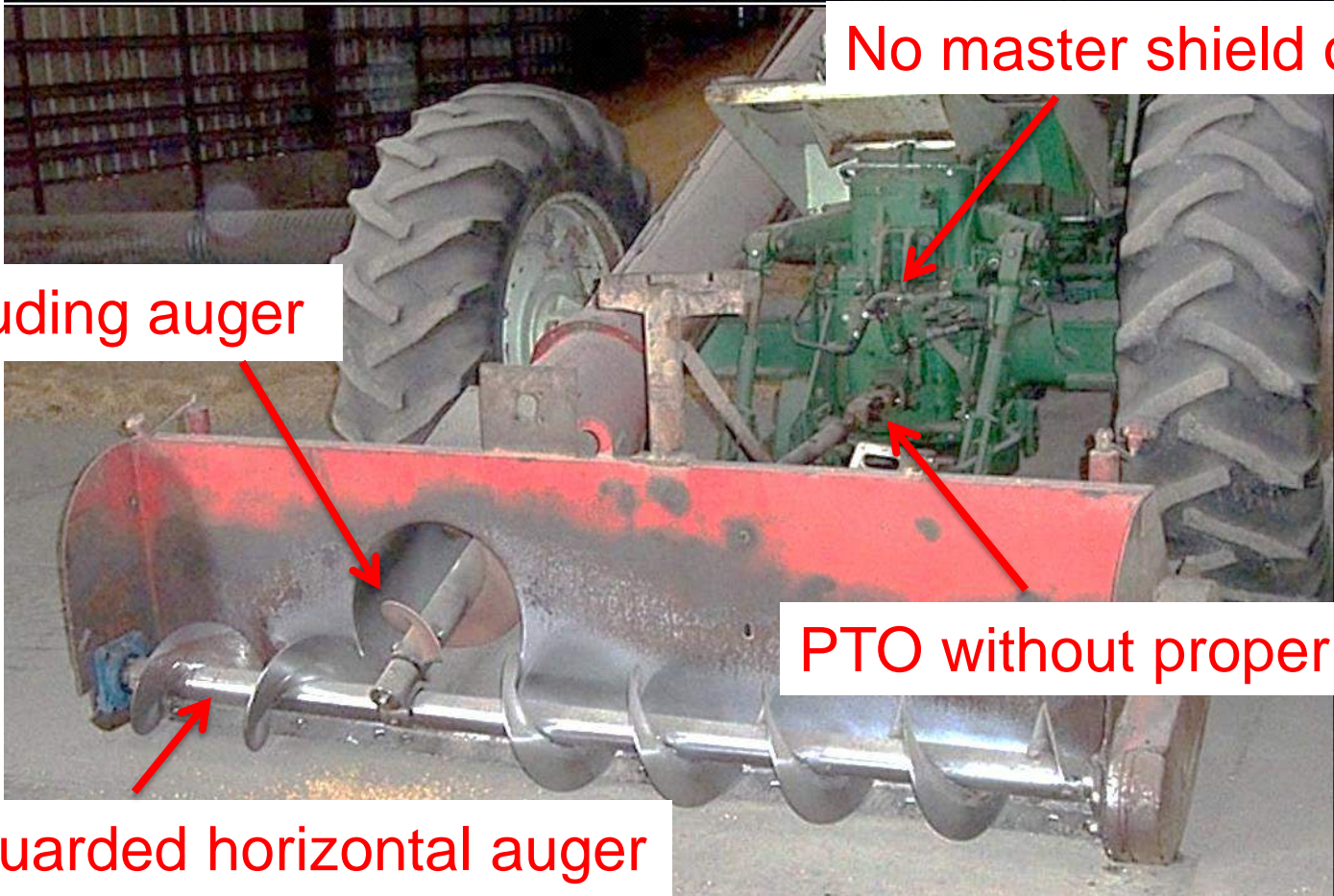


Has  
Multiple  
Types  
of  
Hazards





# Tractor Mounted Conveyor - Auger



No master shield on tractor

Protruding auger

PTO without proper shield

Unguarded horizontal auger



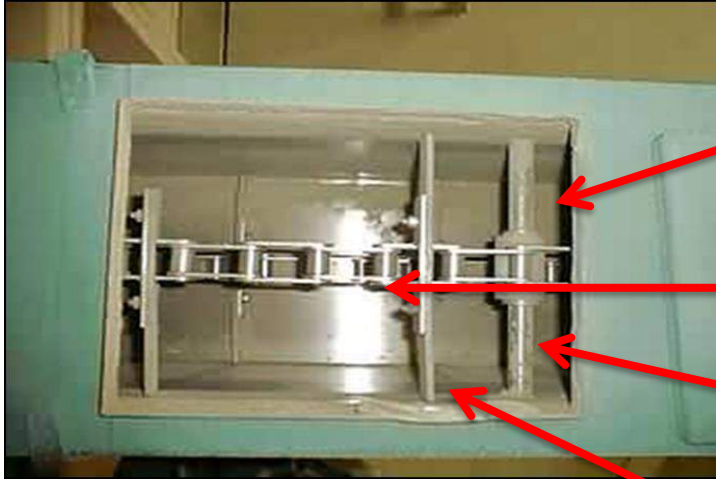
# U-trough Screw Conveyor



- “*Flighting*” - rotating helical screw blade
- Enclosed in tube or U-shape trough (cover across top of U)
- Moves liquid or granular material
- Stationary
- Auger (screw) much larger than portable ones



# Drag Conveyor



- Continuous loop of chain

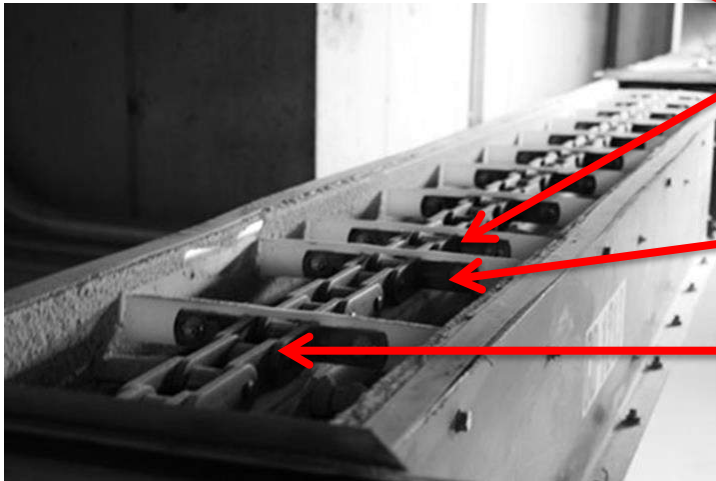
- Opening should have a shield
- Rotates on two or more sprockets

- Pinch Point

- “Paddles” on chain at 90 degree angles

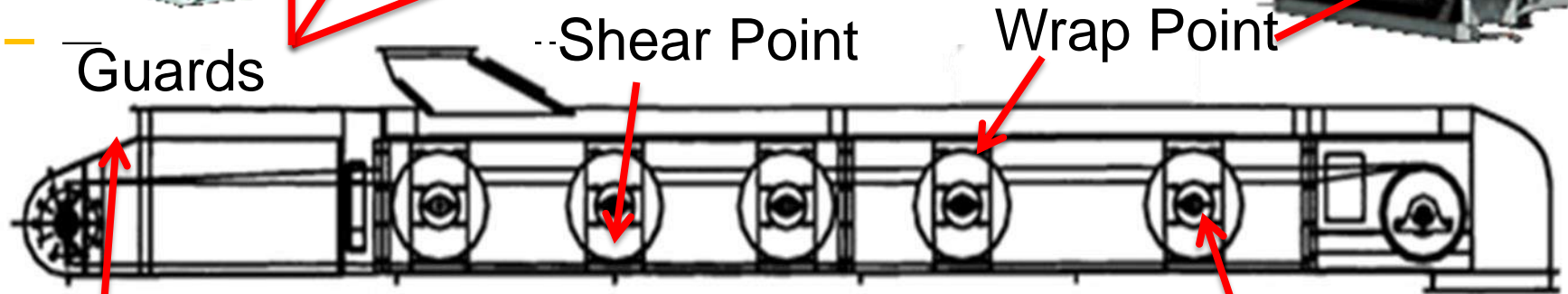
- Saddle Point
- Saddle Point holds material in place

- Chain “drags” material being moved
- Pinch Point

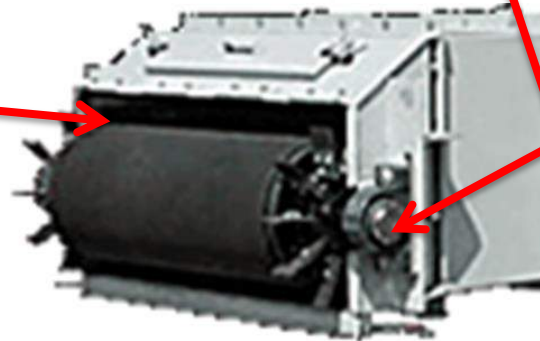




# Belt Conveyor



- Material on the belt
- Belt moves material
  - Can be high speed



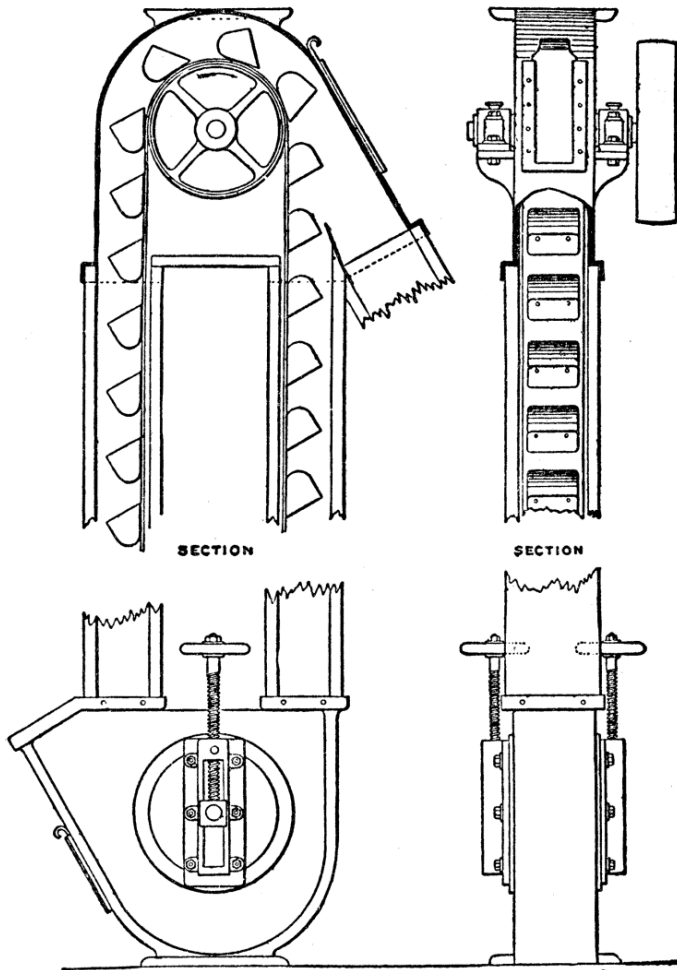
Pinch Point



# Grain Leg



# Grain Leg



Schematics - Courtesy of Florida Center for Instructional Technology  
at University of South Florida <http://etc.usf.edu/clipart/>





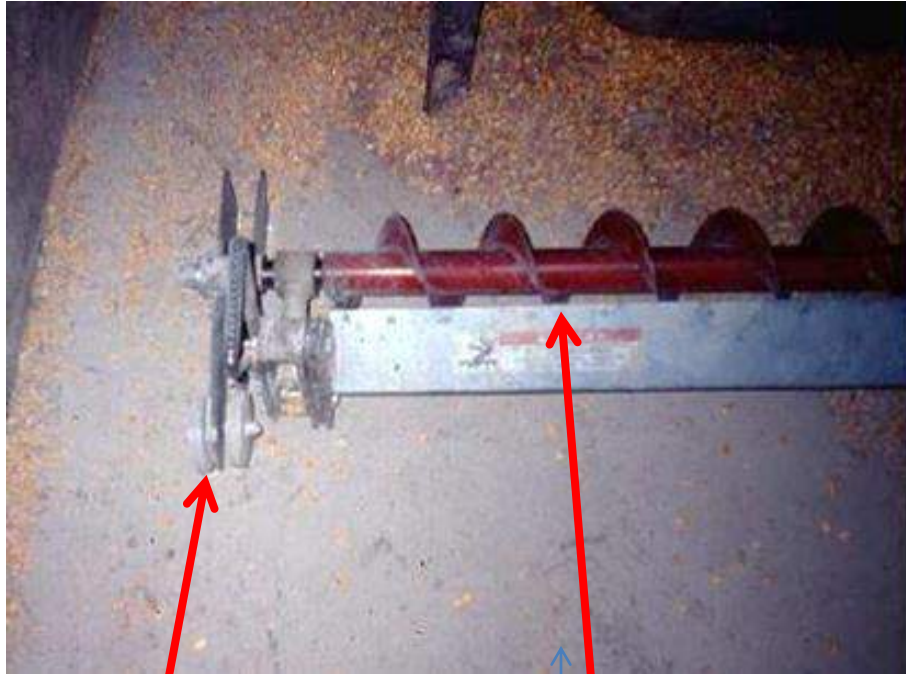
# Operating Sweep Auger w/ Stop



- Helps move grain to center sump for removal.
- Moves at differing rates of speed.
- Stop prevents sweep from more than one rotation.

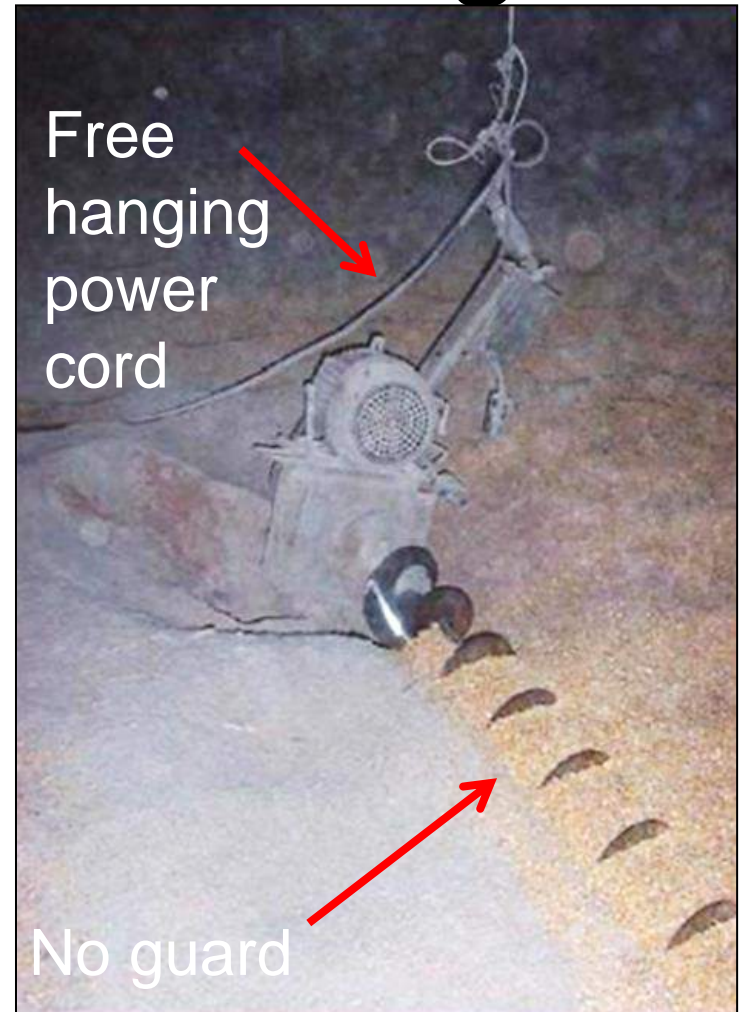


# Sweep Auger Guarding



Exposed  
drive  
mechanism

Inadequate guard

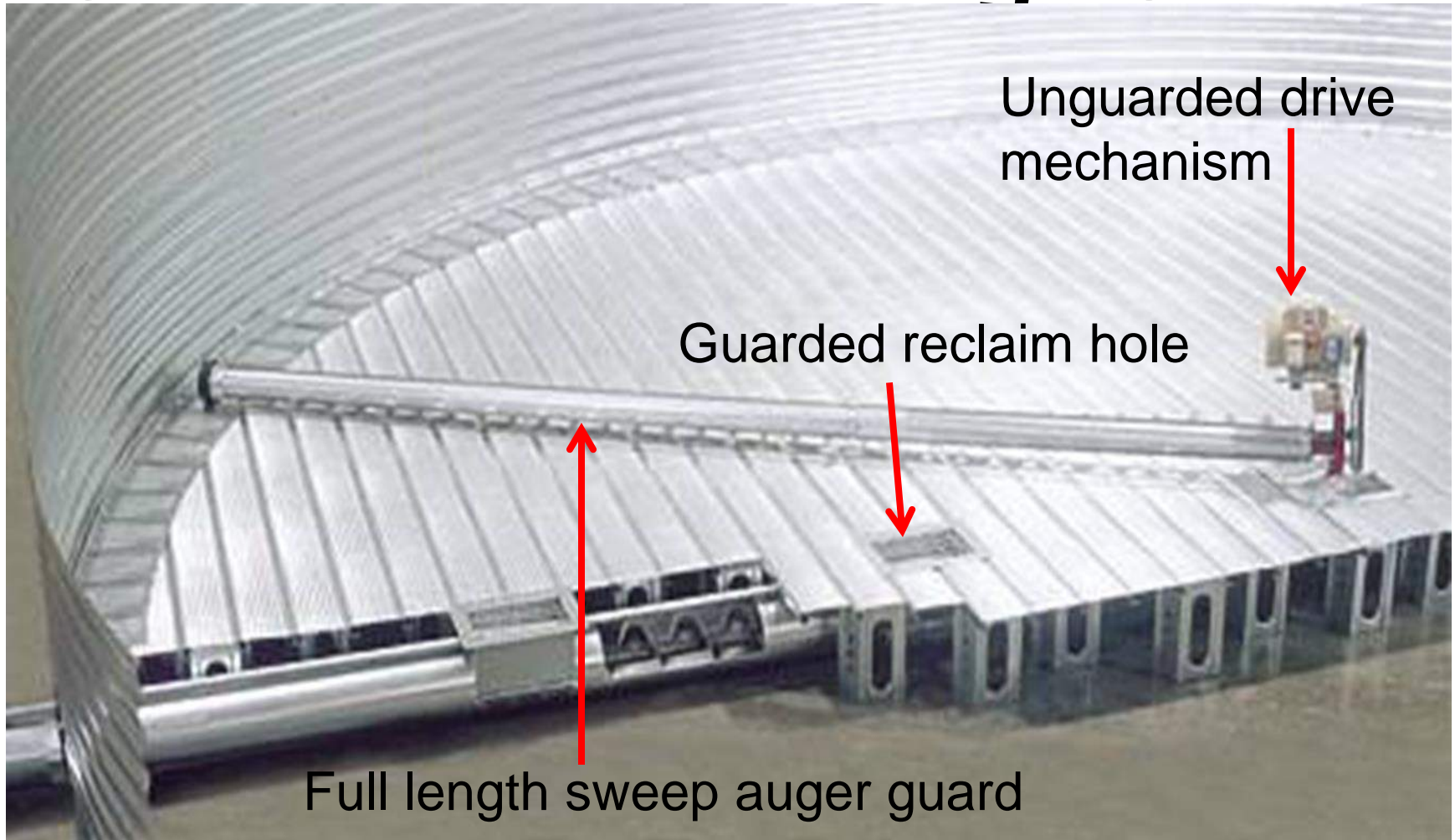


Free  
hanging  
power  
cord

No guard



# Under-floor Discharge Screw





# Power Supply Control Positioning



# Power Supply Control Positioning



# Incident Example



- Employee – sweeping grain to reclaim hole.
- Stepped over sump.
- Turned around.
- Stepped directly into the reclaim hole.
- Reclaim hole had no guard.
- LOST leg from mid-calf.





# Incident Example



Actual sump hole



Actual boot found in bin.  
NEVER found person's foot!



Guarded Reclaim Hole  
Removable Guard



Guarded Reclaim Hole  
Fixed Guard



# Summary – Common Machine Entanglement Hazards

## Pinch Points

- Belts
- Pulleys
- Chains
- Sprockets
- Gears

## Wrap Points

- U-Joints
- Couplings
- Keys & Keyways
- Shafts
- Augers
- PTOs

## Pull-in Points

- Feeders
- Gears
- “Teeth”

## Shear Points

- Augers
- Blades
- Cutter Bars
- Harvesters





# Summary - Specific Machine Hazards

## Conveyors

- Tractor - Belt
- Tractor - Auger
- Screw
- Drag
- Belt

## Grain Legs

- Buckets
- Chains
- Pulleys

## Sweep Augers

- Guarding
- Power Supply
- Reclaim Holes
- Worker Exposure



# Identifying Hazards

A tall, lattice-structured tower, possibly a telecommunications or observation tower, is positioned on a flat roof. The tower has a central vertical shaft with multiple rungs or ladders. At the top, there is a platform or basket. The tower is supported by several diagonal bracing cables. The background shows a blue sky with scattered white clouds. The roof surface is visible at the bottom, showing some equipment and structural elements.

# Identifying Hazards

- Knowledge
- Risk Assessment



**Safety is everyone's responsibility!**



# Knowledge

- Location of potential hazard points
  - Type of hazard
  - Know how machine works
  - Places of human contact with machine
  - Optimal vs “Real” working conditions

**Put  
knowledge  
into action!**

- Regulations/Policy
  - OSHA – 1910.272 & 1910.211-219
  - Other Regulations
  - Standard Operating Procedures (SOPs) and/or work instructions
  - Company Policy



# Risk Assessment

**Reflects both the likelihood harm will occur from exposure to a hazard and the severity of harm.**

- Active, Continual Process
- Severity & Frequency
- Corrective Action

**Protects people from harm!**



# Risk Assessment or Job Hazard Analysis (JHA)

A process to:

- Identify hazards
  - Who is exposed & how many
  - Where & why does it occur
- Assess risks to health & safety
  - Determine probability of occurring – improbable, remote, possible, probable, certain
  - Determine severity – trivial, minor, significant, major, severe, fatal





# Risk Assessment

- Identify & implement measures
  - Engineering Controls
    - Eliminate the hazard – **First Priority**
    - Substitution
    - Containment
  - Administrative Controls
  - Personal Protection Equipment (PPE) – Last resort
    - All other options are in place and there is still a risk
  - Regulatory requirements – MUST DO
  - BATNEEC – Best Available Technology Not Entailing Excessive Cost



# Summary - Identifying Hazards

## Know

- Location of Hazard Points
- Type of Hazard
- Regulations

## Risk Assessment

- Who, Where, Why
- Frequency & Severity
- Fix



A tall, white telecommunications tower stands against a blue sky with scattered white clouds. A worker is visible on a platform near the top of the tower. The tower is supported by several guy wires. In the foreground, the roof of a building with a grey, tiled surface is visible.

# **Preventive and Corrective Action**

# Preventive and Corrective Action

- Guarding
- Guarding devices
- Lock out/Tag out
- Preventive maintenance
- Visual safety information



# Preventive and Corrective Action

Proper Guarding and strict adherence to Lock Out/Tag Out procedures will prevent the majority of Entanglement hazards!



# Guard Definition

A barrier that prevents exposure to an identified hazard.

Maybe not  
THIS kind  
of guard!





# Machine Guarding Basics

- Point of operation
- Power transmission apparatus
- Moving parts

**If it moves and could cause injury it must be guarded! Best Practice for all.**



# Point of Operation

- Where the work actually takes place.
- Where a person comes in contact with the machine.

**Pile of corn?  
Or human foot?**

The machine

- Doesn't know
- Doesn't care

It just keeps on working.

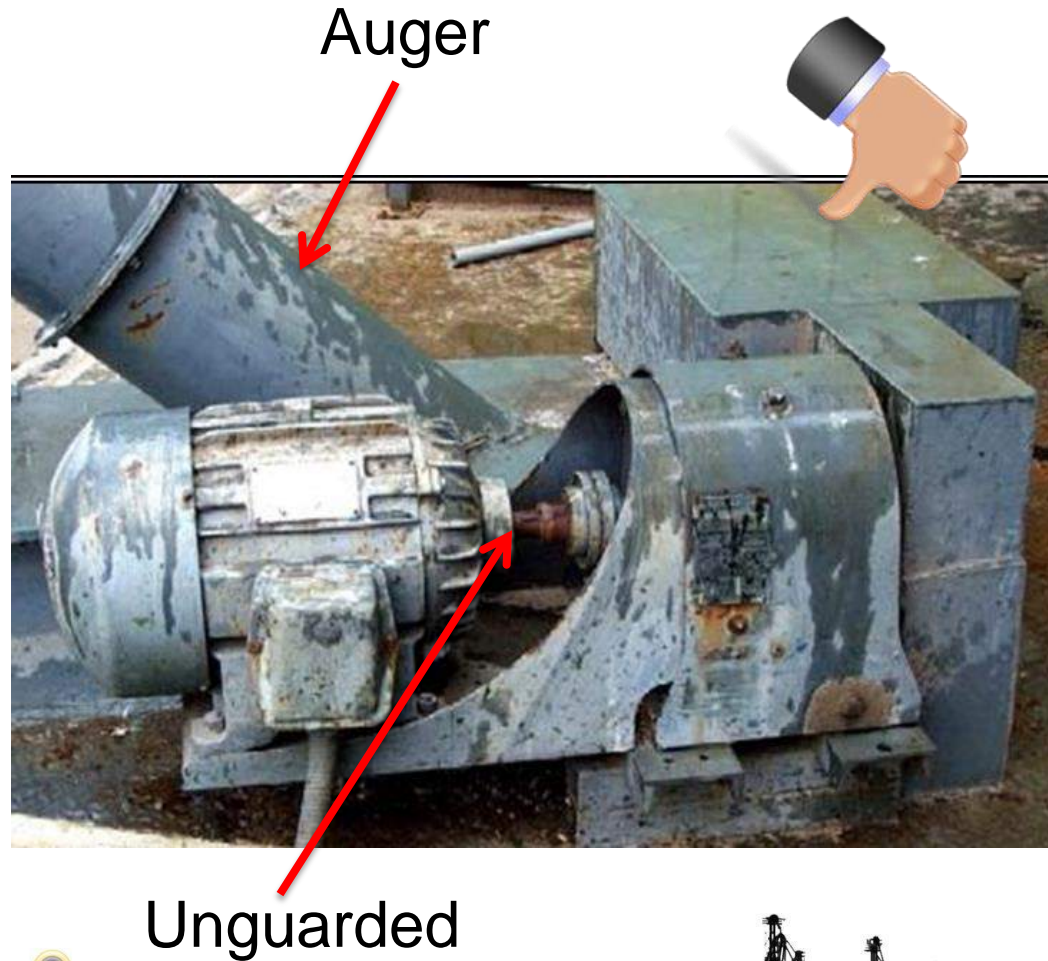


Unguarded Auger



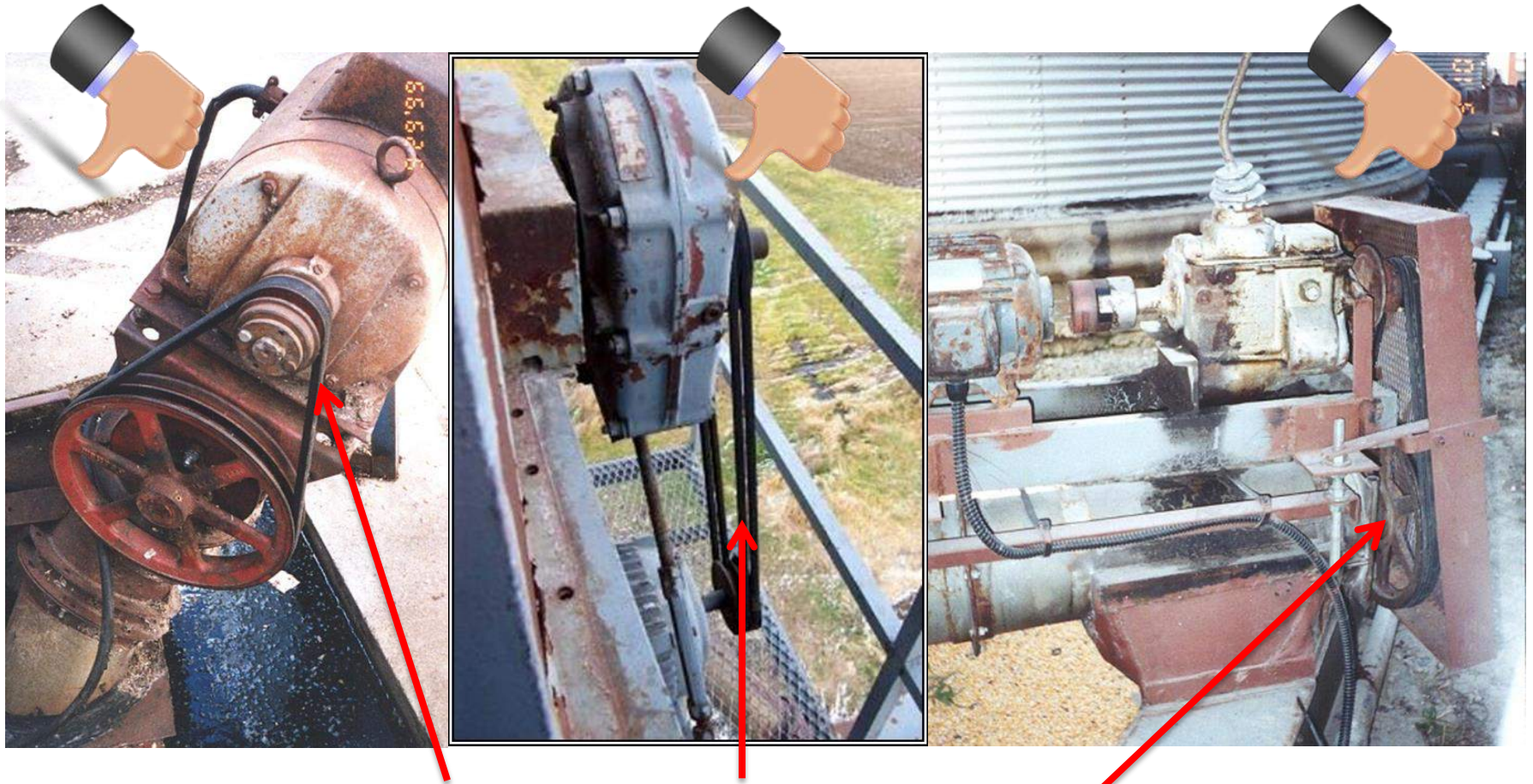
# Power Transmission Apparatus

- Carries power from its originating source (motor)
- Through mechanisms (belts, gears) to
- The point of operation.





# Power Transmission Apparatus



Unguarded belts and pulley



# Moving Parts



Unguarded  
Conveyor

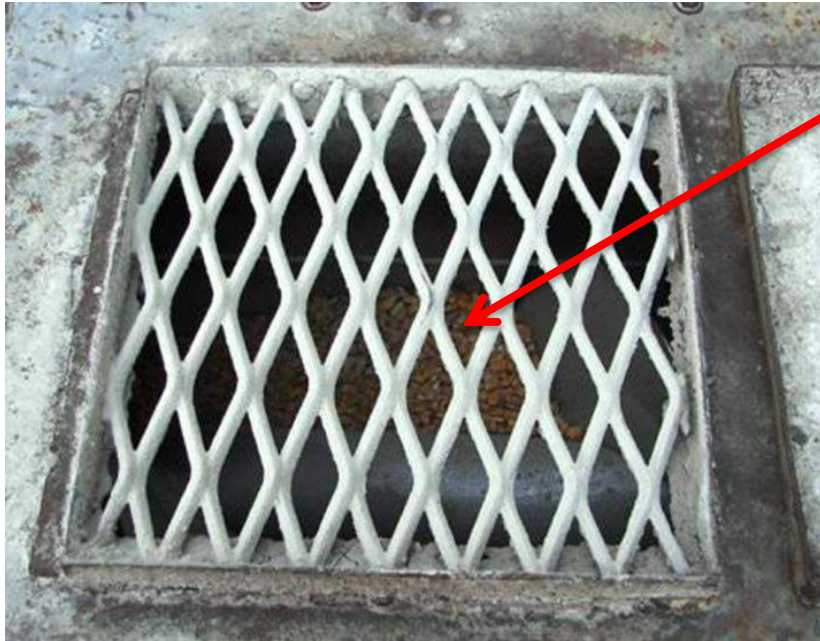


Guarded  
Conveyor



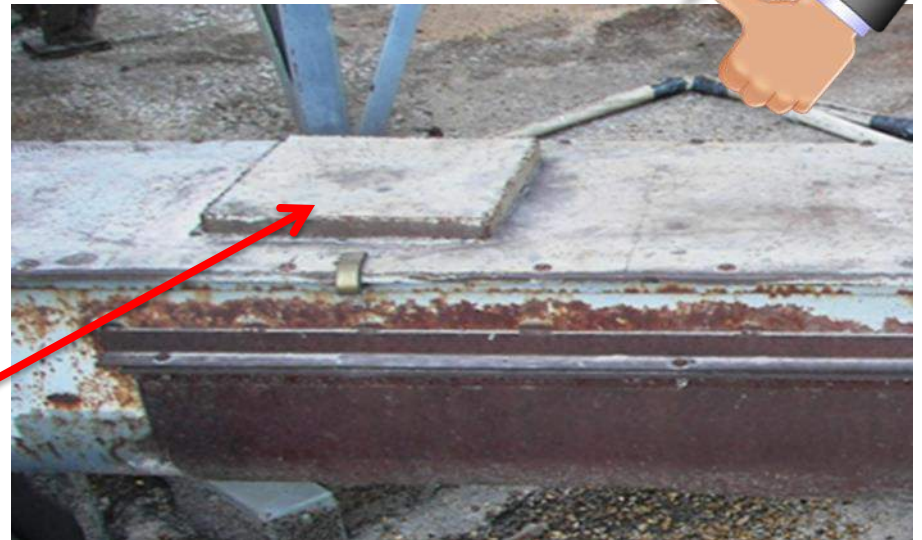


# Guarded Augers



Must not be able to reach moving parts – with body or tool.

No exposure to moving parts.



# Injury Example

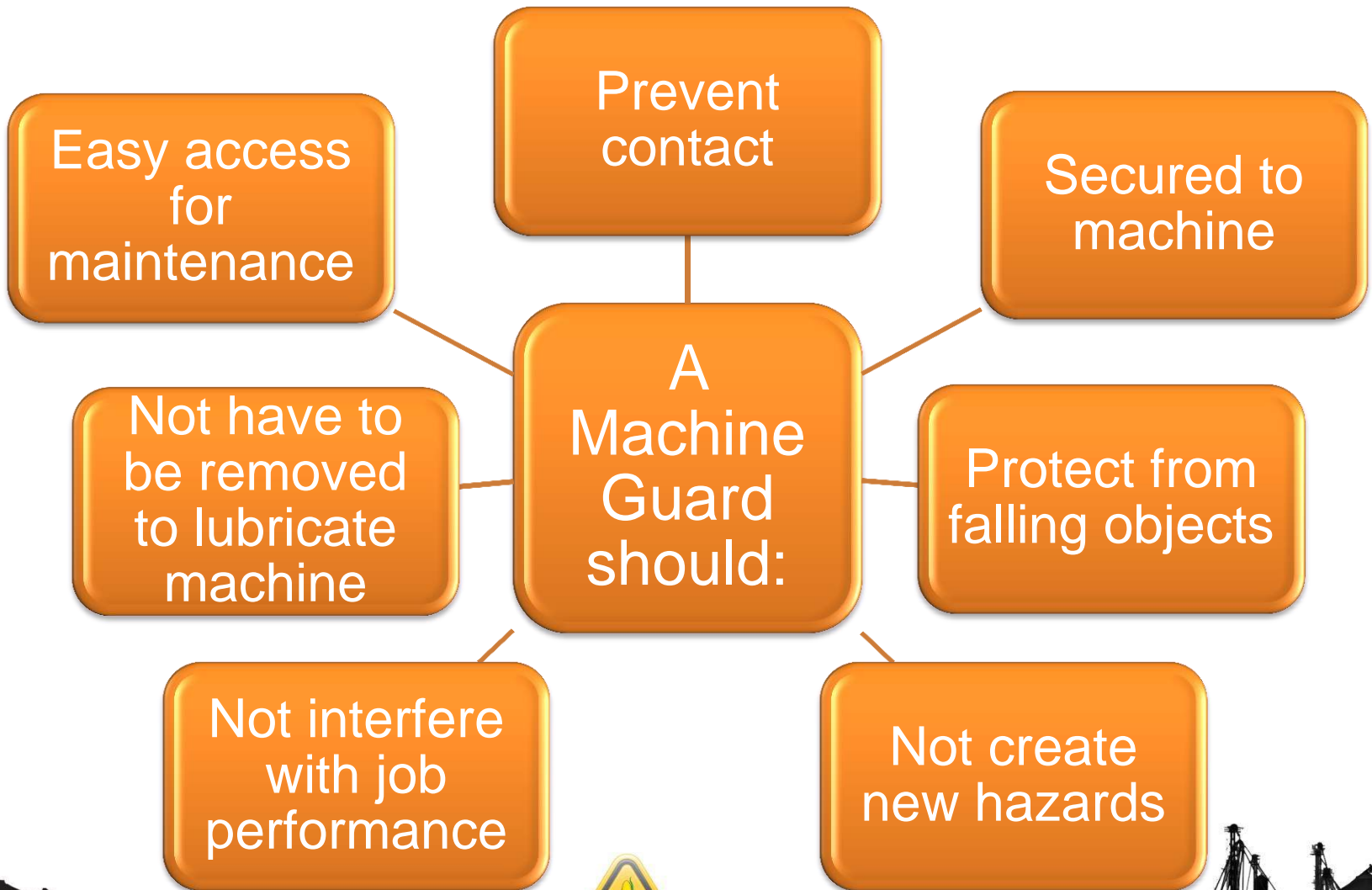
- Corn hung-up & not flowing to dryer from wet holding tank.
- Rod added to top of U-trough conveyor.
- Employee stood on conveyor operating rod.
- Inspection lid was off.
- Employee stepped back into the running screw auger.
- No one around to help.
- Lost inner half of foot.



# Injury Example



# Guard Requirements

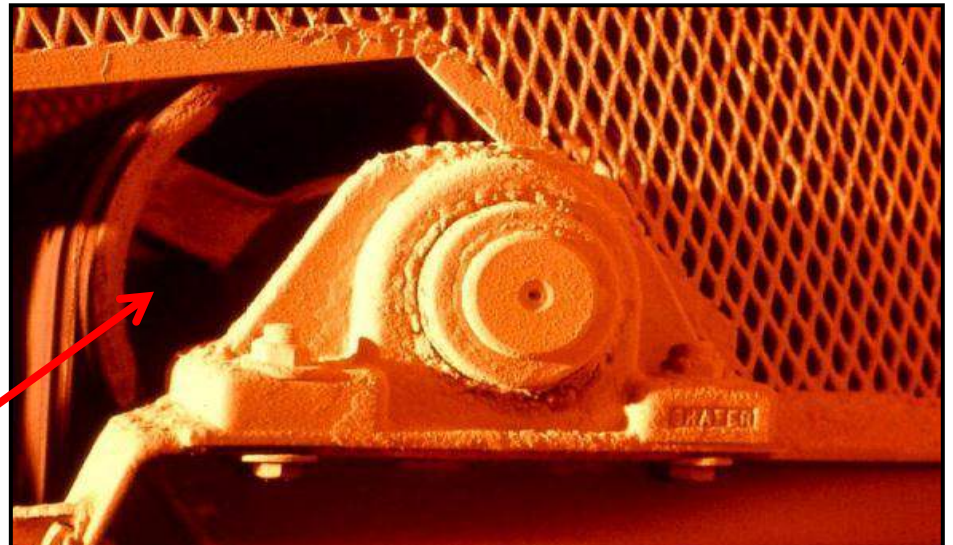




# Guard Requirements

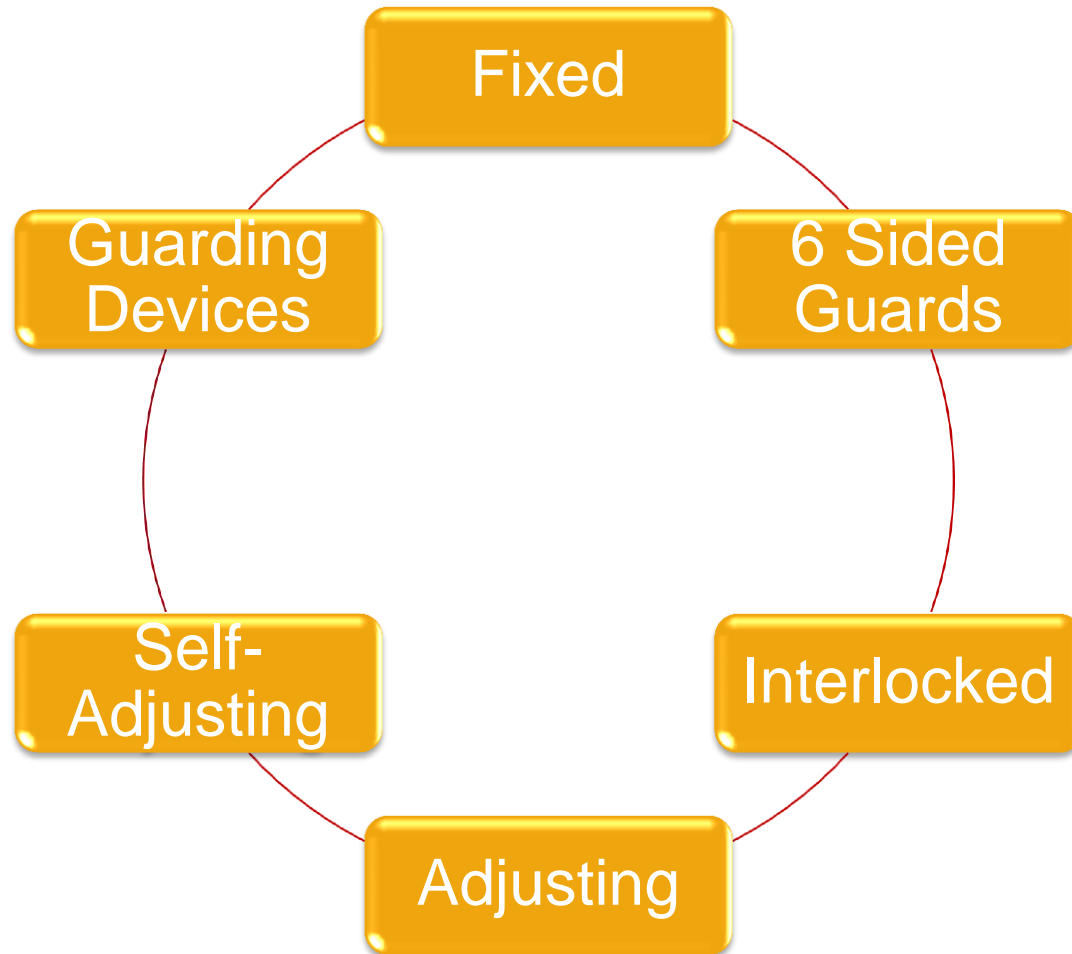
Guards should follow the “AUTO” Principle.

**A**round  
**U**nder  
**T**hrough  
**O**ver





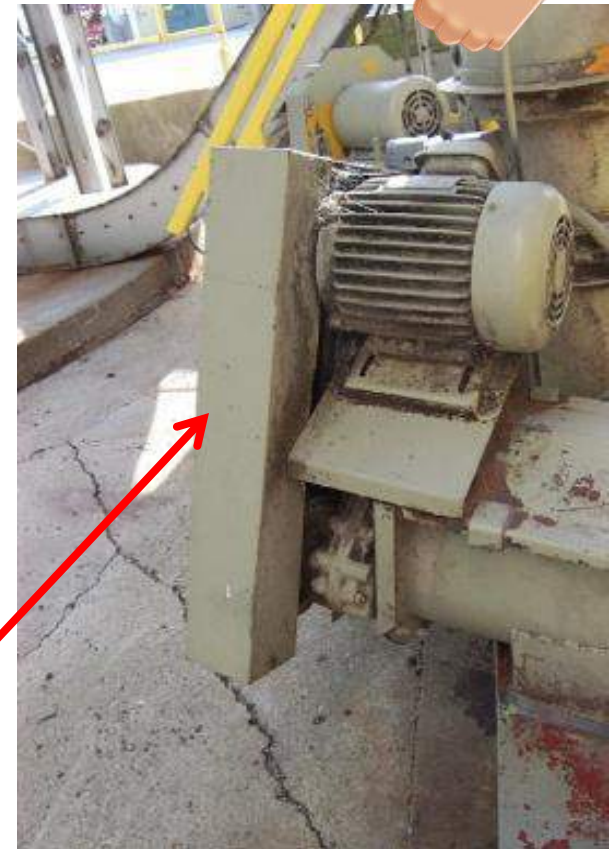
# Machine Guarding - Types



# Fixed Guard

- Permanent fixture – attached to machine
- Requires a tool to remove
- First Choice/Best Choice

Guard covering belt and pulley

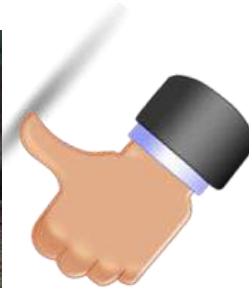


# Fixed Guards



# 6-Sided Guard

- Top
- Bottom
- Front
- Back
- Right Side
- Left Side



# Interlocked Guard



Shuts off or disengages power (to machine) when it is opened or pushed out of position.

Interlock





# Adjustable & Self-Adjusting Guard

- Requires operators to adjust guard to protect themselves
- Similar to fixed – attached to machine

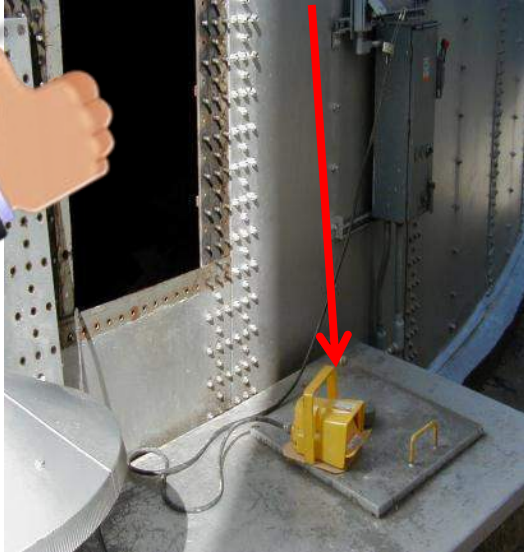


- Guard covers hazard area until moved by
- Material pushed into the point of operation.



# Guarding Device

## Pressure Sensing



- Interrupts machine's operating cycle
- Prevents workers from entering dangerous areas during machine cycles

## Location

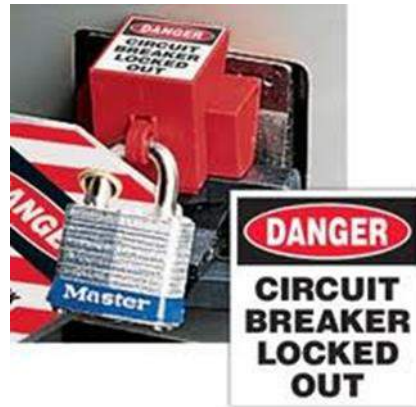


- Prevent access to hazard which cannot be guarded
  - Walls/Barriers/Fences
  - Height



# Lock Out/Tag Out – Try Out

- Protects Employees and You.
- Prevents start-up.
- BEFORE maintenance or service begins.
- Shut-off, de-energize & isolate ALL power sources.
- OSHA 1910.147 & others.



# Lock Out/Tag Out – Try Out

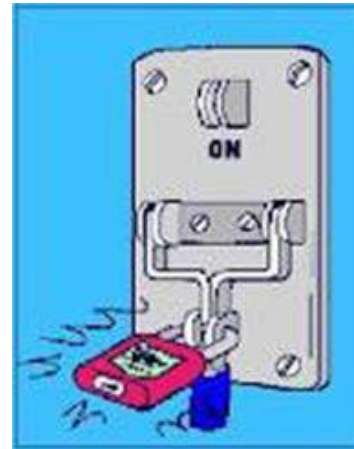
- Electrical cords, power tools, PTO's
  - Unplug & tag cords
  - Remove keys from ignition, pocket & tag





# Lock Out/Tag Out – Try Out

- Equipment & machines
  - Can have multiple energy sources
  - Can have locks from different people
  - Follow LOTO procedures!
  - Everyone must be trained!





# Lock Out/Tag Out – Try Out

**TRY OUT**  
**LOTO BEFORE**  
**BEGINNING**  
**WORK!**

**One Lock, One**  
**Key, One**  
**PERSON!**



**Best Practice for Everyone!**



# Preventive Maintenance

Regularly scheduled



According to manufacturer's  
recommendations



More frequent if needed



Prompt repair

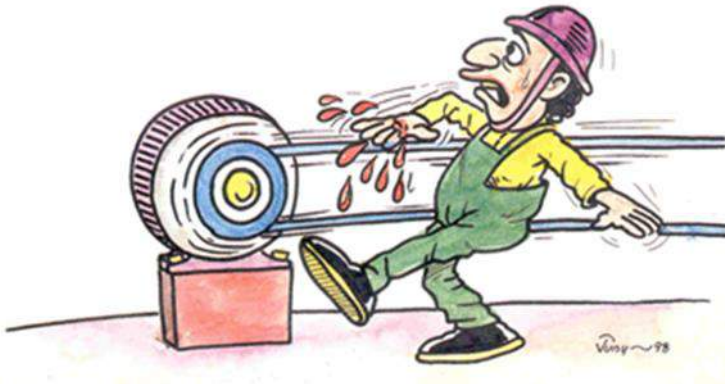


Certification record



# Visual Safety Information

- OSHA Required
- Signal Words
- Visual Safety & Pictorial Images
- Workplace posters (pictured here)



**Machines  
are safe**



**—when safety rules  
are followed**



# OSHA Requirements

- OSHA Regulations
  - 1910.145
  - 1926.200
- Signs and Tags
- ANSI Standards
  - Z535



Currently in both ANSI Z535.2 2011 and ANSI Z535.4 2011



Currently in both ANSI Z535.2 2011 and ANSI Z535.4 2011



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Currently in both ANSI Z535.2 2011 and ANSI Z535.4 2011



# Signal Words

 **DANGER**

- **Immediate** danger.
- Special precautions are necessary.
- High probability of serious injury or death.

 **WARNING**

- Hazard is present.
- Presents risk of injury or death.

 **CAUTION**

- Caution should be used against unsafe practices.
- Follow safety instructions.
- Less serious hazards.





# Visual Safety Signs

Pictorial images used with words.



OSHA compliant signs.



# **SUMMARY - PREVENTIVE AND CORRECTIVE ACTION**

**GUARD!  
DO NOT  
REMOVE  
GUARDS!**

**FOLLOW  
LOTO!**

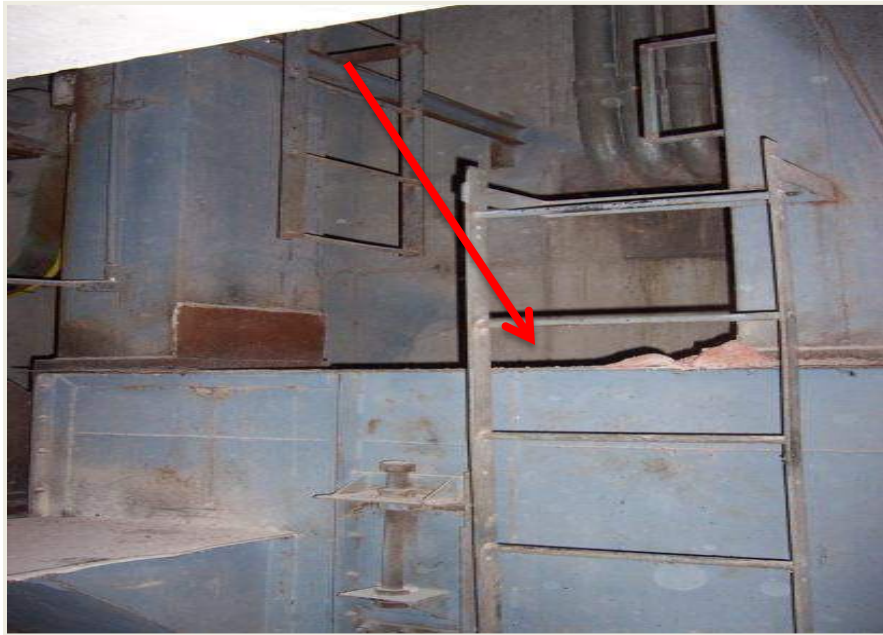
**NO EXCEPTION RULES!**



# Group Exercise



# Identify the Hazard(s) and Corrections

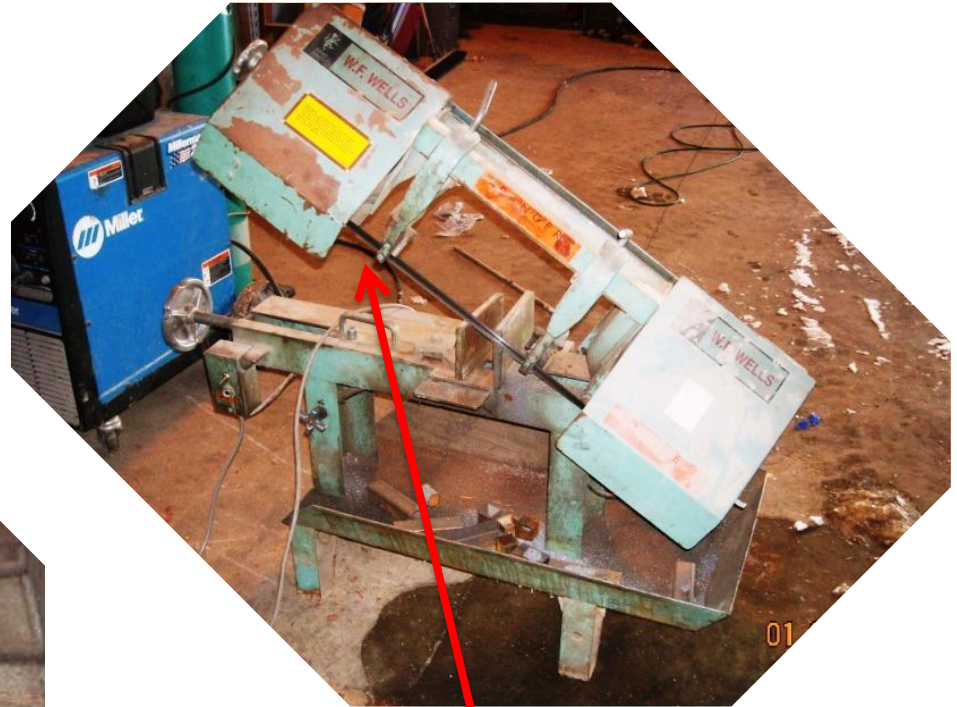
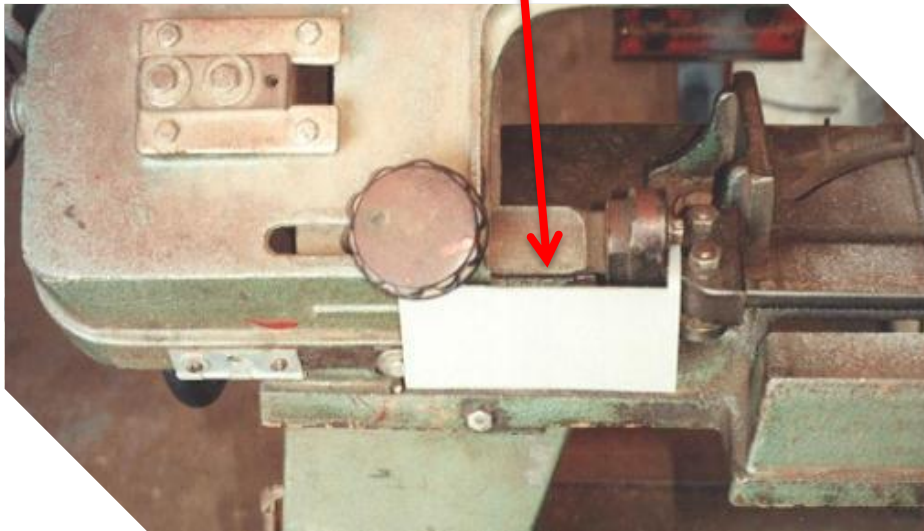




# Identify the Hazard(s) and Corrections



Guard





# Sweep Augers



# Sweep Auger Issue

How to use a sweep auger that:

- Meets OSHA criteria
  - OSHA standards 1910.272 & 1910.272(g)(1)(ii)
  - February 6, 2012 OSHA Letter of Interpretation on Sweep Augers
  - May 3, 2013 OSHA Memorandum - Grain Handling Facility Sweep Auger Enforcement Maintains safety of workers
- Allows for performance issues & tasks



# OSHA – Concerns

- Equipment that exposes workers to hazards must be:
  - De-energized
  - Energy source must be locked out
- Sweep augers may expose workers to hazards-unguarded or partially guarded.
- Employer must demonstrate worker is not exposed to hazards.



# Hazards per OSHA



- Entanglement
- Unable to turn off power to avoid injury
- Engulfment/Entrapment



# What is the issue per industry?

- Entanglement
  - Run sweep augers while worker is in bin to clean it out
  - Sweep augers move slowly
  - Workers go behind sweep
- Unable to turn off power to avoid injury
- Engulfment/Entrapment – minimal risk
  - Sweep augers run when bin is near empty





# Solution - SAMS

## 10 Points of Light

1. Evaluate bin for engulfment & atmosphere hazards before entry.
2. LOTO before entering bin to set up or dig out sweep auger.
3. Sump grate/guard in place & secure before operating sweep auger
4. Employees operating sweep auger cannot walk on grain that presents an engulfment hazard.
5. Sweep auger guards



# Solution - SAMS

## 10 Points of Light

6. A rescue trained and equipped observer.
7. Entering a bin with an energized sweep – use of engineering controls.
8. Auger must be provided with a positive speed control mechanism or bin stop device.
9. Workers are prohibited from using their hands, legs other similar means to manipulate the sweep auger while it is operating.
10. Maintenance/adjustments – LOTO.



# SAMs

## Specific Abatement Measures

1. Evaluate bin for engulfment & atmospheric hazards before entry.
  - a. From entry section of the standard.
  - b. Each time employee enters a bin hazards must be evaluated – by qualified person.
  - c. Employees not to enter until permit completed.
  - d. Producers – use bin entry checklist as guide.
  - e. No engulfment hazards.
  - f. No atmospheric conditions present



# SAMs

## Specific Abatement Measures



Dangerous Entry Condition

Evaluate  
Entry  
Hazards



Acceptable Entry Condition





# SAMs

## Specific Abatement Measures

### 2. LOTO before entering the bin to set up or dig out the sweep auger.

- a. Subfloor auger
- b. Grain entry points





# SAMs

## Specific Abatement Measures

### 3. Sump Grate/guard in place & secure before operating the sweep auger.

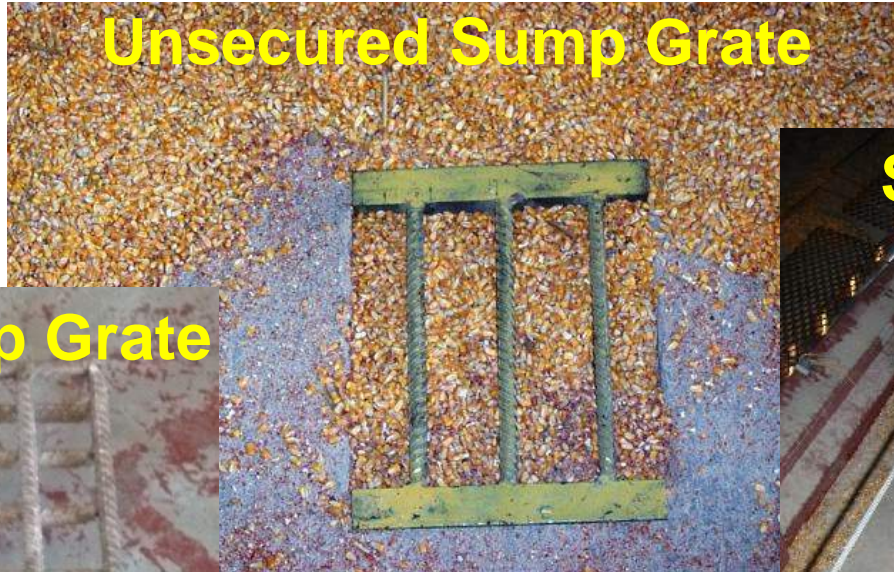
- a. Machine guarding Subpart O
- b. Difficult to secure
- c. Sumps – closed & LOTO



# SAMs

## Specific Abatement Measures

**Unsecured Sump Grate**



**Elevated Sump Grate**



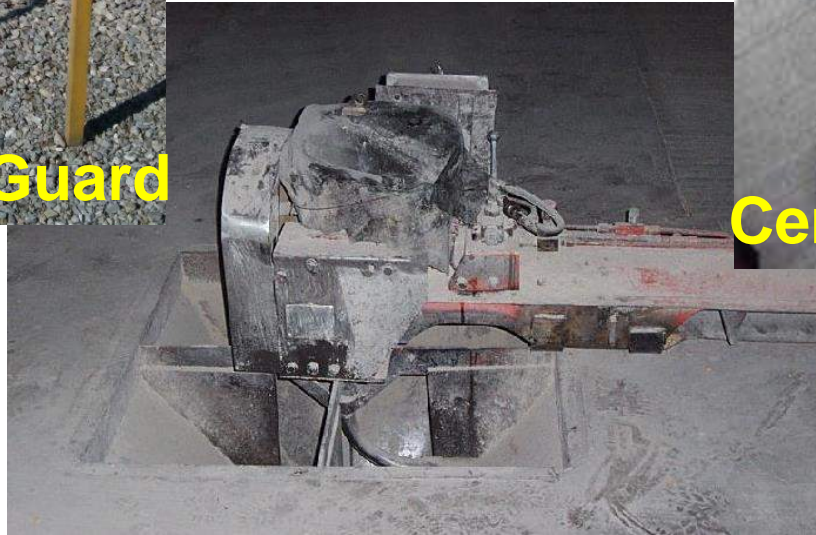
**Sump Grate**





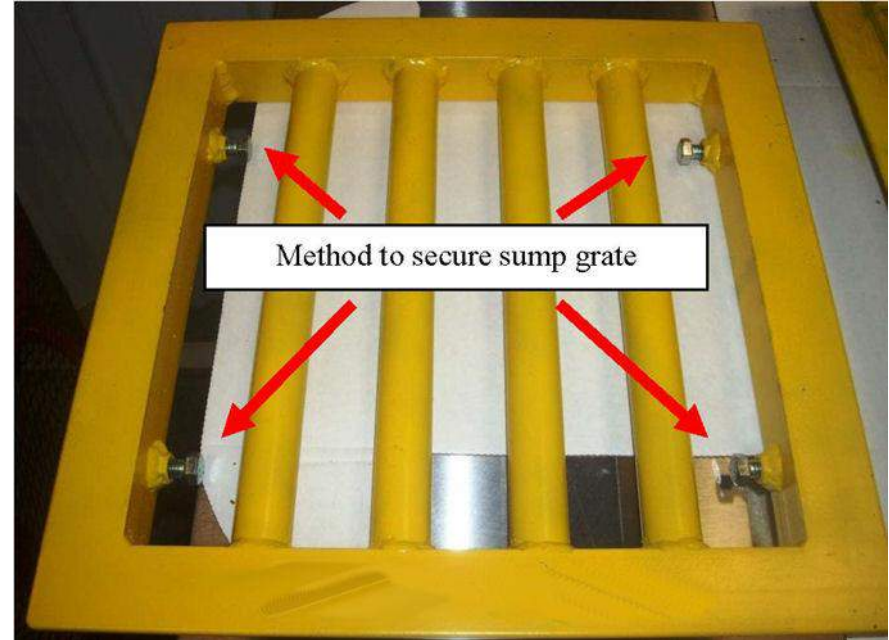
# SAMs

## Specific Abatement Measures



# SAMs

## Specific Abatement Measures



Custom made sump guards



# SAMs

## Specific Abatement Measures

### Subpart O

- 1910.217
- mechanical power press standard
- how far away employee needs to be in relationship to hazards

Distance Between Protective Covering and Moving Parts of Equipment	Maximum Vertical Opening (Horizontal Openings are Unlimited)
½ to 1 ½ inches	¼ inches
1 ½ to 2 ½ inches	⅜ inches
2 ½ to 3 ½ inches	½ inches
3 ½ to 5 ½ inches	⅝ inches
5 ½ to 6 ½ inches	¾ inches
6 ½ to 7 ½ inches	⅞ 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 ¾ inches
17 ½ to 31 ½ inches	2 ¼ inches
31 ½ inches to less than 7 feet	6 inches
More than 7 feet	Protective covering not required





# SAMs

## Specific Abatement Measures

4. Employees operating the sweep auger cannot walk on grain that presents an engulfment hazard.



# SAMs

## Specific Abatement Measures

### 5. Sweep Auger Guards

- a. Provided with guards per manufacturer's design.
- b. Guard that comes with sweep must be intact.
- c. Only part of sweep that can be unguarded is the point of operation.



# SAMs

## Specific Abatement Measures

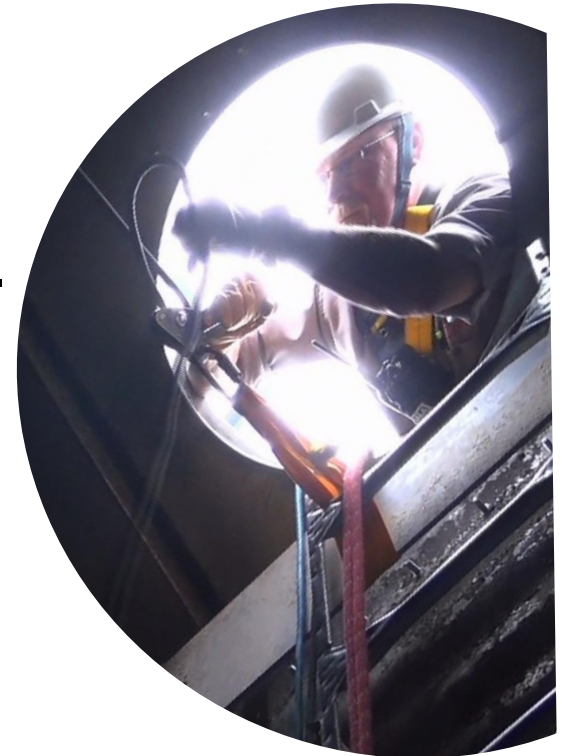


# SAMs

## Specific Abatement Measures

### 6. Observer must always be positioned outside bin.

- a. Rescue trained and equipped.
- b. Monitor activities of workers inside
- c. Trained in calling for help
- d. In constant communication with entrant –visual, voice, other.



# SAMs

## Specific Abatement Measures

### 7. Entering a bin with energized sweep auger.

- a. Must have engineering controls
  - i. Guard or device
  - ii. Prevents workers from coming into contact with energized sweep auger.
- b. Administrative controls only is not sufficient.
  - i. Company policy
  - ii. Is not acceptable means of protection by itself





# SAMs

## Specific Abatement Measures

### Engineering controls:

#### ■ Attached guard

- Prevents worker contact with unguarded portion of the auger.
- 1910 subpart O –chart from the 1910.217 mechanical power press standard.
- Tells how far away employee needs to be in relationship to the hazards.
- The farther the distance away from hazard the larger the opening can be on the guard.



# SAMs

## Specific Abatement Measures

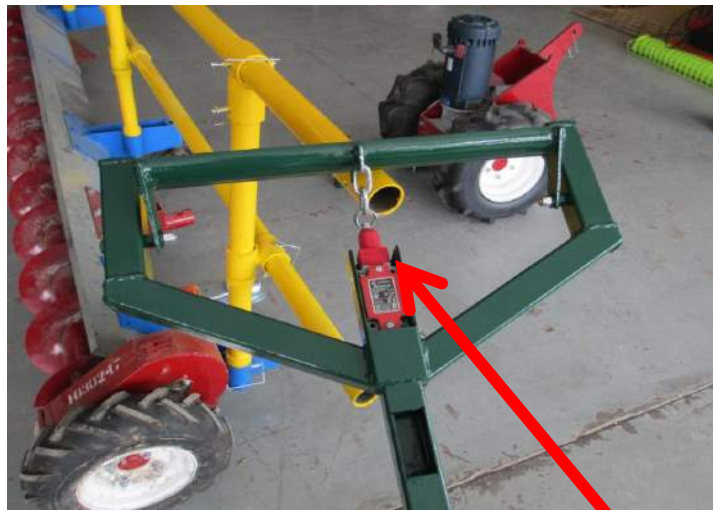
### Engineering controls:

- Equipped with a Control Mechanism
  - Dead-man switch or other similar device.
  - **Only** when operator is in contact with device should sweep operate.
  - Worker must be 7 feet from energized auger at all times.
  - Other workers must be protected by additional engineering controls.



# SAMs

## Specific Abatement Measures



Operator must be 7' from point of operation

**SASH**  
Sweep Auger Safety Handle

(Developed by COOP in Ohio)



Push bar has dead-man switch.

Device to prevent jackknifing  
push handle



# SAMs

## Specific Abatement Measures

### Engineering controls:

- Portable guardrails
  - Placed at least 7 feet behind sweep auger
  - **Comply with Subpart O**
  - Handrail complies with OSHA – 42” top rail & 21” mid-rail
  - Warning line & other easily removable devices not sufficient control.





# SAMs

## Specific Abatement Measures



Extends total length of auger



Meets guard rail requirements





# SAMs

## Specific Abatement Measures



“Snow fence” must  
comply with Subpart O



# SAMs

## Specific Abatement Measures



Safety Cage/Control Center



Dead-man foot switch



# SAMs

## Specific Abatement Measures

### 8. Auger must have positive speed control mechanism or bin stop device.

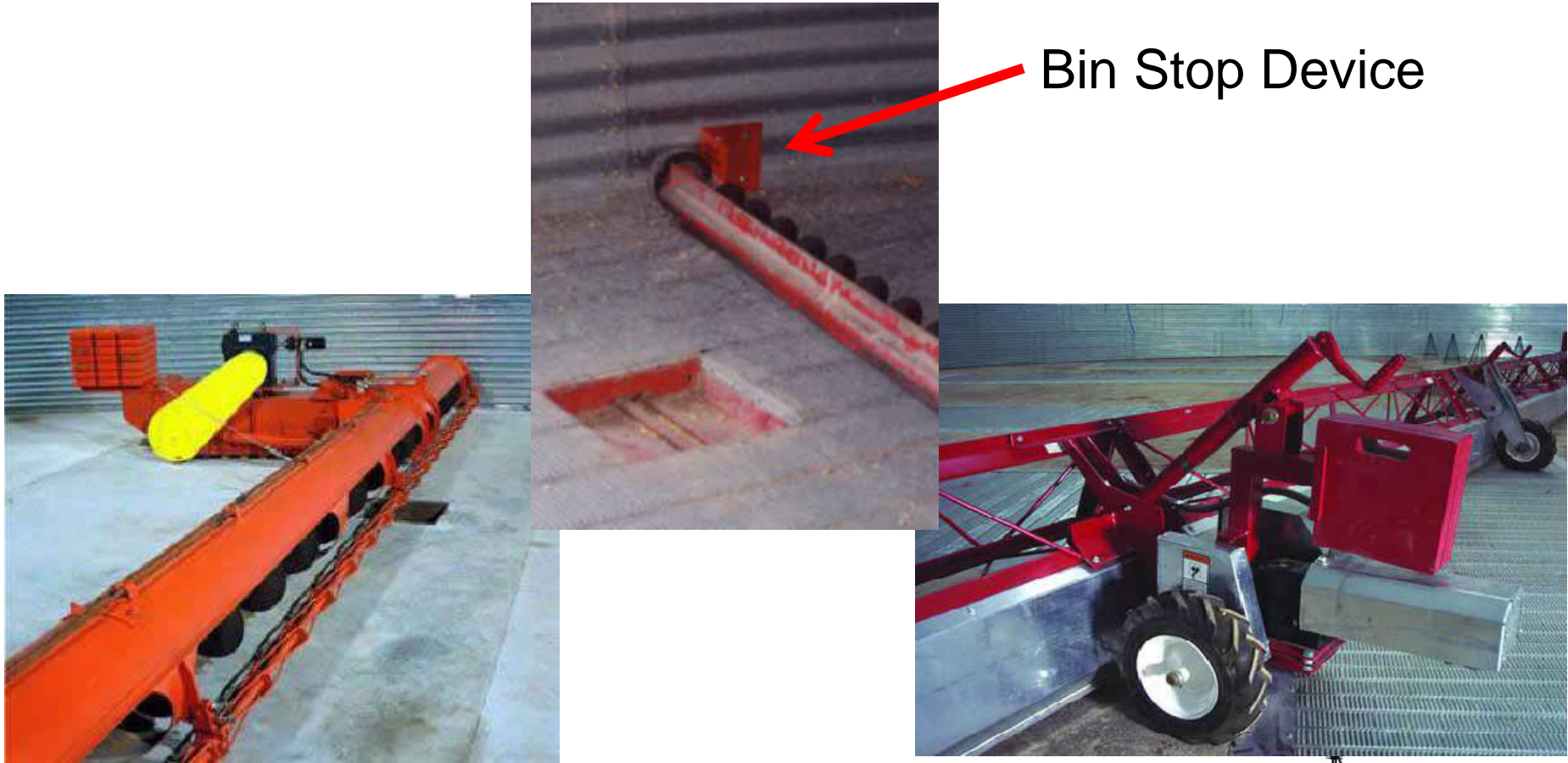
- a. Prevents uncontrolled rotation of the sweep auger.
- b. Hydraulically driven sweep auger is a positive speed control.
- c. Bin stop is for direct drive sweep augers.
- d. Bin stop located no closer than 7 feet from the bin entry point.





# SAMs

## Specific Abatement Measures



# SAMs

## Specific Abatement Measures

**9. Workers are prohibited from using their hands, legs, or other similar means to manipulate the sweep auger while it is operating.**

This is a common practice that must stop.





# SAMs

## Specific Abatement Measures

### 10. Maintenance or adjustments

- a. Sweep auger must be unplugged.
- b. Person making adjustments must maintain exclusive control of the plug.
- c. OR sweep auger must be LOCKED OUT and TAGGED OUT.



# Sweep Auger Non-Entry Procedure

Prepare de-energized sweeps for operation

- Enter bin
- Make adjustments
- Exit bin
- Start sweeps back up

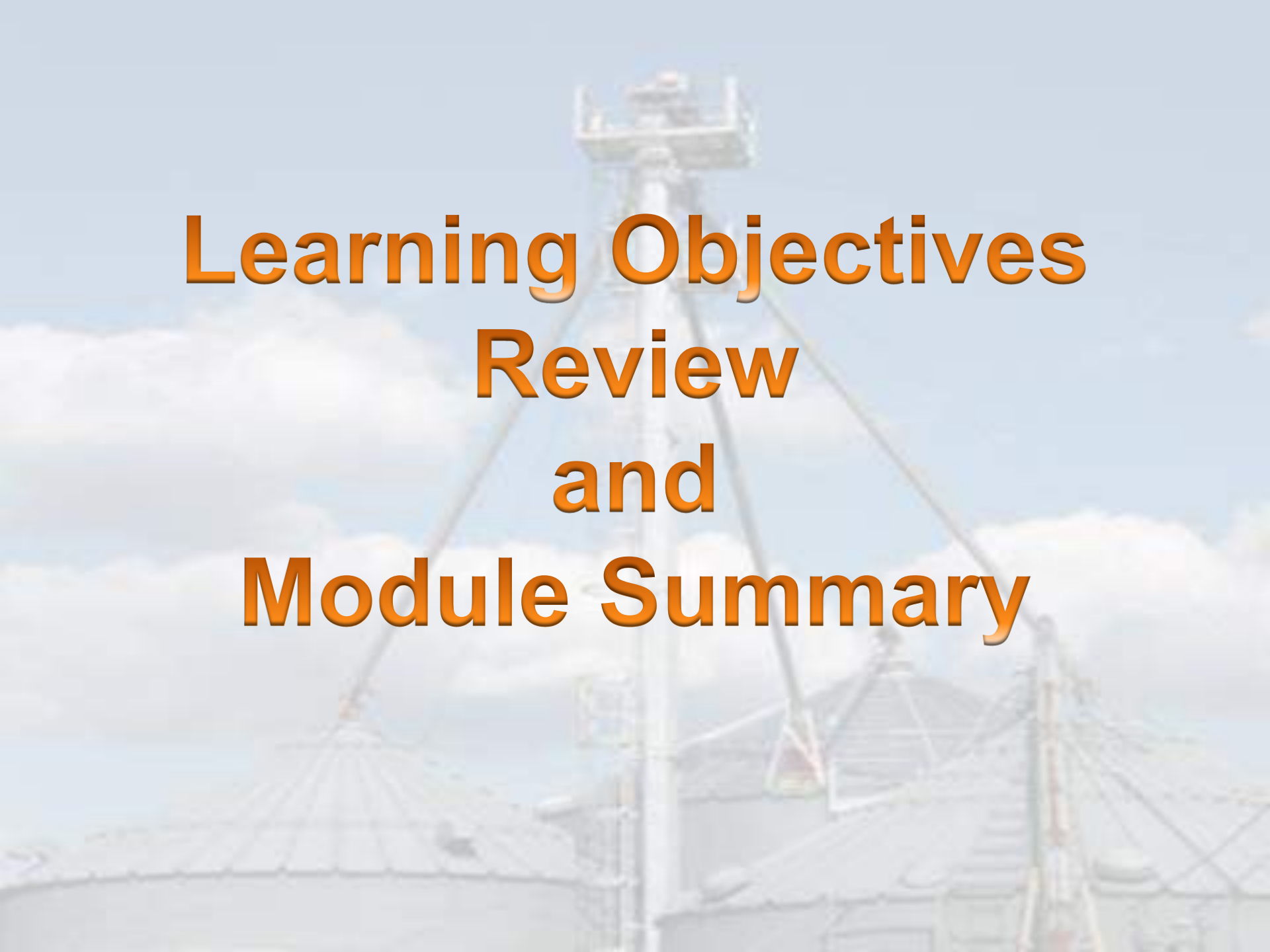
De-energize and lockout sweeps

- Exit bin
- Turn sweeps on
- Sweeps work until not effective

Sweep specified area

- De-energize sweeps
- Clean area
- Exit bin
- REPEAT PROCESS



The background of the slide is a faded, high-angle photograph of a telecommunications tower. The tower is a lattice structure with various antennas and equipment at different heights. It is surrounded by the rooftops of several buildings, which appear to be residential or commercial structures. The sky is blue with scattered white clouds. The overall image has a soft, out-of-focus quality.

# **Learning Objectives Review and Module Summary**

# Learning Objectives Review

**Identify** sources of entanglement & examples:

- Common machine hazards
- Specific machine hazards

**Explain** PTO hazards, factors that influence safety & prevention/abatement

- Wrapping, speed, visibility, exposed parts, shear, unsafe work practices
- Guarding, reaction time, LOTO, clothing/hair, safe work practices



# Learning Objectives Review

**Recognize** unsafe machinery & provide corrective action.

- Exposed hazards
- Identify & eliminate hazards – Risk Assessment
- Continuum of abatement strategies

**Two** most common causes of entanglement & characteristics of corrective action.

- Guarding – requirements, AUTO, type
- LOTO – written procedures, authorized person





# Entanglement Summary

- Discussed sources of entanglement
- Discussed PTO hazards
  - Oldest and most common machinery accident causing Entanglements.
- Introduced specific safe work practices
- Explored hazards of sweep augers & common work practices.
- Learned how to identify & prevent or correct hazards through risk assessments, proper guarding, LOTO, visual safety, & work practices



# Entanglement Summary

**ENTANGLEMENT HAZARDS CAN  
BE PREVENTED!**

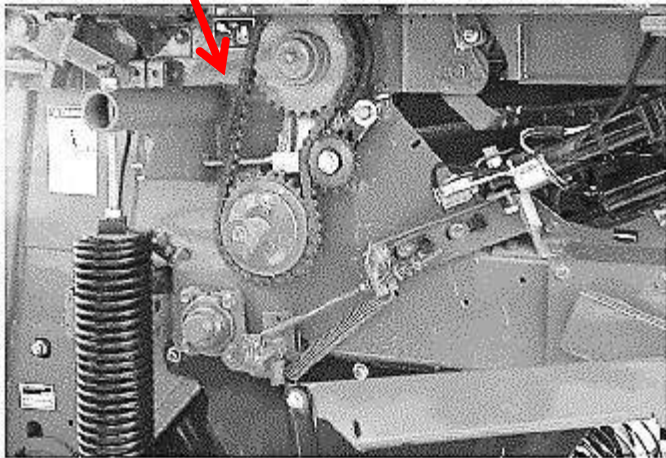
- **PROPER GUARDS ON MACHINES!**
- **FOLLOW LOCK OUT/TAG OUT!**
- **FOLLOW OTHER SAFETY  
PRECAUTIONS COVERED IN THIS  
MODULE!**



# Entanglement Hazards & Guarding Post-Test

**Directions: Circle the correct answer.**

**1. Which pictures show entanglement dangers?**



A. Gears

**YES**

**NO**



B. Catwalk

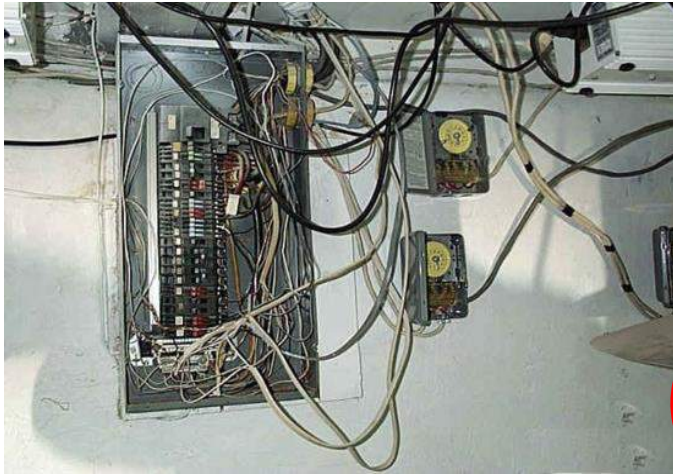
**YES**

**NO**



# Entanglement Post-Test, cont.

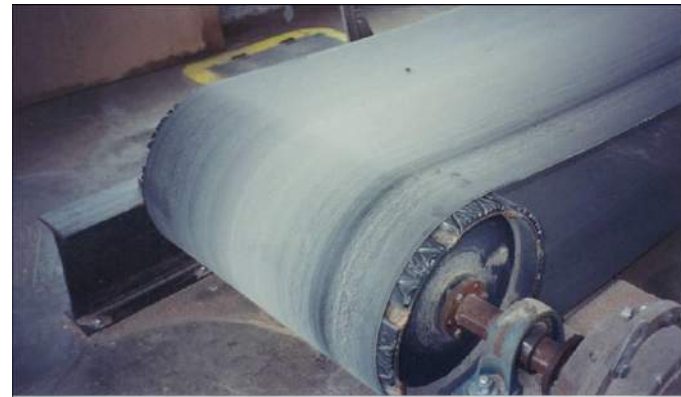
Which pictures show entanglement dangers?



C. Electric Panel

**YES**

**NO**



D. Belt conveyor

**YES**

**NO**



# Entanglement Post-Test, cont.

Which pictures show entanglement dangers?



**YES**

**NO**

E. Electric Panel



**YES**

**NO**

F. Screw conveyor

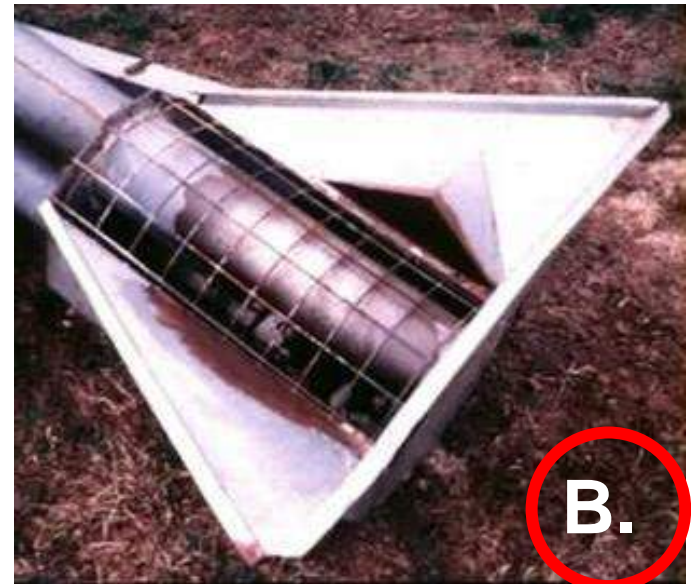




# Entanglement Post-Test, cont.

Circle the best way to prevent the entanglement danger.

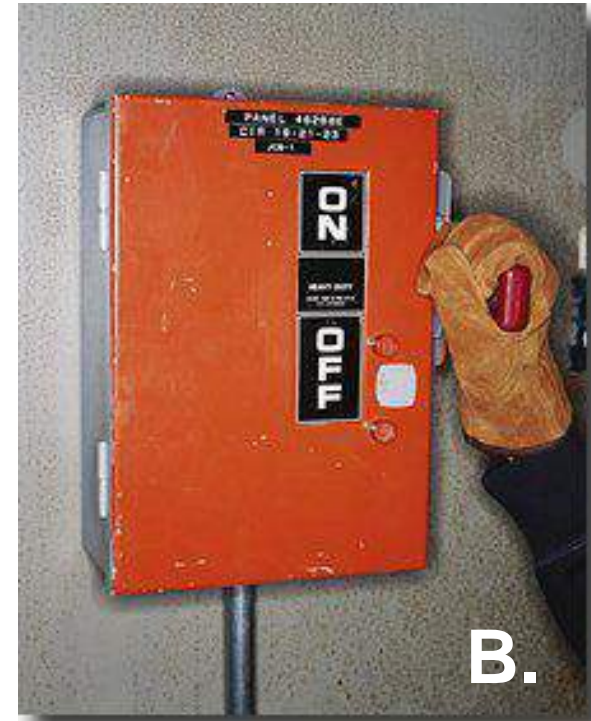
2.



# Entanglement Pre-Test, cont.

Circle the best way to prevent the entanglement danger.

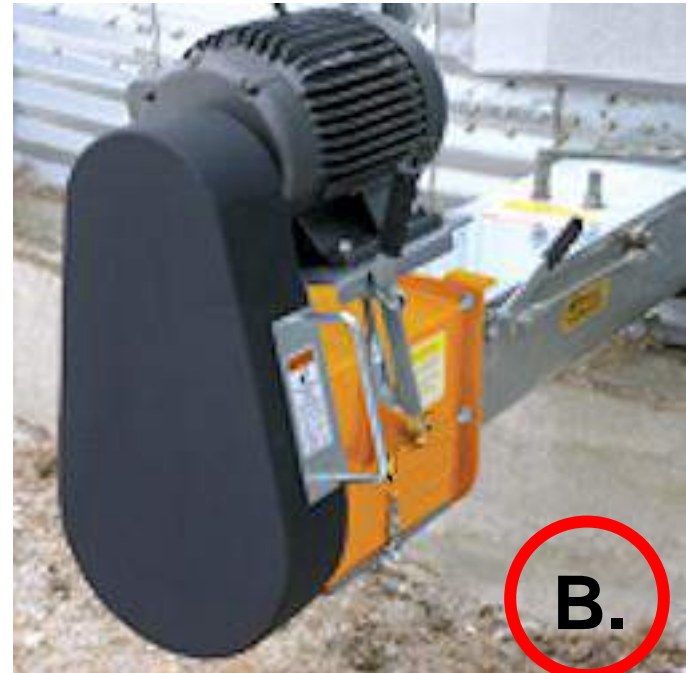
3.



# Entanglement Pre-Test, cont.

Circle the best way to prevent the entanglement danger.

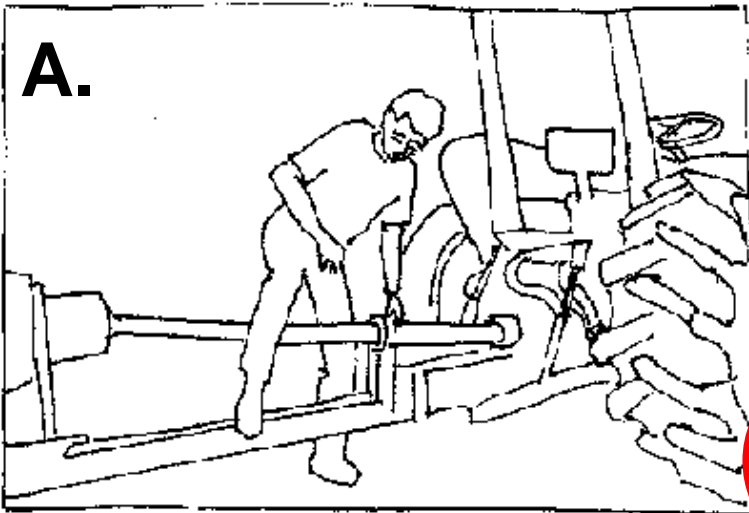
4.





# Entanglement Pre-Test, cont.

5. Is this safe?



YES

NO



YES

NO



# Entanglement Post-Test, cont.

5. Is this safe?



YES

NO



YES

NO





# Entanglement Pre-Test, cont.

5. Is this safe?



YES

NO



YES

NO



# Entanglement Pre-Test, cont.

5. Is this safe?



YES

NO



YES

NO



# Thank you to our Supporters

The Grain Handling Safety Coalition wishes to extend our thanks and appreciation for supporting our efforts by allowing us to use their photos to the following:

- Grain and Feed Association of Illinois (unless noted below or from a government site all photos are theirs).
- The GSI Group, Inc. - slides, 44, 45, 90
- Brock Grain Systems - slides 42 & 80

Photos are used with the permission of the owners.



# Reference Citations

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<http://photobucket.com/images/>
- Unless otherwise noted, pictures are from John Lee of Grain and Feed Association of Illinois
- US Chemical Board
- OSHA
- Brock used with permission
- GSI used with permission





# Risk Assessment Resources

1. OSHA – Job Hazard analysis workbook  
<http://www.osha.gov/Publications/osha3071.pdf>
2. OSHA – Conducting a Job Hazard Analysis –  
<http://www.oshatrain.org/courses/studyguides/706studyguide.pdf>
3. OSHA Safety and Health Program Evaluation Profile -  
<http://www.osha.gov/dsg/topics/safetyhealth/pep.html>
4. Job Hazard Analysis - [https://www.rit.edu/~w-outrea/training/Module2/M2\\_JHA.pdf](https://www.rit.edu/~w-outrea/training/Module2/M2_JHA.pdf)
5. JHA - [https://www.osha.gov/dte/grant\\_materials/fy07/sh-16625-07/worksitehazanalysis2.ppt](https://www.osha.gov/dte/grant_materials/fy07/sh-16625-07/worksitehazanalysis2.ppt)
6. Job Hazard analysis form NASA - [http://server-mpo.arc.nasa.gov/Services/NEFS/GSFC\\_PDFData/GSFC23-60.pdf](http://server-mpo.arc.nasa.gov/Services/NEFS/GSFC_PDFData/GSFC23-60.pdf)
7. Job Safety Analysis templates UCLA - <http://jsa.ehs.ucla.edu/>
8. JHA – Washington State – good  
[http://www.ini.wa.gov/Safety/TrainTools/Online/Courses/courseinfo.asp?P\\_ID=188](http://www.ini.wa.gov/Safety/TrainTools/Online/Courses/courseinfo.asp?P_ID=188)

