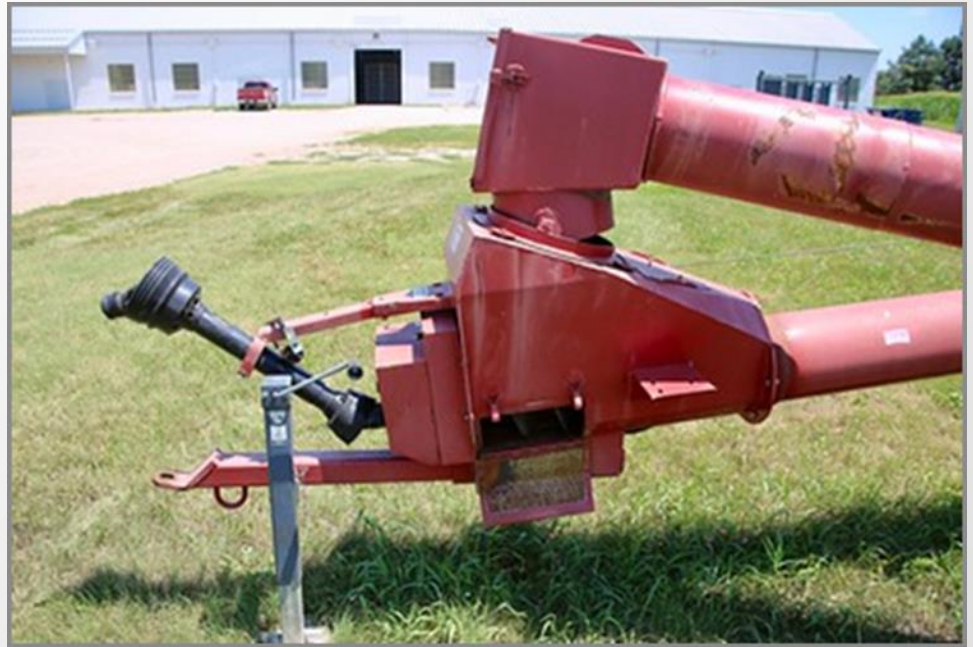




# Webinar Series

Presented By: Aaron Yoder, PhD  
Associate Professor, UNMC/CS-CASH





# Machine Guard Makeover

Tips on effective machine guarding



# Employee Rights

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Employees are entitled to:

- ▲ Safe & healthy working conditions
- ▲ Fair compensation for all hours worked
- ▲ Report unsafe conditions without retaliation

Employers are responsible for providing a safe workplace.

Info at [www.osha.gov](http://www.osha.gov) & [www.whistleblowers.org](http://www.whistleblowers.org)



# Course Overview

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There are a variety of potential machine hazards present in grain handling. Sound machine guarding and safeguarding practices, together with an effective energy control program (lockout/tagout), can help employers to control these hazards. This overview covers the fundamental principles of machine guarding and safeguarding, and the related OSHA General Industry Standards.



# Webinar Objectives

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

-  Summarize core principles of general machine guarding & safeguarding
-  Identify machine guarding hazards in the workplace
-  Apply corrective actions and prevention strategies to hazards



# Topics/Sections Covered

- ▲ Machine Hazards - Overview
- ▲ Guarding Principles
  - ◆ What makes a guard effective
- ▲ Identifying Hazards at Work
- ▲ Makeover - Successful Correction & Prevention Strategies



UNMC





Overview

# Machine Hazards





# Importance of Machine Guarding

- ▲ Machine related injuries – often severe or fatal
  - ◆ Crushed hands/arms, feet
  - ◆ Severed fingers, limbs
  - ◆ Blindness
- ▲ Preventable & needless





# Where Machine Hazards Occur



- ▲ Point of Operation
- ▲ Power transmission apparatus
- ▲ Moving Parts

If it moves and could cause injury it **MUST** be guarded.



# Point of Operation



Where work is performed, bore, and form stock (material)

- ◆ Move material (auger)

▲ Danger

- ◆ Cannot always be guarded

- ◆ Does not differentiate
  - ▶ Material vs body part



# Power Transmission Apparatus

All mechanical components that transmit energy to part of machine performing work

## ▲ Components

- ◆ Flywheels
- ◆ Pulleys, belts
- ◆ Chains, cranks, gears
- ◆ Connecting rods
- ◆ Couplings
- ◆ Cams, spindles

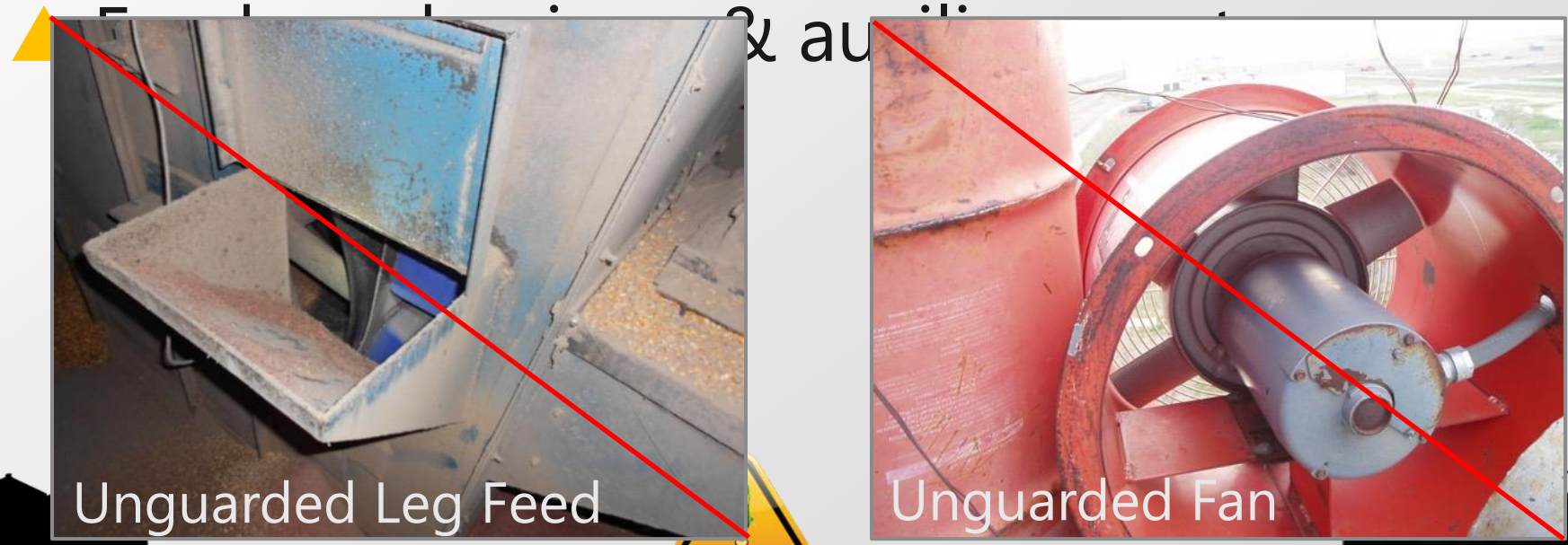




# Moving Parts

Parts of a machine that move while machine is working.

▲ Reciprocating, rotating, transverse movement



# Types of Machine Hazards

- ▲ Pinch point
- ▲ Wrap point
- ▲ Pull-in point
- ▲ Shear point
- ▲ Crush point
- ▲ Burn point
- ▲ Free wheeling part
- ▲ Stored Energy
- ▲ Thrown objects



# Pinch Point

Two machine parts move together and one of the parts moves in a circle.

- ▲ Power transmission systems
- ▲ Belt drives, chain drives, gear drives





# Wrap Point

Any rotating machine part such as shafts or rods. Example: PTO

- ▲ Wrap in direction shaft turns
- ▲ Hazard increases with damaged/dirty shaft



PTOs - oldest, most common machinery hazards.



# Wrap Point Hazard Protection

## PTO Stub

- Transfers power from the tractor to the machine
- Rotates at 540 rpm (9 times/sec.) or at 1,000 rpm (16.6 times/sec.)
- Some tractors have a stub shaft guard that screws onto the PTO stub.

## Master Shield

- Protects the operator from the PTO stub
- Is often damaged or removed and never replaced.



Figure 3.1.b. A PTO stub and a master shield on a tractor. A PTO is a wrap point hazard that causes countless injuries and deaths each year.

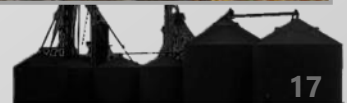


# Pull-in Points

Operating point catches object & drags it in.

▲ Mechanisms that take in crops or other material for processing

- ◆ Conveyors
- ◆ Feed rolls
- ◆ Feed chambers
- ◆ Grinders
- ◆ Harvest Equipment



# Shear Point

Two parts move across or close enough together to cut or move soft material.

- ▲ Cuts from force & speed
  - ◆ Augers, blades
    - ▶ EX: Hedge trimmer
- ▲ Difficult to guard



High speeds make operation less visible.





# Crush Point

Two objects move toward each other OR one moves toward a fixed object and the gap between both decreases.



# Burn Points

Hot mufflers, engine blocks, pipes, and fluids (fuel, oils, chemicals)

▲ Exposure - machine inspection, servicing, maintenance



Place hand near surface to test for heat.



# Freewheeling Parts



Machine parts continue to move after power has been turned off.

Cannot bring rotational force to sudden stop.

EX: Conveyor

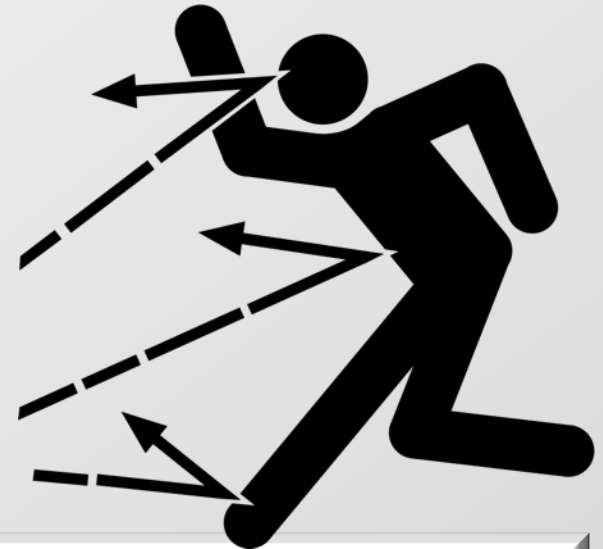


# Thrown Objects

Formed by rotating fan or knife blades used to cut, grind, or chop materials

▲ Normal machine operation discharges materials into surrounding area

◆ EX: rotary mower.



Keep work area clear of others.

Wear eye protection.





# Stored Energy

Confined energy is unexpectedly & uncontrollably released.

- ▲ Pressurized systems & components
  - ◆ Mechanical, hydraulic, pneumatic, gravitational
    - ▶ Capacitors, springs, flywheels



# What do you need to look for

# GUARDING



# Purpose of Guarding

Protect operator & others from hazards created by normal machine operation.

▲ **ANY** machine part, function or process which might cause injury must be safeguarded.

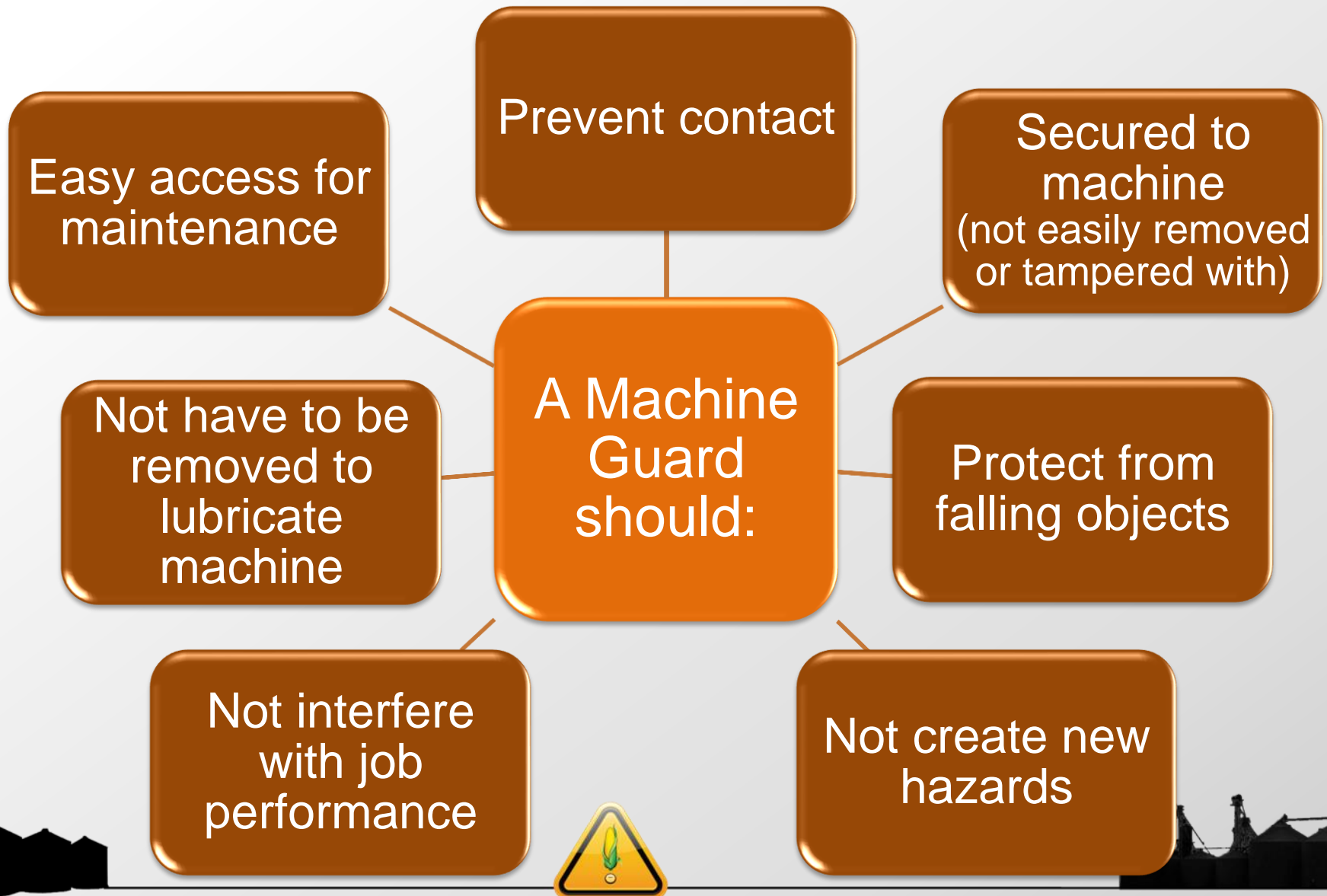
◆ Operation of machine

◆ Accidental contact

Hazards **MUST** be controlled or eliminated.



# How a Guard Should Work



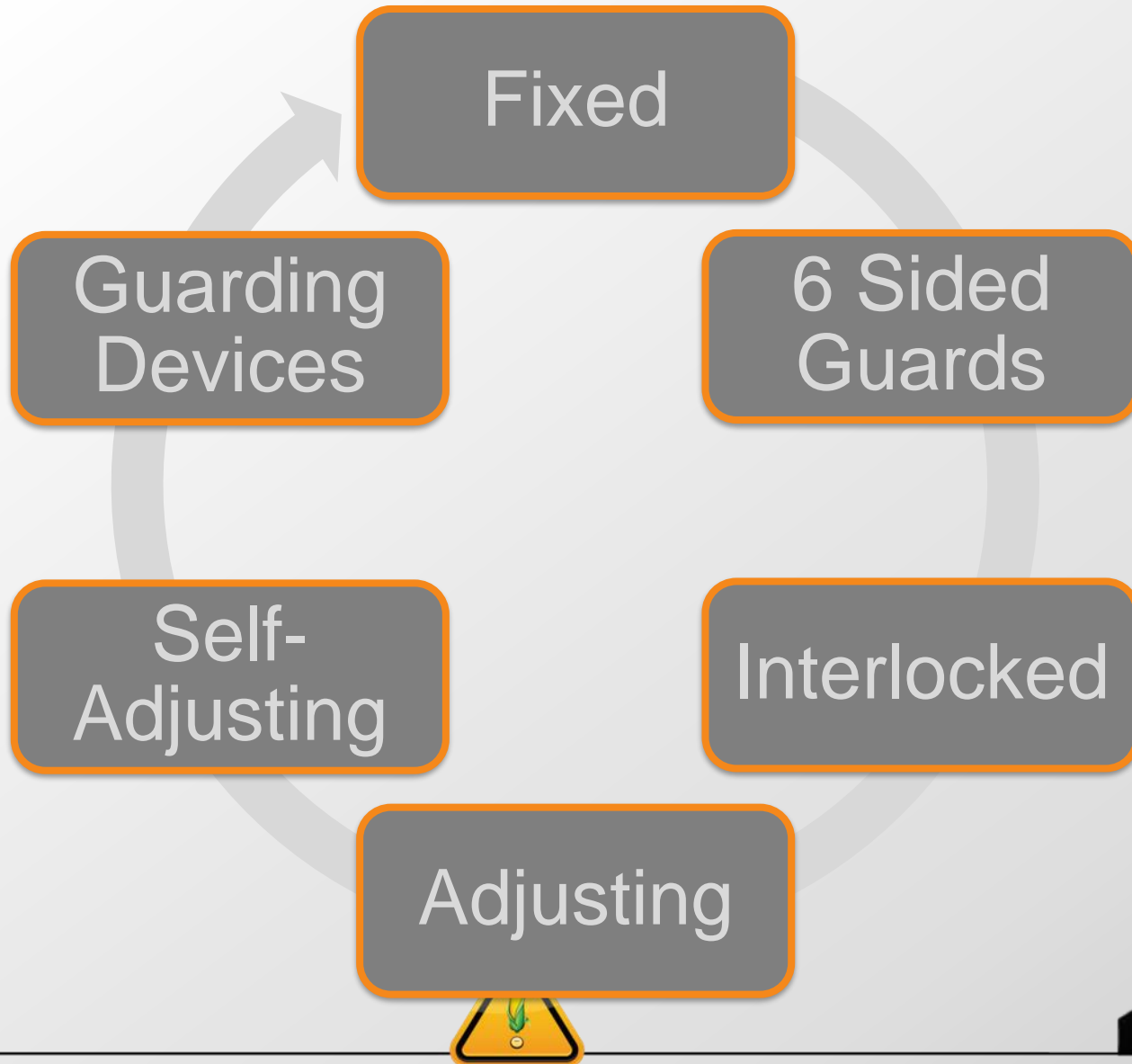
# AUTO Protection

Guards should follow **AUTO**.  
Protect a worker from reaching:

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



# Types of Guards





# Fixed Guarding Methods

## Fixed Guard

- ▲ Permanent fixture
- ▲ Need tool to remove
- ▲ Best/First choice



## 6 Sided Guard

- ▲ Protects all 6 sides
  - ◆ Top, bottom
  - ◆ Front, back
  - ◆ Left, right





# Interlocked guard

Shuts off or disengages power when the guard is opened or pushed out of

position

- ▲ Senses absence or presence of guard

- ▲ Can be circumvented



# Adjustable Guards

## Adjustable

- ▲ Operator adjusts guard
- ▲ Guard is attached



## Self-Adjusting

- ▲ Partially guarded when operating
- ▲ Guard moves/adjusts
  - ◆ Material pushed into point of



# Guarding Device

## Pressure Sensing

- ▲ Interrupt operating cycle
- ▲ Prevent entry into area



## Location/distance

- ▲ Prevents access to hazard
- ◆ Physical barrier point of operation



# Grates/Guards – Opening Size

Must not reach hazard with body or tool.

## ▲ 1910 Subpart O

- ◆ Mechanical power press standard

## ▲ Opening size = distance of worker from hazard

- ◆ Farther from hazard, larger the opening

| 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 ⅞ inches   |
| 17 ½ to 31 ½ inches  | 2 ⅞ inches   |
| 31 ½ inches to less than 7 feet                                    | 6 inches   |
| More than 7 feet   | Protective covering not required                             |



# Protecting Workers from Hazards

# Guard Makeover



# Preventing machine-related hazards

- Learn how various methods of machine guarding protect employees.
- Learn the regulatory requirements for machine safeguarding.
- Identify and categorize the mechanical hazards at your facility. Develop a list of those hazards and their locations.
- Match the hazards with the safeguards that your facility uses.
- If the safeguards do not meet the minimum general requirements, upgrade your machine guarding systems as soon as possible. If the hazard is severe enough, you may need to shut down the machine until appropriate safeguards can be put into place.
- When purchasing new equipment, ensure that the manufacturer provides appropriate machine guards.



# Preventing Hazards

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- ▲ Train employees to ID hazards
- ▲ Learn methods of machine guarding
- ▲ Learn the regulatory requirements
- ▲ Identify & categorize mechanical hazards
  - ◆ Note locations.
- ▲ Match hazards with safeguards facility uses.
- ▲ Upgrade machine guards not meeting requirements.
- ▲ Ensure new equipment has appropriate guards





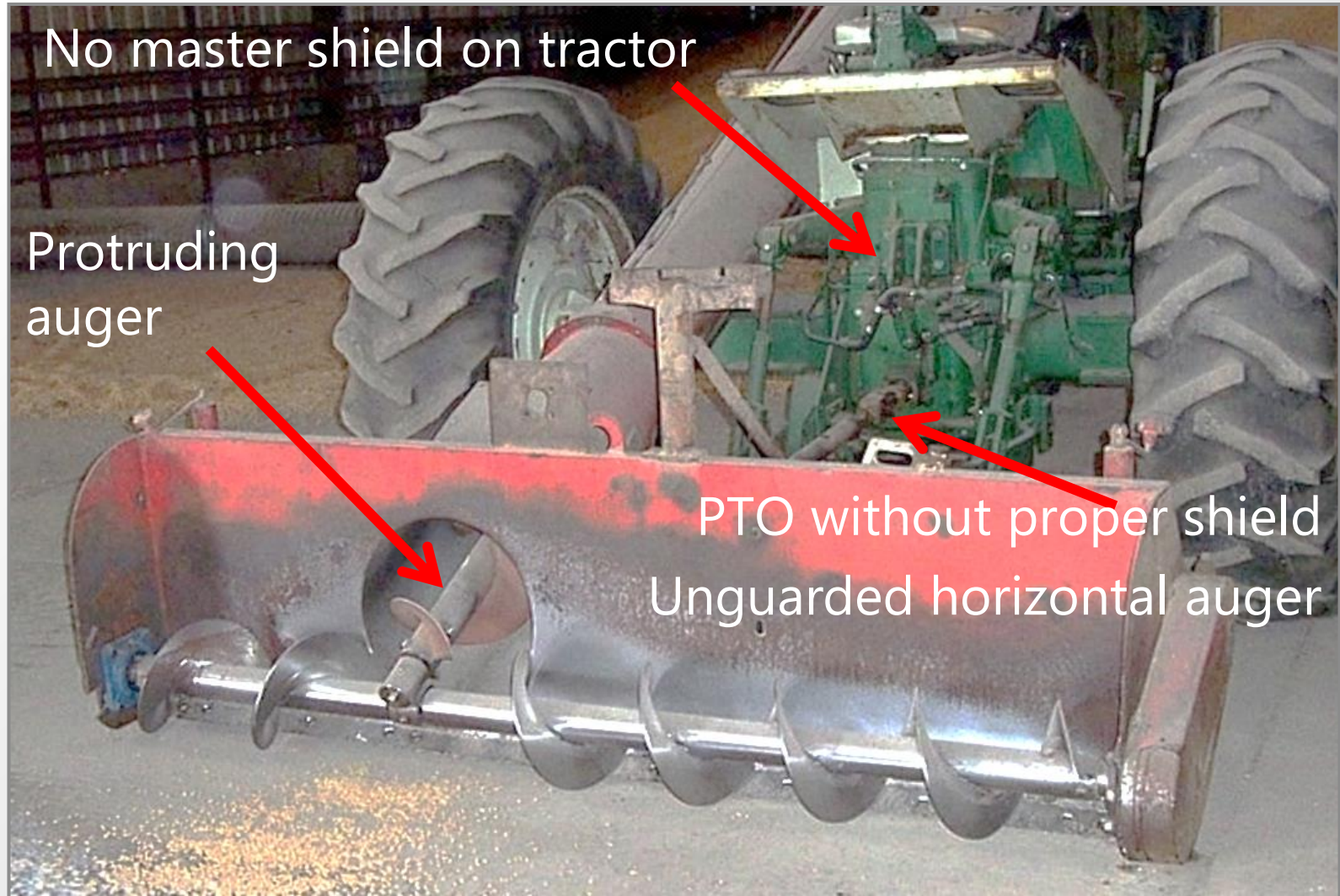
# Guard Makeovers

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- What is the task
- What machine/equipment
- What is the machine/equipment doing
- How & where do you interact with the machine
- Where should the guard be
- What guard would work best
- What can be done to improve
- What should you consider (blocking a walkway, etc)



# Tractor Mounted Conveyor





# Unguarded Conveyor



# Unguarded Shafts





# Unguarded Pulleys, Belts, Chains





# Makeover – Power Transmission



#1 REALLY BAD



#2 BAD



# Makeover – Power Transmission



#3 BETTER

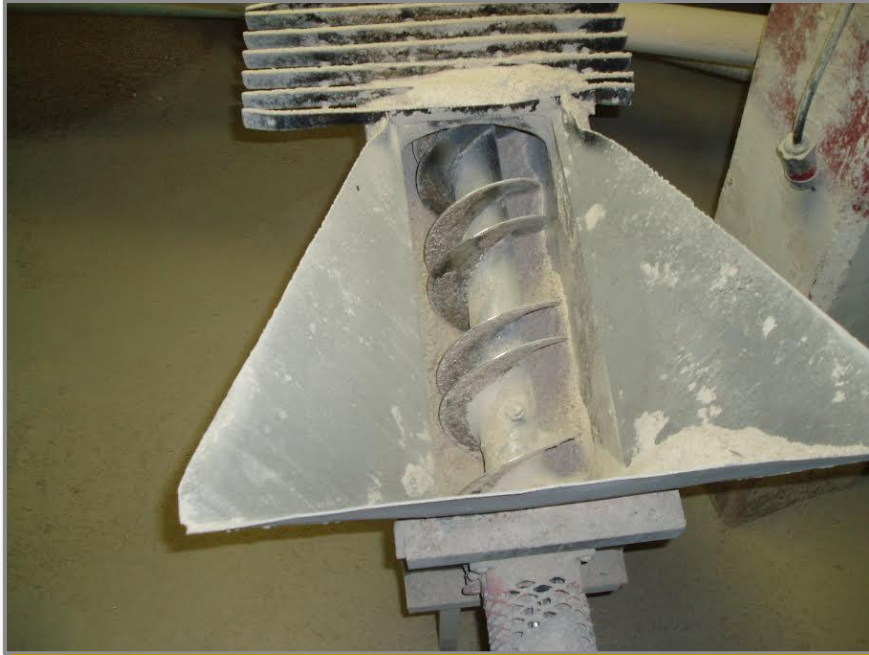


#4 BEST





# Makeover – Portable Auger



#1 BAD



#2 SLIGHTLY BETTER



# Makeover – Portable Auger



#3 BEST





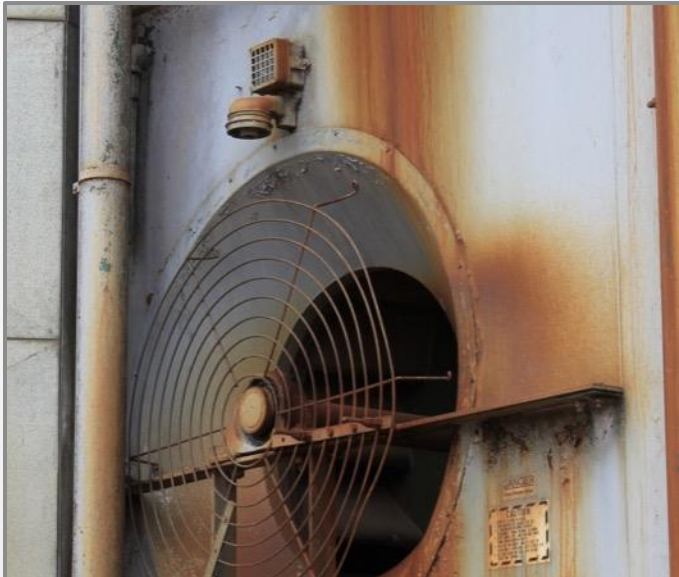
# Makeover - Fan



#1 BAD



#2 BAD



#3 SLIGHTY BETTER



#4 SLIGHTLY BETTER





# Makeover - Fan



#5 BETTER



#6 BEST



# Makeover - Conveyor



#1 BAD



#2 BAD



# Makeover - Conveyor



#3 BEST





# Makeover – Unloading Auger



#1 BAD



#2 BETTER



# Makeover – Unloading Auger



#3 BETTER



#4 BEST





# Makeover – Sump Guards



#1 BAD



#1 BAD



# Makeover – Sump Guards



#3 GOOD



#4 BETTER



# Makeover – Sump Guards



#5 BEST





# Makeover – Sweep Auger



#1 BAD



#2 MARGINAL



# Makeover – Sweep Auger



#3 Try But Fail



#1 BAD





# Makeover – Sweep Auger



#5 BEST



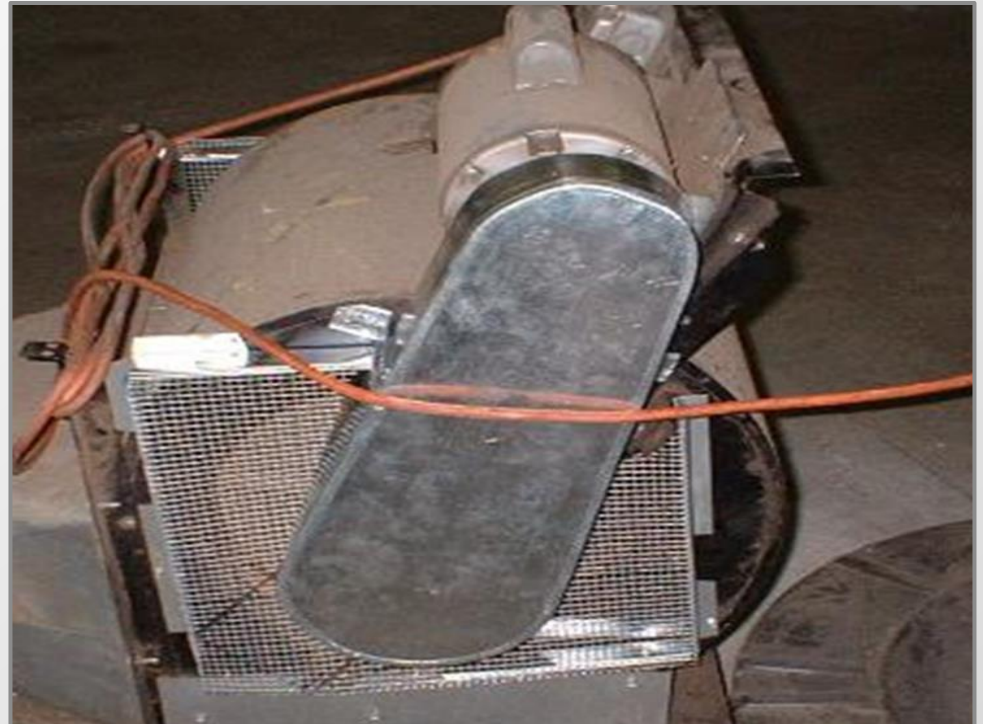
#6 BEST



# Makeover – Pinch Points



#1 BAD



#2 BETTER - ACCEPTABLE





## Machine Guarding



Standards >

Hazard Recognition >

Possible Solutions >

[Additional Resources](#) >

### Overview

Moving machine parts have the potential to cause severe workplace injuries, such as crushed fingers or hands, amputations, burns, or blindness. Safeguards are essential for protecting workers from these preventable injuries. Any machine part, function, or process that may cause injury must be safeguarded. When the operation of a machine or accidental contact injure the operator or others in the vicinity, the hazards must be eliminated or controlled. This page contains general information on the various hazards of mechanical motion and techniques for protecting workers.

### Standards

Machine guarding hazards are addressed in specific OSHA standards for Agriculture, General Industry, Marine Terminals,

### Hazard Recognition

Provides references that may aid in recognizing hazards from ineffective machine guarding.

### Highlights

- [Protect Yourself - Amputations](#). OSHA QuickCard™, (2015). Discusses amputations and the best way to prevent them.
- [Safeguarding Equipment and Protecting Workers from Amputations \(PDF\)](#). OSHA Publication 3170, (2007). Provides information to help identify and manage common amputation hazards associated



<https://www.osha.gov/SLTC/machineguarding/>







eTOOLS

eTools Home : [Machine Guarding](#)

[Scope](#) | [Standards](#) | [Bibliography](#) | [Credits](#)

# Machine Guarding eTool

[Home](#)   [Introduction](#)   [Saws](#)   [Presses](#)   [Plastics Machinery](#)  
[Additional References](#)

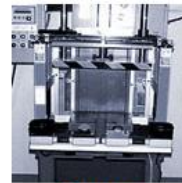
## Machine Guarding eTool

Employee exposure to unguarded or inadequately guarded machines is prevalent in many workplaces. Consequently, workers who operate and maintain machinery suffer approximately 18,000 amputations, lacerations, crushing injuries, abrasions, and over 800 deaths per year. Amputation is one of the most severe and crippling types of injuries in the occupational workplace, and often results in permanent disability. This \*eTool focuses on recognizing and controlling common amputation hazards associated with the operation and use of certain types of machines.

- [Introduction to Machine Guarding](#)



Saws



Presses



Plastics Machinery

### How do I find out about employer responsibilities and worker rights?

[Workers](#) have a right to a safe workplace. The law requires employers to provide their employees with working conditions that are free of known dangers. The OSHA law also prohibits employers from retaliating against employees for exercising their rights under the law (including the right to raise a health and safety concern or



<https://www.osha.gov/SLTC/etools/machineguarding/index.html>







[By Standard Number](#) / 1928.57 - Guarding of farm field equipment, farmstead equipment, and cotton gins.

- **Part Number:** 1928
- **Part Number Title:** Occup. Safety and Health Standards for Agriculture
- **Subpart:** 1928 Subpart D
- **Subpart Title:** Safety for Agricultural Equipment
- **Standard Number:** 1928.57
- **Title:** Guarding of farm field equipment, farmstead equipment, and cotton gins.
- **GPO Source:** e-CFR

[1928.57\(a\)](#)  
General -

[1928.57\(a\)\(1\)](#)  
Purpose. The purpose of this section is to provide for the protection of employees from the hazards associated with moving machinery parts of farm field equipment, farmstead equipment, and cotton gins used in any agricultural operation.

[1928.57\(a\)\(2\)](#)  
Scope. Paragraph (a) of this section contains general requirements which apply to all covered equipment. In addition, paragraph (b) of this section applies to farm field equipment, paragraph (c) of this section applies to farmstead equipment, and paragraph (d) of this section applies to cotton gins.

[1928.57\(a\)\(3\)](#)  
Application. This section applies to all farm field equipment, farmstead equipment, and cotton gins, except that paragraphs (b)(2), (b)(3), and (b)(4) (ii)(A), and (c)(2), (c)(3), and (c)(4) (ii)(A) do not apply to equipment manufactured before October 25, 1976.

[1928.57\(a\)\(4\)](#)  
Effective date. This section takes effect on October 25, 1976, except that paragraph (d) of this section is effective on June 30, 1977.



<https://www.osha.gov/laws-regs/regulations/standardnumber/1928/1928.57>





By Topic

By Language

By Grantee

## By Topic



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A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

▲ <https://www.osha.gov/harwoodgrants/grantmaterials/>



# M

| Topic                            | Title   | Organization/Grantee                                     | Year | Grant Number | Language           |
|----------------------------------|---|--|------|--------------|--------------------|
| Machine Guarding                 | Machine Guarding  | Nebraska Appleseed Center for Law in the Public Interest | 2017 | SH-31233-SH7 | English<br>Spanish |
| Machine Guarding                 | Safety Awareness Training   | Florida State College at Jacksonville                    | 2011 | SH-22297-11  | English<br>Spanish |
| Materials Handling               | Powered Industrial Trucks (PIT) Truck Driver Safety Training          | Graphic Communications Conference, IBT                   | 2009 | SH-18793-09  | English            |
| Materials Handling               | Systems of Safety for Materials Handling                              | Graphic Communications Conference/IBT                    | 2009 | SH-19486-09  | English            |
| Meatpacking Industry             | Meat and Poultry Worker Safety  | Nebraska Appleseed Center for Law in the Public Interest | 2010 | SH-20833-10  | English<br>Spanish |
| Meatpacking Industry             | Meat and Poultry Worker Safety  | Nebraska Appleseed Center for Law in the Public Interest | 2012 | SH-23581-12  | English<br>Spanish |
| Mold                             | Safety Awareness Training   | Florida State College at Jacksonville                    | 2011 | SH-22297-11  | English<br>Spanish |
| Motorized Construction Equipment | Motorized Construction Equipment & Carbon Monoxide/Inhalation Hazards | Western Iowa Technical Community College                 | 2015 | SH-27666-SH5 | English            |



<https://www.osha.gov/harwoodgrants/grantmaterials/bytopic/#m>





## The National Institute for Occupational Safety and Health (NIOSH)

Workplace Safety and Health Topics

**Fatality Assessment and Control Evaluation (FACE) Program** ▾

What's New - 2018 +

NIOSH FACE Reports

State FACE Reports

Program Description

Mission, History, Objectives

Publications Related to FACE

FACE Reports Brought to Life

FACE Program Contacts



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Promoting productive workplaces through safety and health research



[NIOSH](#) > [Workplace Safety and Health Topics](#)

### FATALITY ASSESSMENT AND CONTROL EVALUATION (FACE) PROGRAM



Language: English (US) ▾

Each day, between 12 to 13 U.S. workers die as a result of a traumatic injury on the job. Investigations conducted through the FACE program allow the identification of factors that contribute to these fatal injuries. This information is used to develop comprehensive recommendations for preventing similar deaths. This web page provides access to NIOSH investigation reports and other safety resources.

#### Fatality Investigation Reports Indexed by Program

- [NIOSH FACE Reports](#)
- [State FACE Reports](#)

#### Construction FACE Database

The [Construction FACE Database \(CFD\)](#) [↗](#) is a database in Excel created by CPWR – The Center for Construction Research and Training – to facilitate use of the information provided by the Fatality Assessment and Control Evaluation (FACE) reports. The investigation results in FACE reports provide information on the circumstances surrounding work-related fatalities, and the recommendations are crucial for injury prevention. The CFD contains data from both NIOSH and State FACE reports on construction-related fatalities (total of 768 deaths) that were posted as of June

▲ <https://www.cdc.gov/niosh/face/default.html>







# HAZARD IDENTIFICATION TRAINING TOOL

Introduction

How to Play

Manual & Resources

OSHA's Hazard Identification Training Tool is an interactive, online, game-based training tool for small business owners, workers and others interested in learning the core concepts of hazard identification. After using this tool, users will better understand the process to identify hazards in their own workplace.

This tool is intended to:

- (1) Teach small business owners and their workers the process for finding hazards in their workplace,
- (2) Raise awareness on the types of information and resources about workplace hazards available on OSHA's website.

**Important:** This is a learning tool. The items presented in this tool are for training purposes only and the visual representations are conceptual and do not always show specific control for hazards. OSHA inspections and possible citations and penalties for violation of OSHA regulations are **NOT** part of this tool. Employers and workers must consult the applicable OSHA standards for the specific requirements applicable to their workplaces when developing and implementing their own hazard identification program.



▲ <https://www.osha.gov/hazfinder/>



# SUMMARY

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- ▲ Ensure Guards are in place
- ▲ LOTO –Before any service, maintenance
- ▲ Best Practices
  - ◆ No loose clothing, unfastened hair
  - ◆ Wait for machines to completely stop
  - ◆ Never step over a running PTO
  - ◆ Never reach over running machines

Guarding & LOTO will prevent the majority of all machine injuries.

# Disclaimer

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This material was produced under grant number **(SEE NOTES)** [and revised under SH05033-SH8] 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.



Protect our most  
valuable resource  
Our Workers!



**GRAIN HANDLING**  
SAFETY COUNCIL

For more information visit  
[grainsafety.org](http://grainsafety.org) or  
[StandUp4grainsafety.org](http://StandUp4grainsafety.org)