This guide provides compliance information to help the metal and nonmetal mining industry meet current requirements of the Mine Safety and Health Administration’s (MSHA’s) guarding standards addressing machinery. This document is also intended to enhance awareness of guarding compliance for miners, mine operators, miners’ representatives, independent contractors, equipment manufacturers, and MSHA’s Metal and Nonmetal enforcement personnel with compliance issues related to guarding machinery. This guide should be used to supplement existing guarding guidance contained in "MSHA's Guide to Equipment Guarding" published in 2004, and in MSHA’s existing Program Policy Manual.
Navigating this Presentation

Most of the slides in this presentation have explanatory notes that are critical to understanding the content. If using the PowerPoint® version, be sure to adjust the display on your computer screen to be able to read the notes, or print the slides using the “Notes Pages” option. If using the PDF version, the notes can be read by hovering your cursor over or clicking on the orange icon in the upper left corner of the slide.
Guarding Machinery at Metal & Nonmetal Mines

DO NOT OPERATE WITHOUT GUARDS!

Mine Safety & Health Administration – Oct. 2012
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Goals & Objectives

• Protecting miners by:
  – Improving industry’s understanding of good guarding principles
  – Ensuring the construction, installation and maintenance of high quality, effective guards
  – Improving inspection and enforcement consistency

• This will result in … REDUCED:
  ➢ Serious and fatal accidents
  ➢ Risk of injury to miners
Injuries Related to Equipment Guarding

- Reached past or around guard: 14%
- Inadequate guard size / position: 14%
- Removed guard during operation: 10%
- Climbing on guard: 5%
- Inherently hazardous guard: 12%
- Handling/Dropped oversized and heavy guards: 45%
## Guarding Citations (MNM)

<table>
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<th>Fiscal Year</th>
<th>Total Citations &amp; Orders *</th>
<th>Guarding Citations &amp; Orders *</th>
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<td>62,761</td>
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<td>2011</td>
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<td>2012**</td>
<td>46,583</td>
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* Includes all C & O for 30 C.F.R. §§ 56/57.14107, .14108, .14109, &.14112

** FY 2012 YTD, 7/10/2012;  # - Projected through end FY
Moving Machine Parts
30 C.F.R. §§ 56/57.14107

(a) Moving machine parts shall be guarded to protect persons from *contacting gears, sprockets, chains, drive, head, tail and take-up pulleys, flywheels, couplings, shafts, fan blades* and similar moving parts that can cause injury.

(b) Guards shall not be required where the exposed moving parts are at least seven feet away from walking or working surfaces.
Machinery and Components to Guard

- Crushers and screens
- Rotating equipment
- Drive & power transmission components
- Packaging and palletizing equipment
- Power tools and auxiliary equipment
- Conveying equipment
- Mobile equipment
Guards are meant to protect persons from:

- “inadvertent, careless, or accidental contact” or
- “deliberate or purposeful work-related actions…” (inspection, testing, cleaning, maintenance, troubleshooting, lubrication, adjustment, servicing, etc…)

- Work does not have to be assigned or directed by management or supervisor

- Standard does not address deliberate or purposeful, NON-work-related actions
Inadvertent or Purposeful Work-Related Contact
Inadvertent or Work-Related Contact
Work-Related Contact

[Image of industrial equipment with arrows indicating flow]
Inadvertent or Work-Related Contact
Inadvertent or Purposeful Work-Related Contact
Purposeful Non-Work-Related Contact
Work-Related Contact
Types of Guarding

- Point-of-contact guarding
  - Location guarding
  - Area guarding
Point-of-Contact Guards
Point-of-Contact Guards
Guarding by Location

The distance from the floor to the line shaft, sprockets and connecting chain is greater than 7 feet.

The drive motor must be powered OFF and locked out when the elevated components are inspected or repaired.
Guarded by Location?

7 ft. – 6 in.
Ladder-less Work Platforms
An area guard is a barrier which prevents entry of a miner into an area containing moving machine parts, thus preventing contact with the moving parts. **Effective area guards may require additional practices and provisions, such as signage, locks, color coding, etc., in addition to the physical barrier.** When designing, installing, and/or using area guards, consider:

- **Security of the area**
  - Is the area guard difficult to defeat?
  - Is it locked or bolted?
  - Does the guard prevent entry into the area and is the guard difficult to defeat?

- **How will the moving machine parts be shut down before entry?**
  - Will the guard be interlocked with the hazardous equipment so entry will automatically shut down the moving parts?
  - Will manual shutdown be used?

- **Is the area guard easily recognized as a guard?**
  - Are warning signs or color coding in use?

- **Frequency of entry into the guarded area**
  - Frequently accessed areas may not be suitable for area guarding.

- **Number of people requiring access into guarded area**
  - If a large number of people need access to an area, then area guarding may not be suitable.

- **Education and training in proper procedures**
  - Does the work force understand who may enter area guards?
  - Have lock-out, tag-out procedures been addressed?
Area Guard Best Practices

- Perform risk analysis for equipment considered for area / multiple hazard guarding
- Secure the guard from being easily bypassed
- Make guards easy to recognize
- Include “Area Guarding” in Training Plan
- Adhere to a pre-planned Safe Work Procedure when accessing area-guarded equipment
- Keep the guards, people and training up-to-date
Area Guarding
Area Guarding
Area Guarding
Area Guarding
Area Guarding

1

2

3

32
Area Guarding
Non-Compliant Area Guards
Shaft and Shaft End Guarding

• Point of contact guards are required for shafts and shaft ends that are not guarded by location if they have exposed:
  – Keys, keyways or couplings
  – Setscrews, bolts or other protrusions
  – Burrs

• Smooth shafts and shaft ends – a guard may not necessarily be required.

• Whether a smooth shaft or shaft end requires a guard depends on…
  – Rotation speed
  – Location of shaft in the workplace
  – Diameter and length of exposed shaft
  – Exposed shaft end’s extension into work space
Shaft Guarding

[Images showing shaft guardings: one with a red no symbol indicating it's not safe, and another with a green check symbol indicating it's safe.]
Shaft Guarding

Smooth shafts – guards not required due to location and short length of smooth shaft exposed
Shaft End Guarding

Small shaft protrusion, medium rotation speed, location out of travelway

Minimal shaft protrusion, slow rotation speed, location near floor

OK
Shaft End Guarding

Grease fitting location

OK
Construction and maintenance of guards
30 C.F.R. §§ 56/57.14112

(a) Guards shall be constructed and maintained to –

(1) Withstand the vibration, shock and wear to which they will be subjected during normal operations; and

(2) Not create a hazard by their use
Guard Construction - Acceptable Materials

- Metal - Sheet metal, expanded metal mesh, floor grating, chain link fence, used screen deck cloth or punched plate, etc.
- Plastic - Plexiglas and custom shapes are OK. Plastic construction mesh is not substantial, therefore not acceptable.
- Rubber – OK to be flexible; but must be substantially constructed and well-secured. Caution: rubber is combustible.
- Wood – If used, it should be protected, well-maintained and replaced as needed. Water can damage wood. Caution: wood is combustible.
Protective? Sturdily Constructed?
Protective? Sturdily Constructed?
Guard a Hazard in Itself?
Easily Handled?
Easily Handled?
Construction and maintenance of guards
30 C.F.R. §§ 56/57.14112

(b) Guards shall be securely in place while machinery is being operated, except when testing or making adjustments which cannot be performed without removal of the guard.

Also consider 30 C.F.R. §§ 56/57.14105 - Procedures during repairs or maintenance
Securely in Place means “not easily dislodged”

- Attached to the equipment
- Fastened to a nearby frame or structure
- Hang, sit or otherwise remain in place by its own size, weight, bulk or method of attachment
- Not be easily defeated or bypassed
Securely in Place?
Securely in Place?
Securely in Place
Securely in Place?

OK, when hinged door is closed
Guard Attachment
Examples of Acceptable Fasteners

• Bolts
  – With nuts / wing nuts
  – In some cases nuts may not be required
• Clamps, bars, wedges
• Cotter pins, pins and sleeves
• Hooks, hinges, J-bolts
• Wire ties – heavy duty plastic or wire

It is not necessary to use fasteners that can only be removed with tools
Procedures during repairs or maintenance
30 C.F.R. §§ 56/57.14105

Repairs or maintenance of machinery or equipment shall be performed only after the power is off and the machinery or equipment blocked against hazardous motion. Machinery or equipment motion or activation is permitted to the extent that adjustments or testing cannot be performed without motion or activation, provided that persons are effectively protected from hazardous motion.
Preamble: 30 C.F.R. §§ 56/57.14105


- “...permits machinery and equipment motion or activation to the extent necessary for adjustment or testing, as long as persons are not exposed to hazardous motion.”
- Does not address power “lockout”
Equipment Testing

Guard shown removed for illustration purposes
Mining and Off-Road Vehicles: Engine Drive Belts
Overhead drive belts shall be guarded to contain the whipping action of a broken belt if the action could be hazardous to persons.
Whipping Action of V-Belts
Whipping Action of V-Belts
In areas where flying or falling materials generated from the operation of screens, crushers or conveyors, guards, shields or other devices that provide protection against such flying or falling materials shall be provided to protect persons.
Flying and Falling Materials
(a) When persons are exposed to slushing operations, the slushers shall be equipped with rollers and drum covers and anchored securely before slushing operations are started.
Stationary grinding machines, other than special bit grinders, shall be equipped with -

(a) Peripheral hoods capable of withstanding the force of a bursting wheel and enclosing not less than 270º of the peripheral of the wheel;
Tongue Guards
Stationary grinding machines
30 C.F.R. §§ 56/57.14115

(b) Adjustable tool rests set so that the distance between the grinding surface of the wheel and the tool rest is not more than 1/8 inch; and

(c) A safety washer on each side of the wheel.
Tool rest: 1/8 inch gap maximum
Note: use of a face shield or goggles is required when operating a grinder.
Ring Testing

• Ring testing an abrasive wheel before installing it on a grinder is considered a best safety practice.
Side Grinding

- Avoiding grinding on the side of an abrasive wheel is considered a best safety practice.
Safety defects
30 C.F.R. §§ 56/57.14100

- (b) Defects on any equipment, machinery and tools that affect safety shall be corrected in a timely manner to prevent the creation of a hazard to persons.
- (c) When defects make continued operation hazardous to persons, the defective items, including self-propelled mobile equipment, shall be taken out of service and placed in a designated area posted for that purpose, or a tag or other effective method of marking that defective item shall be used to prohibit further use until the defects are corrected.
Administrative Controls Are Not Guards
Well Maintained?
Ejected Materials - Presses

100 Ton Press

55 Ton Press
Ejected Materials - Fans
Screens & Metal Grids
Screen Mesh - Opening Sizes
Opening Size
Opening Size
Risk Management Achieves Guarding Compliance

Noncompliant & high risk

Compliant & low risk
We Can Build Better Guards

Aim High!!

Go *Beyond* Compliance