Machine Guarding
The Importance of Machine Guarding

• Amputations are among the most severe and disabling workplace injuries
• Amputations may result from improperly using machines
• In 2005, 8,450 non-fatal amputations occurred within the private industry sector
• In 2008, machines were the primary or secondary source of 604 work-related fatalities (BLS, 2010b)
• That same year, machinery was the source of 64,170 cases involving days away from work (BLS, 2010b)
• Protect yourself from amputations and other hazards by using effective machine guarding
The Importance of Machine Guarding

• Machine-related injuries may include
  – Crushed hands and arms
  – Severed fingers and limbs
  – Lacerations and abrasions

• Moving machine parts create many hazards
  – Pinch points
  – Rotating parts
  – Flying chips
  – Sparks
Machine Guarding

• Guards are barriers which prevent access to danger areas
  – Act as physical barriers
  – Enclose and prevent employee contact with dangerous machine parts

• Machine guards are essential for protecting you from preventable injuries
Three Parts of a Machine

All machines consist of three areas

• Point of operation
  – Where work is performed on the material
  – Work may include cutting, shaping, boring, or forming of stock

• Power transmission device
  – All components of the machine that transmit energy to the part of the machine performing work
  – Include flywheels, pulleys, belts, connecting rods, couplings, cams, spindles, chains, cranks, and gears

• Other moving parts
  – All parts of the machine that move while the machine is energized
  – May include reciprocating, rotating, and transversely moving parts, as well as feed mechanisms
Hazardous Mechanical Motions

• Rotating motion
  – Circular motion
  – Generated by rotating collars, couplers, cams, clutches, flywheels, shaft ends, and spindles
  – May grip clothing or force a body part into a dangerous location

• Reciprocating motion
  – Back-and-forth or up-and-down motion
  – May strike or entrap an employee between a moving part and a fixed object

• Transverse motion
  – Motion in a straight, continuous line
  – May strike or catch employee in a pinch or shear point
Hazardous Mechanical Actions

• Cutting action
  – Involves rotating, reciprocating, or transverse motion
  – Seen in band saws, circular saws, boring or drilling machines, turning machines, or milling machines

• Punching action
  – Results when a slide or ram hits a fixed object
  – Seen in power presses and iron workers

• Shearing action
  – A slide or knife trims metal or other materials
  – Seen in mechanical, hydraulic, or pneumatic shears

• Bending action
  – A slide draws or stamps metal
  – Seen in power presses, press brakes, and tubing benders
Machine Guard Requirements

• Prevent contact
  – Must prevent hands, arms, or any other part from making contact with dangerous moving parts

• Secure
  – Guard should not be easily removed

• Protect from falling objects
  – Should ensure that no objects can fall into moving parts or strike worker

• Create no new hazards
  – Guard should not present new hazards

• Create no interference
  – Should not impeded worker from performing job

• Allow safe lubrication
  – Should be able to lubricate machine without removing guard
Four Types of Machine Guards

• Fixed
• Interlocked
• Adjustable
• Self-adjusting
Fixed

• Characteristics
  – Permanent part of the machine
  – May be constructed of sheet metal, screen, wire cloth, bars, or plastic

• Safeguarding action
  – Provides a barrier
  – Allows for stock feeding but does not permit operator to reach danger area
Interlocked

• Characteristics
  – When opened or removed, automatically shuts off machine
  – Stops all moving parts
  – Machine cannot cycle or be started until guard is back in place

• Safeguarding action
  – Shuts off or disengages power, stops the moving parts, and prevents the starting of the machine when the guard is open
  – Stops machine before worker can reach into the danger area
Adjustable

• Characteristics
  – Allows flexibility in accommodating various sizes of stock

• Safeguarding action
  – Provides a barrier that may be adjusted to work with a variety of production operations
Self-adjusting

• Characteristics
  – Guard opens and closes to admit stock

• Safeguarding action
  – Provides a barrier that moves according to the size of the stock entering the danger area
Safeguarding

There are two types of safeguarding methods

• Primary safeguarding methods
  – Guards
  – Some type of safeguarding device

• Secondary safeguarding methods
  – Probe detection and safety edge devices
  – Awareness devices
Safeguarding

Safeguarding devices are primary safeguarding methods that detect or prevent inadvertent access to a hazard

- Prevent machine operation if your hand or body part is placed in the danger area
- Restrain or withdraw your hands from the danger area
- Require you to place both hands on machine controls
Safeguarding

Primary safeguards include

• Pullback devices
  – A series of cables are attached to the operator’s hands, wrists, or arms
  – As the machine begins to cycle, the operator’s hands are pulled out of the danger area

• Restraint devices
  – Cables are attached to operator
  – Prevents operator from reaching into the danger area
  – Operator must use hand-feeding tools
Safeguarding Devices

• Presence-sensing mats
  – Senses operator is near danger area and shuts off machine

• Two-hand control
  – Requires operator to use both hands on separate controls
  – Prevents hands from being in the danger area when machine cycle states
Safeguarding Devices

• Two-hand trip
  – Requires concurrent use of both hands
  – Prevents hands from being in danger area when machine starts

• Gates
  – Movable barrier that protects the operator at the point of operation
Additional Guarding

• Exposed fan blades must be guarded by a barrier with openings no larger than ½ inch
• Interlock revolving barrels, containers, and drums
• Securely anchor fixed machines to prevent walking or moving
• Use Lockout/Tagout
Training

• Operators should receive specific and detailed training in safeguarding against mechanical hazards

• Operator training should explain
  – The hazards associated with particular machines
  – How and why to use each safeguard
  – How and under what circumstances safeguards can be removed
  – When lockout/tagout is required
  – What to do if a safeguard is damaged, missing, or inadequate
Machine Maintenance and Repair

When performing machine repair and maintenance, each piece of equipment should be safeguarded:

- Notify all affected employees that the machine or equipment must be shut down to perform maintenance or repairs.
- Stop the machine.
- Isolate the machine or piece of equipment from its energy source.
- Lock out or tag out the energy source.
- Relieve any stored or residual energy.
- Verify that the machine or equipment is isolated from the energy source.
Machine Maintenance and Repair

When machine maintenance and repairs are finished, the following steps should be followed to put the machine back in service:

• Inspect the machine to ensure that all guards and safety devices are in place and functional
• Check the area to ensure that start up of the machine will not endanger employees
• Remove lockout/tagout devices
• Reenergize the machine
• Notify all affected employees that the machine is back up and running
Personal Protective Equipment

• Appropriate PPE provides the last line of defense in machine guarding

• Appropriate PPE may include
  – Hard hats
  – Face shields, safety goggles, or glasses
  – Hearing protection
  – Protective coveralls, jackets, vests, aprons, or full-body suits
  – Special sleeves and gloves
  – Safety shoes and boots