

**In this issue of the Environmental Health and Safety (EHS) Listserv, December 15, 2011:**

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## **1. Machine Guarding**

Machines make work easier and more efficient. However they can pose a significant risk for injury to the operator. Crushed hands and arms, severed fingers, blindness -- the list of possible machinery-related injuries is as long as it is horrifying. There seem to be as many hazards created by moving machine parts as there are types of machines. Safeguards are essential for protecting workers from needless and preventable injuries.

A good rule to remember is: Any machine part, function, or process which may cause injury must be safeguarded. When the operation of a machine or accidental contact with it can injure the operator or others in the vicinity, the hazards must be either controlled or eliminated.

Mechanical hazards from dangerous moving parts fall into three basic classifications:

- **The point of operation:** that point where work is performed on the material, such as cutting, shaping, boring, or forming of stock.
- **Power transmission apparatus:** all components of the mechanical system which transmit energy to the part of the machine performing the work. These components include flywheels, pulleys, belts, connecting rods, couplings, cams, spindles, chains, cranks, and gears.
- **Other moving parts:** all parts of the machine which move while the machine is working. These can include reciprocating, rotating, and transverse moving parts, as well as feed mechanisms and auxiliary parts of the machine.

What must a safeguard do to protect workers against mechanical hazards? These are the minimum safety requirements:

- **Prevent contact:** The safeguard must prevent hands, arms, and any other part of a worker's body from making contact with dangerous moving parts.
- **Secure:** Guards must be firmly secured to the machine so workers cannot easily remove or tamper with the safeguard.
- **Protect from falling objects:** The safeguard should ensure that no objects can fall into moving parts and become a projectile that could strike and injure someone.
- **Create no new hazards:** A safeguard defeats its own purpose if it creates a hazard of its own such as a shear point, a jagged edge, or an unfinished surface which can cause a laceration.

- **Create no interference:** Safeguards must allow workers to perform their job quickly and comfortably, enhancing efficiency since it can relieve the worker's apprehensions about injury.
- **Allow safe lubrication:** If possible, one should be able to lubricate the machine without removing the safeguards.
- **Safe shutdown:** There must be a method to shut down (de-energize) the machinery before safeguards are removed or in case of emergency.

Before you operate any machine you must be authorized and know how to operate it safely. An inspection of all equipment should be done before any machine is turned on. Items to be inspected prior to the operation of a machine will vary with the type of machine. Report any missing or damaged guards to your supervisor.

How to be on the safe side:

- DO NOT WEAR loose-fitting clothing or long sleeves and do not wear rings, bracelets, neck chains, etc., all of which might get caught in machinery.
- DO WEAR the Personal Protective Equipment (PPE) recommended for the task.
- NEVER try to adjust a machine, reposition/stock a material or clear a jam while the machine is running.
- ALWAYS use established lockout/tagout procedures for maintenance and servicing of equipment and machines.
- NEVER bypass or remove safeguards. Report defective tools, equipment and machines.
- FOLLOW the operating instructions for the machine in use. Never take shortcuts. Read and adhere to the manufacturer's instructions and precautions.
- MAINTAIN positional awareness. Keep your hands, other body parts, and tools away from moving machine parts. Don't reach under or around a guard or reach blindly into an area that may contain energized parts.
- CLEAN UP/PICK UP in the area around machines.
- STAY ALERT and be prepared for emergencies.

When considering "machine guarding" the first thought is regarding concepts and techniques for safeguarding mechanical motion. However, machines obviously present a variety of other hazards which cannot be ignored. Some non-mechanical hazards to consider are :

- All **power sources** for machines are potential sources of danger. When using electrically powered or controlled machines, for instance, the equipment as well as the electrical system itself must be properly grounded. Replacing frayed, exposed, or old wiring will also help to protect the operator and others from electrical shocks or electrocution.
- **High pressure systems** need careful inspection and maintenance to prevent possible failure from pulsation, vibration, or leaks. Such a failure could cause, among other things, explosions or flying objects.
- Machines often produce **noise (unwanted sound)** which can result in a number of hazards to workers. Noise can startle and disrupt concentration, and can

interfere with communications, thus hindering the worker's safe job performance. Noise at certain levels for certain amounts of time may require the worker to become part of the UNL Hearing Conservation Program.

- Because some machines require the use of cutting fluids, coolants, and other potentially harmful substances, operators, maintenance workers, and others in the vicinity may need protection from **chemical hazards**. Specially constructed safeguards, ventilation, and protective equipment and clothing may be necessary.

#### Resources:

- Occupational Safety & Health Administration (OSHA) 29CFR 1920 Subpart D (Machine Guarding) <http://www.osha.gov/SLTC/machineguarding/index.html>
- OSHA Machine Guarding e-tool [http://www.osha.gov/SLTC/etools/machineguarding/generalrequirements.html#Machine\\_Guarding](http://www.osha.gov/SLTC/etools/machineguarding/generalrequirements.html#Machine_Guarding)
- OSHA Machine Safeguarding publication [http://www.osha.gov/Publications/Mach\\_SafeGuard/intro.html](http://www.osha.gov/Publications/Mach_SafeGuard/intro.html)
- EHS web-based training <http://ehs.unl.edu/onlinetraining/>
  - **General Electrical Safety Awareness**
  - **Lockout/Tagout (LO/TO) for Machines & Equipment**
  - **Chemical Safety**
- EHS Virtual Manual <https://scsapps.unl.edu/VirtualManual/>
- UNL Hearing Conservation Program SOPs <http://ehs.unl.edu/sop/#hearing>

#### 4. Can You Prevent This Injury?

Following is a recap of **actual** injury incidents at UNL involving equipment/machines which have occurred over the past 18 months. Read the Incident. Thinking about Machine Guarding and other aspects of safe equipment/machine use, consider which of the listed causal factors applies and what should have been done differently to avoid injury.

Then check the answer key. See if you correctly determined the causal factor, which will lead you to what can be done to prevent the injury. Hint: There might be more than one causal factor.

#### Causal factors to consider:

- a. Inadequate procedure/Procedure not followed.
- b. Location/Position problem
- c. Worker inattention/distraction
- d. Guards missing/inoperable
- e. Tool needed but not available/used.

#1 An employee put their hand into a slicer to release a jam. The employee de-energized the machine before removing guards. However, the blade was still turning and sliced the employee's finger.

#2 One employee was using a chain saw, working very near a second employee. The employee with the chain saw was holding it with one hand while operational, lost control, and dropped the chain saw. The chain saw injured the second employee working near him. The employee had not been trained in proper chain saw usage and safety considerations.

#3 An employee was working on a valve in a tight space and his finger was pinched. The space was too tight to allow the worker to wear protective gloves. The worker did not use a tool of any sort to assist. While working, the employee was talking with the occupant of the room.

#4 In two separate instances, employees were using a paper cutter and cut their finger. In both cases the injured employee did not realize their finger was in the way of the blade.

#5 A worker was feeding plant stalks into a portable thresher when he lost his balance. His arm and hand went into the threshing chamber. His finger was pinned between the edge of the chamber and the rotating metal cylinder, resulting in a broken finger.

#7 An employee sliced off the top of their thumb while using a slicer. The slicing guide was in place. The worker said they were holding the slicing guide too low.

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ANSWER #1: (c.) The worker had followed the established procedure, but did not pay close attention to ensure that all moving parts had stopped moving prior to proceeding. (e.) When resolving material jams in a machine it is advisable to use a tool for the manipulation. Injury is possible from contact with sharp objects, even if they are not moving.

ANSWER #2: (a.) There was no procedure in place to ensure proper training of workers before using a chain saw. (b.) The second employee was working too close to the worker using the chain saw.

ANSWER #3: (c.) The primary causal factor was worker distraction. (b.) The location/position of the valve made it likely that it would be necessary to use a tool to assist with releasing the valve without a pinch injury.

ANSWER #4: (b.) The position of the employee's finger in relation to the blade was unsafe. When using cutting tools, fingers/hands must not be positioned so the cutting edge can come into contact with any part of the fingers/hands.

ANSWER #5: (d.) Machinery should have adequate safeguarding so that worker's hands, arms, and any other part of a worker's body cannot come into contact with dangerous moving parts.

ANSWER #6: (b.) When using any equipment/machinery, employees should follow manufacturer's instructions for operation to ensure that their fingers/hands are not positioned in such a way as to compromise safe guarding. (e.) When using such equipment, if necessary to hold material, use tool as recommended by manufacturer.

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Always follow the guidelines for safe use of equipment/machinery. Don't become a statistic in the quarterly UNL Injury Incident report!

### 3. Revised Safe Operating Procedure

- Air Conditioning & Refrigeration (renamed from "Refrigerants")  
[http://ehs.unl.edu/sop/s-air\\_conditioning\\_&\\_refrigeration.pdf](http://ehs.unl.edu/sop/s-air_conditioning_&_refrigeration.pdf)
- Biosafety Training <http://ehs.unl.edu/sop/s-bio-training.pdf>
- Disposing of Biohazardous Materials, Including Recombinant Nucleic Acids  
<http://ehs.unl.edu/sop/s-bio-dispose.pdf>
- Preparing a Laboratory Biosafety Manual [http://ehs.unl.edu/sop/s-bio-preparing\\_biosafety\\_manual.pdf](http://ehs.unl.edu/sop/s-bio-preparing_biosafety_manual.pdf)
- Shipping Biological Substances [http://ehs.unl.edu/sop/s-ship\\_biological\\_substances.pdf](http://ehs.unl.edu/sop/s-ship_biological_substances.pdf)
- Shipping Infectious Substances w/wo Dry Ice [http://ehs.unl.edu/sop/s-ship\\_infectious\\_substances.pdf](http://ehs.unl.edu/sop/s-ship_infectious_substances.pdf)
- Shipping Items with Dry Ice That Are Not Otherwise Dangerous Goods  
[http://ehs.unl.edu/sop/s-ship\\_nondanger\\_dry\\_ice.pdf](http://ehs.unl.edu/sop/s-ship_nondanger_dry_ice.pdf)
- Spill & Exposure Response for Biohazardous Materials (Including Recombinant Nucleic Acids) [http://ehs.unl.edu/sop/s-bio-clean\\_spills\\_biohaz.pdf](http://ehs.unl.edu/sop/s-bio-clean_spills_biohaz.pdf)

**Remember...SAFETY IS AN ATTITUDE!**

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