INDIANA UNIVERSITY

OFFICE OF THE EXECUTIVE VICE PRESIDENT
FOR UNIVERSITY ACADEMIC AFFAIRS

University Environmental Health and Safety

Machinery and Machine Guarding Program

October 14, 2015

1. INTRODUCTION

1.1. Purpose

Indiana University Environmental Health and Safety (IUEHS) has developed the Machinery and Machine Guarding Program to protect employees from the hazards associated with machinery by establishing the minimum requirements for machine guarding at Indiana University. This Program is also intended to ensure compliance with all applicable requirements specified by the Occupational Safety and Health Administration (OSHA) standards contained within 29 CFR 1910 212, 213, 215, 217, 219, and 243.

1.2. Scope

This Program applies to all Indiana University employees, and covers all machinery, which due to nature of operation and/or design, possess inherent hazards caused by mechanical motion such as ingoing nip points, rotating parts, flying chips, and sparks. This Program does not apply when:

1.2.1. Indiana University does not own the machinery or machine responsible for creating the hazard, and by contract or through actual practice, does not have the authority to correct or mitigate the hazard;
1.2.2. Sources of hazardous energy, including mechanical motion, have been isolated or controlled in accordance with the Indiana University Control of Hazardous Energy (i.e. Lockout/Tagout) Program; or
1.2.3. Sources of hazardous energy, including mechanical motion, have been isolated for plug-connected equipment by disconnecting the plug and tagging the equipment out of service.

2. AUTHORITY AND RESPONSIBILITY

2.1. University Environmental Health and Safety (IUEHS) is responsible for:

2.1.1. Developing the Machinery and Machine Guarding Program and revising the Program as appropriate;
2.1.2. Inspecting machines and machinery for appropriate guarding as deemed appropriate or upon request, and reporting any hazardous conditions to the appropriate department(s);
2.1.3. Assisting departments with the selection of proper machine guards upon request; and
2.1.4. Investigating injuries related to machine operation and/or lack of machine guarding.

2.2. Departments are responsible for:

2.2.1. Ensuring all machines are properly guarded in accordance with this Program;
2.2.2. Inspecting machines for adequate guarding as specified within this Program;
2.2.3. Providing adequate guarding solutions (i.e. engineering controls) for machines in accordance with this Program;
2.2.4. Providing personal protective equipment (PPE) in accordance with the Indiana University PPE Policy.

2.2.5. Disciplining employees who violate the requirements of this Program; and
2.2.6. Ensuring that machine-specific training is provided as specified in this Program.

2.3. Supervisors are responsible for**:**

2.3.1. Ensuring that unguarded machines are removed from service until all necessary guards are in place;
2.3.2. Contacting IUEHS for the respective campus for an evaluation of safeguards when concerns regarding adequate protection cannot be resolved within the applicable department(s), or when guarding alternatives are necessary as specified in Machine Guarding Alternatives section below; and
2.3.3. Ensuring that all employees have received training as specified in this Program.

2.4. Employees are responsible for:

2.4.1. Complying with this Program, and all applicable federal, state, and local regulations regarding machine guarding;
2.4.2. Wearing appropriate PPE in accordance with the Indiana University PPE Policy;
2.4.3. Notifying the supervisor of any machine that does not have appropriate machine guards or engineering controls in place;
2.4.4. Refraining from using machines that do not have all necessary guards in place;
2.4.5. Reporting all damaged or malfunctioning machines or powered hand tools to the appropriate supervisor and/or appropriate department;
2.4.6. Performing pre-use inspections as specified in this Program; and
2.4.7. Wearing appropriate attire around machines and machinery (i.e. employees shall not wear loose-fitting clothing, jewelry, or other items that could become entangled in machinery and long hair shall be worn under a cap or otherwise contained to prevent entanglement in moving machinery).

3. PROGRAM ELEMENTS

3.1. Types of Machines

For the purposes of this Program, machines are divided into two main categories based upon how an employee interacts with the machine. Machines that have a “point of operation”, or area on or near the machine in which work is performed by an operator are considered “employee-driven” machines. Employee-driven machines include portable power tools, power saws, power presses, wood-working equipment, kitchen equipment, etc. See IU Hand and Power Tool Safety Program for additional information. Machines that do not have a specific “point of operation” and which do not have an operator during normal operation are considered “self-driven”. Self-driven machines can include elevators, pumps, compressors, exhaust fans, ceiling fans, etc.

3.2. General Requirements

3.2.1. One or more methods of machine guarding shall be provided to protect the operator and other employees in the machine area from hazards such as those created by the point of operation, ingoing nip points, rotating parts, flying chips/material, and sparks. See Appendix B for an explanation of hazardous mechanical motions and actions. See also Basic Safeguarding requirements (Section 3.3) and Machine-Specific Safeguarding requirements (Section 3.4).
3.2.2. When barrier guards are used, they shall be affixed to machine(s) where possible and secured elsewhere if for any reason attachment to the machine is not possible. The guard shall be such that it does not offer an accident hazard in itself.
3.2.3. The point of operation for self-driven machines whose operation exposes an employee to injury, shall be guarded. The guarding device shall conform with any appropriate standards, or, in the absence of applicable specific standards, shall be so designed and constructed as to prevent the operator from having any part of his body in the danger zone during the operating cycle.

3.2.4. Special hand tools for placing and removing material from self-driven machines shall be such as to permit easy handling of material without the operator placing a hand or other body part in the hazardous zone near the point of operation. Such tools shall not be in lieu of other guarding requirements, but can only be used to supplement protection provided.
3.2.5. Revolving drums, barrels, and containers shall be guarded by an enclosure which is interlocked with the drive mechanism, so that the barrel, drum, or container cannot revolve unless the guard enclosure is in place.
3.2.6. When the periphery of the blades of a fan or power transmission apparatus are less than seven (7) feet above the floor or working level, the equipment shall be guarded. The guard shall have openings no larger than one-half (1/2) inch.
3.2.7. Machines designed for a fixed location shall be securely anchored to prevent walking or moving (e.g. drill press).
3.2.8. All machines shall have appropriate guards in place during operation except when undergoing maintenance in accordance with the Indiana University Control of Hazardous Energy Program.

3.3. Basic Safeguarding

All safeguards must also meet the following basic safeguarding performance requirements:

3.3.1. **Prevents contact:** The safeguard shall prevent hands, arms, and any other part of an employee's body from making contact with dangerous moving parts. A good safeguard system eliminates the possibility of the operator or other employees from placing their bodies near hazardous moving parts.
3.3.2. **Prevents tampering:** Employees shall not be able to easily remove or tamper with the safeguards. Guards and safety devices shall be made of durable material that will withstand the condition of normal use. They shall be firmly secured in place.
3.3.3. **Protects from falling objects:** The safeguard shall ensure that no objects can fall into moving parts. A small tool which is dropped into a cycling machine could easily become a projectile that could strike and injure someone.
3.3.4. **Creates no new hazard**: 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 that could cause laceration. The edges of guards, for instance, shall be rolled or bolted in such a way that they eliminate sharp edges.
3.3.5. **Creates no interference:** Any safeguard which impedes an employee from performing the job quickly and comfortably might soon be overridden or disregarded. Proper safeguarding can actually enhance efficiency since it can relieve the employee's apprehensions about injury.
3.3.6. **Allows safe lubrication:** If possible, employees shall be able to lubricate the machine without removing the safeguard. Locating oil reservoirs outside the guard, with a line leading to the lubrication point, will reduce the need for the operator or maintenance employee to enter the hazardous area.

3.4. Machine-Specific Safeguarding

In addition to the basic safeguarding requirements specified within the Basic Safeguarding section above, all machines and safeguards must also meet any applicable mandatory and non-mandatory machine-specific guarding requirements specified within 29 CFR 1910.213, 215, 217 and 219, and all other applicable IUEHS programs.

3.4.1. For specific woodworking machinery requirements, refer to 29 CFR 1910.213.
3.4.2. For abrasive wheel machinery requirements, refer to 29 CFR 1910.215.
3.4.3. For mechanical power press requirements, refer to 29 CFR 1910.217.
3.4.4. For mechanical power transmission apparatus, refer to 29 CFR 1910.219.
3.4.5. For portable power tool requirements, refer to 29 CFR 1910.243 and the Indiana University Hand and Power Tool Safety Program.
3.4.6. For robot and robotic systems requirements, refer to the Indiana University Robot Safety Program.

3.5. Machine Guarding Alternatives

When certain guarding requirements cannot be achieved as specified within the Machine-Specific Safeguarding section above, guarding alternatives may be necessary to ensure the safety of employees during machine operation. IUEHS for the respective campus should be contacted to identify appropriate alternatives that provide an equivalent level of protection.

3.6. Machinery Inspection Requirements

3.6.1. Employee-driven machines shall be visually inspected prior to each use by the operator to ensure all necessary guards are in place to mitigate hazards including those caused by the point of operation itself, the power transmission apparatus, or other moving parts. Other moving parts include all parts of the machine which move while the machine is working, including, but not limited to, reciprocating, rotating, and transverse moving parts, as well as feed mechanisms and auxiliary parts of the machine.

3.6.2. Visual inspections of guarding for self-driven machines are not required at specific intervals; however, employees should report any unguarded machinery to the appropriate and/or responsible department or to IUEHS for the respective campus when the responsible department is unknown. The applicable department is responsible for providing guards for this machinery, and taking the equipment out of service until the appropriate guards are in place.

4. TRAINING

All departments are responsible for ensuring that employees understand the requirements of this Program, and that employees are trained to recognize general machine-guarding hazards (See Appendix B). Each department shall also be responsible for providing machine-specific operator training that includes instruction or hands-on training when employees use employee-driven machines during the course of work. Training shall include at a minimum:

4.1.1. A description and identification of the specific hazards associated with particular machines;

4.1.2. The safeguards on the particular machines including, but not limited to: how they provide protection; the hazards for which they are intended; and how to use them; and

4.1.3. What to do (e.g., contact the supervisor) if a safeguard is damaged, missing, or unable to provide adequate protection.

This training shall be provided to all new operators or setup personnel, when any new or altered safeguards are put in service for equipment-driven machines, or when employees are assigned to a new machine or operation. Training may be generalized to multiple machines as long as the three minimum training criteria noted in this section are met.

5. REFERENCES

- 29 CFR 1910 212 –General Requirements for All Machines
- 29 CFR 1910.213 – Woodworking Machinery Requirements
- 29 CFR 1910.215 – Abrasive Wheel Machinery
- 29 CFR 1910.217 – Mechanical Power Presses
- 29 CFR 1910.219 – Mechanical Power-Transmission Apparatus
- 29 CFR 1910 243 – Guarding of Portable Powered Tools
- Indiana University Control of Hazardous Energy Program
- Indiana University Hand and Power Tool Safety Program
- Indiana University PPE Policy
- Indiana University Robot Safety Program

6. REVISIONS

New Document: October 14, 2015

APPENDIX A – GLOSSARY

1. **Employee-Driven Machines -** Machines that have a “point of operation”, or area on or near the machine in which work is performed by an employee.

2. **Enclosures** – Mounted physical barriers which prevent access to moving parts of machinery or equipment.

3. **Nip Points** – In-running machine or equipment parts, which rotate towards each other, or where one part rotates toward a stationary object.

4. **Point-of-Operation** – The area on a machine or item of equipment, where work is being done and material is positioned for processing or change by the machine.

5. **Power Transmission** – Any mechanical parts which transmit energy and motion from a power source to the point-of-operation. Example: Gear and chain drives, cams, shafts, belt and pulley drives and rods.

6. **Safeguards** – Barriers or mechanisms that prevent employees from contact with moving portions or parts of exposed machinery or equipment which could cause physical harm to the employees.

7. **Self-Driven Machines -** Machines that do not have a specific “point of operation” and which do not have an operator during normal operation.

APPENDIX B – HAZARDOUS MECHANICAL MOTIONS AND ACTIONS

A wide variety of mechanical motions and actions may present hazards in the workplace. These can include the movement of rotating members, reciprocating arms, moving belts, meshing gears, cutting teeth, and any parts that impact or shear. These different types of hazardous mechanical motions and actions are basic in varying combinations to nearly all machines, and recognizing them is the first step toward protecting workers from the danger they present.

Potentially Hazardous Mechanical Motions

1. **General Rotation:** Rotating motion can be dangerous; even smooth, slowly rotating shafts can grip clothing, and through mere skin contact force an arm or hand into a dangerous position. Injuries due to contact with rotating parts can be severe. Collars, couplings, cams, clutches, flywheels, shaft ends, spindles, meshing gears, and horizontal or vertical shafting are some examples of common rotating mechanisms which may be hazardous. The danger increases when projections such as set screws, bolts, nicks, abrasions, and projecting keys are exposed on rotating parts.

2. **In-Running Nip Points:** In-running nip point hazards are also caused by rotating motion on machinery. There are three main types of in-running nips:
   - Parts can rotate in opposite directions while their axes are parallel to each other. These parts may be in contact (producing a nip point) or in close proximity. In the latter case the stock fed between the rolls produces the nip points. This danger is common on machines with intermeshing gears and rolling mills.
   - Nip points are also created between rotating and tangentially moving parts. Some examples would be: the point of contact between a power transmission belt and its pulley, a chain and a sprocket, and a rack and pinion.
   - Nip points can occur between rotating and fixed parts which create a shearing, crushing, or abrading action. Examples are: spoked hand wheels or flywheels, screw conveyors, or the periphery of an abrasive wheel and an incorrectly adjusted work rest.

3. **Reciprocating Motion:** Reciprocating motions may be hazardous because, during the back-and-forth or up-and-down motion, a worker may be struck by or caught between a moving and a stationary part, or lacerated by the reciprocating part.

4. **Transverse Motion:** Transverse motion (movement in a straight, continuous line) creates a hazard because a worker may be struck or caught in a pinch or shear point by the moving part.

Potentially Hazardous Mechanical Actions

1. **Cutting:** Cutting action may involve rotating, reciprocating, or transverse motion. The danger of cutting action exists at the point of operation where finger, arm and body injuries can occur and where flying chips or scrap material can strike the head, particularly in the area of the eyes or face. Such hazards are present at the point of operation in cutting wood, metal, or other materials. Examples of mechanisms involving cutting hazards include bandsaws, circular saws, boring or drilling machines, turning machines (lathes), or milling machines.
2. **Punching:** Punching action results when power is applied to a slide (ram) for the purpose of blanking, drawing, or stamping metal or other materials. The danger of this type of action occurs at the point of operation where stock is inserted, held, and withdrawn by hand. Typical machines used for punching operations are power presses and iron work.
3. **Shearing:** Shearing action involves applying power to a slide or knife in order to trim or shear metal or other materials. A hazard occurs at the point of operation where stock is actually inserted, held, and withdrawn. Examples of machines used for shearing operations are mechanically, hydraulically, or pneumatically powered shears.
4. **Bending:** Bending action results when power is applied to a slide in order to draw or stamp metal or other materials. A hazard occurs at the point of operation where stock is inserted, held, and withdrawn. Equipment that uses bending action includes power presses, press brakes, and tubing benders.