Physical Hazards of Machinery and Equipment

Overview
Safeguards are essential for protecting workers from needless and preventable machinery-related injuries. There are several physical hazards associated with mechanical equipment and machinery that users must be protected from, including pinch points, wrap points, shear points, crush points, pull-in points, and the potential for objects to be thrown from the equipment. The point of operation, as well as all parts of the machine that move while the machine is operating, must be safeguarded. A good rule to remember is: Any machine part, function, or process which may cause injury, must be safeguarded.

It is important that equipment users follow the safe practices below before operating equipment.

- Users must be trained on the piece(s) of equipment and should not work alone.
- Machine guarding must be in place and functioning properly. Report machine guarding problems to Supervisors immediately.
- Loose clothing (including neck-ties) may NOT be worn around equipment.
- Dangling jewelry (e.g., necklaces, earrings, non-breakaway lanyards) must be removed when around equipment.
- Long hair must be tied back and secured.
- Appropriate personal protective equipment must be utilized including eye, face, and/or hearing protection (if required).

Applicability
This update applies to anyone operating machinery at Weill Cornell Medicine (WCM), including all employees, students, and volunteers working in laboratory, clinical, and administrative/service work environments. The requirements of this update apply, but are not limited to, machine tools, mechanical equipment, laboratory equipment, and other areas where machinery presents a physical hazard which may cause injury to users. Additionally, this update is applicable to all equipment that contains pinch points, wrap points, shear points, crush points, pull-in points, or the potential to throw objects. The scope of this update is not limited to machine shops, but extends to all machinery and/or tools utilized at WCM.

Physical Hazards Associated with Machinery

- **Pinch Points** – Where two parts move together and at least one of the parts moves in a circle; also called mesh points, run-on points, and entry points. Examples include: belt drives, chain drives, gear drives, and feed rolls. When shields cannot be provided, operators must avoid contact with hands or clothing in pinch point areas. Never attempt to service or unclog a machine while it is operating or the engine is running.

- **Wrap Points** – Any exposed component that rotates. Examples include: rotating shafts such as a PTO shaft or shafts that protrude beyond bearings or sprockets. Watch components on rotating shafts, such as couplers, universal joints, keys, keyways, pins, or other fastening devices. Splined, square, and hexagon-shaped shafts are usually more dangerous than round shafts because the edges tend to grab fingers or clothing more easily than a round shaft. However, round shafts may not be smooth and can also grab quickly. Once a finger, thread, article of clothing, or hair is caught it begins to wrap; pulling only causes the wrap to become tighter.

- **Shear Points** – Where the edges of two moving parts move across one another or where a single sharp part moves with enough speed or force to cut soft material. Remember that cutting devices cannot be totally guarded to keep hands and feet out and still perform their intended function. Recognize the potential hazards of cutting and shear points on implements and equipment that are not designed to cut or shear. Guarding may not be feasible for these hazards.

- **Crush Points** – Points that occur between two objects moving toward each other or one object moving toward a stationary object. Never stand between two objects moving toward one another. Use adequate blocking or lock-out devices when working under equipment.

- **Pull-In Points** – Points where objects are pulled into equipment, usually for some type of processing. Machines are faster and stronger than people. Never attempt to hand-feed materials into moving feed rollers. Always stop the equipment before attempting to remove an item that has plugged a roller or that has become wrapped around a rotating shaft. Remember that guards cannot be provided for all situations - equipment must be able to function in the capacity for which it is designed. Freewheeling parts, rotating or moving parts that continue to move after the power is shut off are particularly dangerous because time delays are necessary before service can begin. Allow sufficient time for freewheeling parts to stop moving. Stay alert! Listen and watch for motion!
Thrown Objects – Any object that can become airborne because of moving parts. Keep shields in place to reduce the potential for thrown objects. Wear protective gear such as goggles to reduce the risk of personal injury if you cannot prevent particles from being thrown. All guards, shields or access doors must be in place when equipment is operating. Electrically powered equipment must have a lock-out control on the switch or an electrical switch, mechanical clutch or other positive shut-off device mounted directly on the equipment. Circuit interruption devices on an electric motor, such as circuit breakers or overload protection, must require manual reset to restart the motor.

Responsibilities

- Supervisors must ensure Equipment Users have been properly trained to safely operate the equipment and machinery. This equipment must be inspected regularly to ensure it is operating properly and all guarding is in place and functional. Supervisors are responsible for ensuring all machine guard deficiencies are corrected immediately and damaged equipment is removed from service.
- Equipment users must only operate equipment for which they have received training. Equipment users are not permitted to operate machinery or equipment unless all guards are in place. Only equipment users who have been appropriately trained may perform service and maintenance on equipment. All service and maintenance must be performed in accordance with the manufacturer’s guidelines. Prior to performing any service the equipment user must ensure all hazardous energy from the equipment has been properly controlled. Equipment users must report machine guard problems, malfunctioning and/or damaged equipment to their supervisor immediately.
- Environmental Health and Safety (EHS) provides technical assistance and guidance on machine guarding, and inspects areas using machinery and mechanical equipment for compliance. EHS is available to provide supplemental machine guarding awareness training for equipment users and supervisors. This training can be provided in addition to the required training on safe equipment operation and use.

Requirements for Safeguards

Moving machine parts have the potential to cause death or severe workplace injuries, such as crushed fingers or hands, amputations, burns, or blindness. Safeguards are essential for protecting workers from these needless and preventable injuries. 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 eliminated or controlled. The following safeguards (if applicable) are required for all equipment:

- Prevent contact - prevent worker’s body or clothing from contacting hazardous moving parts.
- Secure - must be firmly secured to the machine and not easily removed.
- Protect from falling objects - ensure that no objects can fall into moving parts.
- Create no new hazards - must not have shear points, jagged edges or unfinished surfaces.
- Create no interference - must not prevent worker from performing the job quickly and comfortably.
- Allow safe lubrication - if possible, be able to lubricate the machine without removing the safeguards.

Hazards to machine operators that can’t be designed around must be shielded to protect the operator from injury or death. Guards, decals and labels which identify the danger must be kept in place whenever the machine is operated. Guards or shields removed for maintenance must be properly replaced before use. Moving parts present the greatest hazard because of the swiftness of their action and unforgiving and relentless motion.

Training

Supervisors must ensure equipment users are adequately trained in the proper use of all equipment used. Equipment user training must, at a minimum, address the following areas:

- Hazards associated with particular machines.
- How the safeguards provide protection and the hazards for which they are intended.
- How and why to use the safeguards.
- How and when safeguards can be removed and by whom.
- What to do if a safeguard is damaged, missing, or unable to provide adequate protection.

Equipment users who will perform service or maintenance on equipment must be adequately trained in these procedures prior to performing this work.
EHS is available to provide general machine guarding awareness training for any WCM equipment user. This training can be provided in addition to the required training above. Supervisors must contact Environmental Health and Safety to arrange awareness training.

References
Occupational Safety and Health Administration (29 CFR 1910 Subpart O)
Cornell University EHS – Physical Hazards Manual 16.2 Machine Guarding