General Shop Safety

Environmental Health and Safety
Tool Safety
# Common Hand and Power Tools

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Switches

- Positive “on-off” control
  - *Routers, planers, shears, scroll saws, laminate trimmers, jig saws, nibblers*

- Momentary contact “on-off” control
  - *Power drills, grinders, tappers, disc and belt sanders, reciprocating saws*

- Constant pressure switch
  - *Circular saw, chain saw, and percussion tools*
Power-Operated Hand Tools

• Never carry or lift a tool by its electrical cord
• To protect a worker from electrical shock, tools must:
  • Have a 3-wire cord plugged into a grounded receptacle
  or
  • Be double-insulated

Plug with a grounding pin

Double-insulated markings
Pneumatic Power Tools

• Secured to the hose or whip by some positive means to prevent the tool from becoming accidentally disconnected

• Tools operating at more than 100 p.s.i must have a safety device on the muzzle to prevent the tool from ejecting fasteners unless the muzzle is in contact with work surface
Spray Equipment

• Airless spray guns
  • Operating at ≥1,000 p.s.i. must have automatic or visible manual safety device that prevents pulling trigger until manually released

• Abrasive blast cleaning nozzles
  • Must be equipped with operating valve which must be held open manually
Fuel-Powered Tools

- Fuel powered tools must be stopped while being refueled, serviced, or maintained

- Fuel must be transported, handled, and stored in accordance with Subpart F- Fire Protection and Prevention
Power-Actuated Tools

- All users must be properly trained
- Use with the correct shield, guard, or attachment recommended by the manufacturer
  - Test tool daily before loading to ensure the safety devices are working properly
- Never use a tool that is not working properly
- Don’t use in explosive or flammable atmosphere
- Do not load until just prior to intended firing time
- Wear suitable ear, eye, and face protection
- Keep hands clear of the barrel end
- Never point the tool at anyone
- Loaded tools shall not be left unattended
Use of Abrasive Wheels

- Must be closely inspected and ring-tested before mounting to ensure that they are free from cracks and defects
- Ensure the spindle speed does not exceed the maximum speed marked on the wheel
- Grinding wheels must fit freely on the spindle
- Tighten the spindle nut only enough to hold the wheel in place

Maximum RPM 8,700
Abrasive Wheel Machinery

- Distance between the wheel periphery and the adjustable tongue shall not exceed ¼ inch
Abrasive Wheels and Tools - Guards

• Must be provided with safety guards that cover the spindle end, nut, and flange
• Floor and bench-mounted grinders
  • Angular exposure of the grinding wheel should not exceed 90 degrees or ¼ of the periphery
• Work rests must be adjusted closely to the wheel with a maximum opening of ⅛”
Portable Grinders

- Vertical portable grinders must have safety guard on tool with a maximum exposure angle of 180°
- Install the proper type guard located so as to be between the operator and the wheel during use
- Guard adjusted to deflect broken pieces of wheel away from operator
Anchoring Fixed Machinery

• Machines designed for fixed location must be anchored to prevent walking or moving
Woodworking Tools

- Fixed power driven woodworking tools must be provided with a disconnect switch
- Switch can either be locked or tagged in the off position
Woodworking Tools – Portable Circular Saw

• Must be equipped with guards above and below the base plate or shoe.
• Upper and lower guard must cover the saw to the depth of the teeth.
• Lower guard must automatically return to the covering position over the blade teeth when tool is withdrawn from the work.
• Mechanical or electrical power control provided for operator to cut off power.
• Control is located on machine where operator does not have to leave his position at the point of operation.
Woodworking Tools - Jointer

• Hand-fed jointer with horizontal cutting head must have an automatic guard
  • Must cover the **working** side of the fence or gage
  • Automatically adjust and cover the unused portion of the head
Woodworking Tools- Bandsaw and Band Resaw

• All portions of saw blade must be enclosed or guarded except working portion between guide rollers and the table
• Bandsaw wheels must be fully encased
Woodworking Tools – Radial Saws

• Must have guard to prevent the operator from coming in contact with the rotating blade

• Lower portion of blade must be guarded on both sides
  • Guarded to the full diameter of the blade
  • Will adjust itself to the thickness of the stock
Woodworking Tools – Hand-fed Ripsaw

• Provided with a hood guard
  • Must automatically adjust itself to thickness of material being cut
• Remain in contact with material
• Hood must completely enclose portion of saw blade above the table
• Mounting must be strong enough to resist any reasonable side thrust
Machine Guarding

OSHA 29 CFR 1910.212 General Requirements for All Machines
Introduction to Machine Guarding

- Protects body parts and unwanted objects from coming into contact with moving or dangerous machinery parts
- Required by OSHA for any machine part, function or process that has the potential of causing an injury
- Methods for guarding are machine- and use-specific
OSHA Annual Statistics

- Workers who operate and maintain machinery suffer approximately 18,000 amputations, lacerations, crushing injuries, and abrasions
  - Amputation is one of the most severe and crippling types of injuries in the occupational workplace, and often results in permanent disability.
- Over 800 deaths per year due to machine use
Injuries from Improper Guarding

• Cuts, punctures, or abrasions
  • Drill presses, table saws, various woodworking machines, metal forming/cutting equipment

• Pinched, crushed or severed body parts
  • Compactors, mowers, printing machines, wood and metal cutting machines

• Eye injuries or blindness
  • Grinders, table saws, power saws, drill presses
Machine Components

• Point of Operation – guarded
  • Where work is performed on material

• Power Transmission Devices
  • Mechanical component that transmits energy to the point of operation

• Operating Controls
  • All parts of the machine that move during operation
Hazardous Activities

• Situations that may present a potential hazard to the operator

• Examples
  • Normal production operations
  • Setup/preparation
  • Inspection
  • Clearing jams
  • Adjustments
  • Cleaning/Lubricating
  • Maintenance
Hazardous Motions

• Rotation - circular motion
  • Can “grab” operator and force body part into dangerous position

• Reciprocating – back and forth or up and down
  • Can strike or pin an employee between moving and fixed objects

• Transverse

• In-running nip (pinch) points
Hazardous Actions - Cutting

• May be rotating, reciprocating, or transverse motion
• Hazard exists at point of operation where bodily injury can occur or flying materials can strike eye or face
• Bandsaw, circular saw, boring and drilling machines, lathes, etc.
Hazardous Actions - Punching

• Results when power is applied to a slide
• Hazard exists at point of operation where stock is manipulated by user
• Presses, etc.
Hazardous Actions - Shearing

• When power is applied to slide or knife used to trim or shear materials
• Shearing – hazard exists where user inserts, holds or withdraws material by hand
• Metal shear, etc.
Hazardous Action - Bending

• Occurs when power is applied to a slide to draw, turn, or stamp materials into shape
• Hazard at point of operation where stock is inserted, held and withdrawn
• Power presses, tube bender, press brake
Machine Guards (Safeguards)

- Six requirements set by OSHA must be met or exceeded
  - Prevent contact
    - Prevent body parts from making contact with dangerous moving parts
  - Be secured to machine, floor, wall, etc.
    - Workers should not be able to move or tamper with guard
  - Protect from falling objects
    - Ensure that nothing can fall into moving parts
  - May NOT create a new hazard
    - Guard should not have shear point, jagged edge or unfinished surface
  - May NOT create interference
    - Should not impede worker from performing the job quickly and comfortably
  - Allow for safe lubrication
    - If possible should be able to lubricate or service machine with guard in place
OSHA GUARD-OPENING REQUIREMENTS
The maximum permissible opening for guards as required by OSHA 29 CFR 1910.217 for mechanical power presses is as follows:

<table>
<thead>
<tr>
<th>Distance of Opening from Point-of-Operation Hazard (Inches)</th>
<th>Maximum Width of Opening (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>½ to 1 ½</td>
<td>1/4</td>
</tr>
<tr>
<td>1 ½ to 2 ½</td>
<td>3/8</td>
</tr>
<tr>
<td>2 ½ to 3 ½</td>
<td>1/2</td>
</tr>
<tr>
<td>3 ½ to 5 ½</td>
<td>5/8</td>
</tr>
<tr>
<td>5 ½ to 6 ½</td>
<td>3/4</td>
</tr>
<tr>
<td>6 ½ to 7 ½</td>
<td>7/8</td>
</tr>
<tr>
<td>7 ½ to 12 ½</td>
<td>1 1/4</td>
</tr>
<tr>
<td>12 ½ to 15 ½</td>
<td>1 1/2</td>
</tr>
<tr>
<td>15 ½ to 17 ½</td>
<td>1 7/8</td>
</tr>
<tr>
<td>17 ½ to 31 ½</td>
<td>2 1/8</td>
</tr>
<tr>
<td>Over 31 ½</td>
<td>6</td>
</tr>
</tbody>
</table>
Machine Guard Construction

- Guards should be purchased from the equipment manufacturer for the specific machine
  - Conform to the design and function of specific equipment
  - May strengthen machine or serve additional functional purpose
User Built Guards

• Just because a guard is not produced does NOT mean one doesn’t have to be used

• If machine pre-dates the use or production of guards or guard is not produced by manufacturer
  • User guards can be developed as long as they are fabricated to meet specifications of proper guarding for specific machine
Machine Guarding Aides

• Safety trip controls
• Gates
• Photoelectric barrier
• Awareness barriers
• Special hand tools
Safety Trip Control

• Quick means for deactivating machine in emergency

• Examples
  • Pressure activated bar
  • Emergency stop buttons
  • Emergency pull cord
Gates

• Moveable barrier that protects operator at point of operation
• Gate must be interlocked so that machine will not begin a cycle without gate in place
• Gate must be closed for machine to function
Photoelectric Barrier

• Optical presence-sensing device
• Light sources are known as “light curtains”
• If light curtain is broken – machine instantly stops
Awareness Barrier

• Reminds person that they are approaching danger area
• Does NOT physically prevent person from entering
• Must be used in conjunction with actual guard – never alone
• Employee must take action to enter danger area
  • Step or reach over, under or through the barrier
Special Hand Tools

- Tools used to place and remove material without operator having to place hands in danger zone
- Does not replace actual guard
Feeding

• Automatic
  • Material is fed from rollers or another automatic method

• Semi-Automatic
  • Material is fed by chutes, moveable dies, dial feed, plunger or sliding bolster
Ejection

• Automatic
  • Material is ejected by air or mechanical means
  • May create debris hazard and/or noise hazard

• Semi-automatic
  • Material is ejected by mechanical means initiated by operator
Lockout/Tagout

• If guarding must be removed for maintenance proper LOTO procedures must be followed
• See NCCU LOTO awareness training and program
Ladder Safety

OSHA 1926.1053
When Should a Ladder be Used?

• When there is a break in elevation 19” or more and no ramp, runway, embankment or personnel hoist
• Ask these questions to decide if a ladder is the best choice
  • Do I need to hold heavy items while on the ladder?
  • Is the elevated area so high that the required ladder might be unstable?
  • How long will I be on the ladder working?
  • Would I have to stand on the ladder sideways to work?

If you answer yes to any of these questions, consider another option!
Best Practices

- Maintain ladders free of oil, grease and other slip hazards
- Use ladders only for designated purpose
- Do not load ladders beyond rated capacity
- Use ladders on stable, level surfaces
- Secure ladders when traffic or activity may displace ladder
- Do not place ladder on other objects to obtain additional height
- Do not move, shift or extend ladder while in use
- Always secure the base of the ladder
3-point Contact

• Always maintain 3-point contact when climbing
  • 2 hands + foot
  • 2 feet + hand

• Keep body near middle of step and face the ladder
Types of ladders

- Step
- Portable
- Fixed
- Do NOT use single-rail ladder
Use the Right Ladder for the Job

- Do not stand on top rung
- Do not overextend reach
Extension or Straight Ladder

- Must extend at least 3 feet above the point of support
- Do not stand on the three top rungs of a straight, single or extension ladder
- Place base ¼ of working length of the ladder from the wall or other vertical surface
Maintain Ladders Properly

- Before use, check to ensure there are no defects
- Ladders must be inspected before initial use in each work shift, per OSHA 1910.23(b)(9) – any ladders found with deficiencies must be tagged and taken out of service immediately
- Do not use ladder if bent, missing steps or locking device
Combustible Dust Hazard Training

NFPA 652, 654, and 664
Introduction

• Dust is generated as a by-product of processes is not necessarily a hazard; however

• Combustible dust that is allowed to accumulate can lead to explosion and cause injury, loss of life, and property damage
Combustible Dust

• Combustible materials (and some non-combustible materials) can burn rapidly when found in a finely divided form (dust) in air in right concentration can become explosive

• National Fire Protection Association (NFPA 654)
  • “any finely divided solid material that is 420 microns or smaller in diameter and presents a fire or explosion hazard when dispersed and ignited in air”

• OSHA National Emphasis Program (NEP)
  • “A combustible particulate solid that presents a fire or deflagration hazard when suspended in air or some other oxidizing medium over a range of concentrations, regardless or particle size or shape.”
NEP Definitions

• Minimum Explosive Concentration (MEC)
  • Minimum concentration of dust suspended in air that will support a deflagration (combustion which propagates through a gas or across the surface of an explosive at subsonic speeds, driven by the transfer of heat)
  • Typically 2-3 times orders of magnitude higher than “health” based exposure levels
  • Normally present inside process equipment (conveyors, silos, etc.)
  • Accumulation of dust in an area, when disturbed, may result in temporary concentrations greater than MEC
Dust Explosion Pentagon

- Fuel – combustible dust
- Heat/ignition – flame
- Oxygen in air
- Dispersion of dust
- Confinement of dust cloud

When all elements are present in a enclosed space, resulting pressure can cause an explosion
Materials That Form Combustible Dust

• Metals (i.e. aluminum)
• Wood
• Coal
• Plastics
• Paper
• Soap
• Certain textiles
Possible Ignition Sources

- Open flames and sparks
- Hot surfaces
- Heat from mechanical impact
- Electrical discharges
- Static electricity
- Smoldering or burning dust
- Smoking materials
Ignition Control

• No hot work should be performed in areas where combustible dust hazard exists even after cleaning
• Follow all safe welding, cutting, and brazing precautions
• Ensure employees do not smoke near these work areas
Dust Concentration

• Dust layer greater than 1/32 of an inch accumulated on surface area of at least 5% of a room’s floor or above ceiling area constitutes a significant explosion hazard
Control Recommendations (NFPA 654)

- Minimize escape of dust from process equipment or ventilation systems
- Use dust collection systems and filters
- Use surfaces that reduce accumulation and help with cleaning
- Conduct regular inspections and cleaning for dust
  - Clean in a manner that does not generate dust clouds
- Develop and implement written plan for hazardous dust inspection, housekeeping, and control
Control Measures
American Industrial Hygiene Association (AIHA)

- Keep ignition sources out of hazardous areas
- Keep areas and equipment clean
- Establish regular cleaning program for horizontal surfaces such as ducts, pipes, ledges, etc. that are not part of normal cleaning
- Train employees and emphasize the importance of good housekeeping and other operational procedures
Housekeeping

- Use supplemental dust cleaning equipment (HEPA filtered vacuums) to clean area
- Never blow dust around – use wet cleaning methods
- Remove dust as soon as possible to prevent accumulation
- Maintain cleanliness in woodworking areas and on tools and equipment where wood dust may accumulate
- Keep overhead ventilation ducts and equipment free of dust
Hot Work and Welding

NCFC Chapter 35 and OSHA 1910.252
Definition

- Hot Work includes:
- Cutting
- Welding
- Soldering
- Brazing
- Grinding
- Any activity similar to the above
Permit Required

• Any hot work on campus requires the issuance of a **Hot Work Permit** prior to the work beginning.

• All requirements set forth in the permit must be followed.
Fire Watch Required

• During any approved hot work operations, a Fire Watch must be maintained in accordance with NCFC 3504.2
• The Fire Watch personnel must have no other responsibilities beyond the watch
• A portable fire extinguisher, in good condition, must be available throughout
Prohibited Areas

• Hot work may not be performed in the following areas:
  • Any area not authorized
  • Near storage of combustible materials
  • In any area that may develop an accumulation of combustible dusts
  • In any area where a combustible atmosphere is present or could develop
Personal Protective Equipment (PPE)

• All persons exposed to hazards created by hot work shall be issued appropriate PPE
• PPE shall be worn at all times during hot work operations
Painting Safety

OSHA 1910.106, NFPA 30, and NFPA 33
General Safety

• Paint and other flammable or combustible liquids must be stored appropriately – in a flammable storage cabinet, when required
  • Be aware of the classification/characteristics of the liquid(s) you are using – check the SDS before use or storage

• Practice good housekeeping – do not leave brushes, rags, etc. lying about
  • Clean up paint spills immediately

• Ensure adequate ventilation is present when painting
Personal Safety

- Wear proper PPE when painting – for example, wear a respirator and eye protection when spray painting
- Be aware of the type of paint to be used – some paints are toxic and present potential health hazards
- Do not paint when other hazards are present
  - Painting should not be done in the same area as "hot work," for example
Fire Safety

• Store paint and other liquids in the appropriate container/cabinet
  • Only take out for use the amount necessary to complete your intended purpose
• Open flames are not permitted in the area of paint storage or painting operations
  • Be aware of other possible sources of ignition such as improper electrical fixtures or appliances
• Spray painting must be done in areas with adequate ventilation
Workers’ Rights
Rights

• Working conditions that do not pose risk of serious harm
• Receive information and training (in a language and vocabulary the worker understands) about workplace hazards, methods to prevent them, and the OSHA standards that apply to their workplace
• Review records of work-related injuries and illnesses.
• File a complaint asking OSHA to inspect their workplace if they believe there is a serious hazard or that their employer is not following OSHA’s rules.
• Exercise their rights under the law without retaliation, including reporting an injury or raising health and safety concerns with their employer or OSHA. If a worker has been retaliated against for using their rights, they must file a complaint with OSHA as soon as possible, but no later than 30 days.
Questions

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EHS Website

To complete this training, you must take this quiz and pass with a score of ≥ 80%