# Falls, Electrical, Struck-By and Caught-In

*Applied to General Industry*

NCDOL
N.C. Department of Labor

**Cherie Berry**

*Commissioner of Labor*

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*This booklet highlights four categories of hazards (commonly referred to as the Big Four Hazards for industry) that cause many injuries and fatalities in the workplace. It is not inclusive. It contains suggestions and established requirements to prevent injuries. The booklet also discusses common topics and primary areas of concern. We welcome your questions and want to help you in your efforts to ensure workplace safety.*

*In North Carolina, the N.C. Department of Labor enforces the federal Occupational Safety and Health Act through a state plan approved by the U.S. Department of Labor. NCDOL offers many educational programs to the public and produces publications to help inform people about their rights and responsibilities regarding occupational safety and health.*

*When reading this booklet, please remember the mission of the N.C. Department of Labor is greater than just regulatory enforcement. An equally important goal is to help citizens find ways to create safe workplaces. Everyone profits when managers and employees work together for safety. This booklet, like the other educational materials produced by the N.C. Department of Labor, can help.*

Cherie Berry

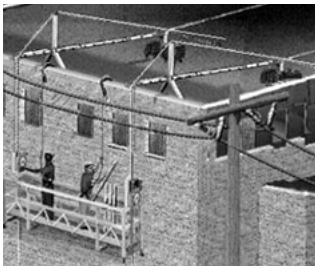
# The Big Four Hazards: Falls, Electrical, Struck-By and Caught-In Applied to General Industry

1. **FALLS from ladders, scaffolds, stairs and other walking/working surfaces can be prevented.**
   A fall hazard is anything in the workplace that could cause an unintended loss of balance or bodily support and result in a fall.

*Top or top step of stepladder must not be used as a step.*

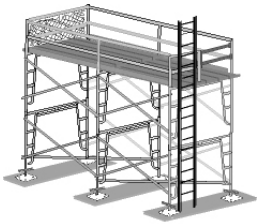
**Safety Requirements for Ladders:**

- Maintain ladders in good condition.
- Inspect ladders frequently (relative to their use).
- Do not use ladders with defects.
- Train employees in the hazards associated with ladders.
- Use nonconductive ladders near electrical equipment.
- Face the ladder when ascending and descending.
- Ensure ladders are placed at the proper angle of one-fourth the working length of the ladder from the vertical wall.
- Ensure the top step is not used on a stepladder (unless so designed by manufacturer/qualified person).
- Ensure ladders are used only for the purpose intended.
- Slippery walking/work surfaces can contribute to falls.



**Safety Requirements for Scaffolding:**

- Scaffold planks must extend over their end supports not less than 6 inches nor more than 18 inches.
- An access ladder or equivalent safe access must be provided.
- The poles, legs and uprights of scaffold must be plumb and securely braced.
- Guardrails shall be used when scaffold is 10 feet or more above ground or lower level. New scaffolds should be set on sound footing.
- Damaged parts that affect the strength of the scaffold must be replaced.
- Scaffolds cannot be altered.
- All scaffolds must be fully planked.
- Scaffolds may not be moved horizontally while workers are on them unless they are designed to be mobile and workers have been trained in the proper procedures.
- Employees may not work on scaffolds that are covered with snow, ice or other slippery materials.
- Scaffolds may not be erected or moved within 10 feet of power lines.
- Employees are not permitted to work on scaffolds in bad weather or high winds unless a competent person has determined that it is safe to do so.
- Ladders, boxes, barrels, buckets or other makeshift platforms may not be used to raise work height.
- Extra material is not allowed to build up on scaffold platforms.
- Scaffolds should not be loaded with more weight than they were designed to support.
- On single-point and two-point adjustable suspension scaffolds, workers must be protected with guardrails and personal fall arrest systems.



| Fall protection required | Type of scaffold |
|---|---|
| *Personal fall arrest system* | • boatswain's chair; catenary scaffold; float scaffold; needle beam scaffold; ladder jack scaffold |
| *Guardrails* | • self-contained adjustable scaffold when platform is supported by the frame structure; walkways located within a scaffold |
| *Personal fall arrest system and guardrails* | • single-point adjustable suspension scaffold; two-point adjustable scaffold; self-contained adjustable scaffold when platform is supported by ropes |
| *Personal fall arrest system, guardrails or grabline* | • crawling board (chicken ladder) |
| *Personal fall arrest system or guardrails* | • overhand bricklaying on a supported scaffold; all other types of types of scaffolds not identified in this table |

Fall hazards also exist at unprotected edges at stairs, open-sided floors, platforms and runways. Ensure use of guardrail, handrail or other system as appropriate to protect worker where exposed to potential fall.

**Safety Requirements for Stairs:**

Flights of stairs with four or more risers or rising more than 30 inches (76 cm) in height—whichever is less—must be equipped with standard stair railings or standard handrails.

*Unguarded openings*

**Safety Requirements for Walking and Working Surfaces:**

- Open-sided floors or platforms 4 feet or more above adjacent level must be guarded.
- Open-sided floors, walkways or platforms adjacent to dangerous equipment (regardless of height) must be guarded by standard railing and toeboard.
- Top edge height of top rails, or equivalent guardrail system members, must be between 39 and 45 inches above the walking/working level, except when conditions warrant otherwise and all other criteria are met (e.g., when employees are using stilts, the top edge height of the top rail must be increased by an amount equal the height of the stilts).
- Midrails, screens, mesh, intermediate vertical members or equivalent intermediate structures must be at least 21 inches high, installed between the top edge and the walking/working surface when there is no wall or other structure.

- Guardrail systems must be capable of withstanding at least 200 pounds of force applied within 2 inches of the top edge, in any direction and at any point along the edge, and without causing the top edge of the guardrail to deflect downward to a height less than 39 inches above the walking/working level.
- Midrails, screens, mesh, and other intermediate members must be capable of withstanding at least 150 pounds of force applied in any direction at any point along the midrail or other member.
- Guardrail systems must not have rough or jagged surfaces that would cause punctures, lacerations or snagged clothing.
- A standard toeboard must be 4 inches nominal in vertical height from its top edge to the level of the floor, platform, runway, or ramp. It must be securely fastened in place and with not more than ¼ inch clearance above floor level.

- Dockboards or bridge plates must be properly secured. Handholds or other means must be provided to permit safe handling of them.
- Positive protection must be provided to prevent railroad cars from being moved while dockboards are in position.
- Wheel stops or other positive protection must be provided to prevent railroad cars from moving during loading or unloading operations.

- Floor holes into which people can accidentally walk must be guarded by either:
  - A standard railing and toeboard.
  - A floor hole cover of standard strength and construction.

- Floor opening covers must be properly marked to denote where the hole or opening exists.
- Skylights must be guarded by a standard skylight screen or fixed standard railing (i.e., to protect where employee may sit, step or stand on).

*The broken skylight is an incident where an employee fell through unprotected skylight (i.e., person was handling and moving material used to resurface flat roof); the other photo shows a skylight that has a guard/protective cover made of wire screen.*

**Housekeeping**

Good housekeeping is an important method of preventing falls due to slips and trips. It includes:

- Identifying and removing hazardous conditions and factors that create slips, trips and falls.
- Cleaning all spills immediately.
- Marking spills and wet areas.
- Mopping or sweeping debris from floors.
- Removing obstacles from walkways and keeping them free of clutter.
- Securing (tacking, taping, etc.) mats, rugs and carpets that do not lay flat.
- Closing file cabinet or storage drawers.
- Covering cables that cross walkways.
- Keeping working areas and walkways well lit.
- Replacing used (blown) light bulbs and faulty switches.

2. **ELECTRICITY offers many benefits, but dangers exist when contact is made.**
   - Ensure electrical energy is properly controlled. Establish and comply with lockout/tagout (LOTO) procedures (see more LOTO on page 12).

**Safety Tips for Overhead Power Lines:**

- Assume that all overhead wires are energized at lethal voltages. Never assume that a wire is safe to touch, even if it is down or appears to be insulated.

- Never touch a fallen overhead power line. Call the electric utility company to report fallen electrical lines.
- Stay at least 10 feet away from overhead wires during cleanup and other activities. If working at heights or handling long objects, survey the area for the presence of overhead wires before starting work.
- If an overhead wire falls across your vehicle while you are driving, stay inside the vehicle and continue to drive away from the line. If the engine stalls, do not leave your vehicle. Warn people not to touch the vehicle or the wire. Call or ask someone to call the local electric utility company and emergency services.
- Never operate electrical equipment while you are standing in water.

**General Rules for Electrical Safety:**

- Never repair electrical cords or equipment unless qualified and authorized.
- Have a qualified electrician inspect wet electrical equipment before energizing it.
- If working in damp locations, inspect electrical cords and equipment prior to use (afterwards as appropriate) to ensure that they are in good condition and free of defects, and ensure use of a ground-fault circuit interrupter (GFCI).
- De-energize items that a worker may be exposed to before the employee works on or near these items, unless the work is being performed by a qualified person. Exceptions to this rule can be made if the employer can show that de-energizing would create additional or increased hazards or was not possible because of equipment design or operational limitations.
- Use other safety practices to protect employees exposed to the hazard where circuits cannot be de-energized.
- Guard (i.e., faceplate or proper cover) live items operating at 50 volts or more against accidental contact.
- Train employees in safe electrical work practices.
- Ground all electrical circuits and equipment.

- Ensure flexible cords and cables are approved and suitable for conditions of use.
- Ensure qualified employees permitted to work on or near exposed energized parts receive training, have skills necessary to distinguish exposed live parts from other parts of electrical equipment and are provided with appropriate personal protective equipment.

3. **STRUCK-BY incidents occur when employees are working around mechanized equipment.**
   - Ensure safe operating distance; maintain proper or adequate separation between workers and machine/equipment.

**Material Handling Equipment**

- Know where vehicles operate. Be aware or ensure that they only operate in the assigned areas to keep other workers safe.
- Anywhere there are vehicles and mechanized equipment in use, a detailed site-specific plan is necessary. All employees should regularly review the plan.
- Keep brakes in good working condition.
- Block and chock as needed.
- Keep all lights working.
- Use seats and seat belts.
- Inspect all vehicles before use.
- Employers must ensure that forklift operators are trained to operate them safely.

*Overturned forklift resulted in fatality.*

*Forklift driven off loading dock.*

*Safety features include an overhead guard.*

**Operating a forklift safely prevents injury. Guidelines include:**

- Designate aisles as travel paths for forklifts.
- Operate vehicles at a safe speed.
- Allow only authorized personnel to operate and maintain forklifts.
- Don’t allow employees to stand under raised forks.
- Secure dockboard and trailer while loading and unloading.

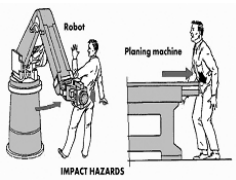
- Train operators in safe vehicle operation. Observe them to make sure they understand.
- Park vehicles with the forks lowered and brakes set.
- Monitor carbon monoxide produced by forklifts.
- Wear seat belts while operating a forklift.

**4. CAUGHT-IN injuries occur when employees make contact with moving parts or are trapped in a machine.**

- Proper safeguarding of machinery and equipment is essential to protect employees from serious injury.
- The machine will do the work or perform tasks that it is designed to do, such as cutting, braking or bending.

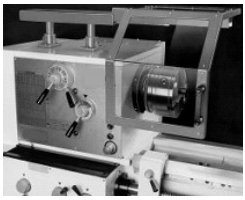
**Dangerous moving parts in these three basic areas need safeguarding:**

- **The point of operation:** the 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 that 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 that 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.
- An operator can be pulled into a lathe when working too close to the machine (e.g., polishing a slotted shaft with emery cloth).
- Wearing gloves, loose clothing and jewelry, and long hair can create caught-in hazards.
- Pay close attention to work pieces that have keyway slots or other surface profiles that may increase the risk of entanglement.

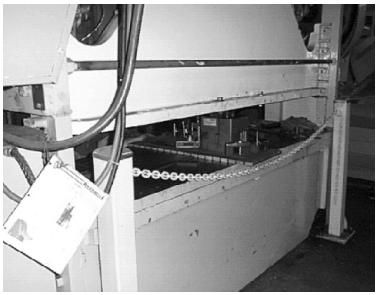



*Ensure proper machine guarding around moving parts.*

*Hazardous exposures are present simply due to the operator's close proximity to the lathe's rotating parts.*



*Barrier guards in use for lathe work to protect operator from point of operation.*



*Press Brake*

*Power Press Brake Bending Metal*

A machine that punches metal in a blink of an eye leaves little to the imagination as to what it can do to body parts. Severe crushing injuries, amputations and even death can occur in the point of operation or while performing maintenance such as die setting or troubleshooting. As with mechanical power presses, point of operation injuries are the most common type of injury associated with power press brakes.

**Beware of these frequent causes of amputations from power press brakes:**

- Foot controls being inadvertently activated while the operator's hand is in the point of operation.
- Parts of the body caught in pinch points created between the stock and the press brake frame while the bend is being made.
- Controls of a single-operator press bypassed by having a co-worker activate the controls while the operator positions or aligns stock or repairs or troubleshoots the press.
- Failure to properly lockout/tagout presses during the necessary tasks of making adjustments, clearing jams, performing maintenance, installing or aligning dies, or cleaning the machine.

**Other Potential Hazards:**

- Skin burns from contact with the heated barrel or burns from splatter of hot plastic and gases/vapors.
- Hands or limbs caught in machine while loosening trapped materials at feed throat.
- Slips, trips and falls at material feed location.

**Safety Requirements for Press Safeguarding:**

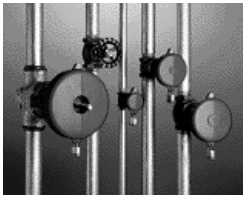
- Ensure that an operator's (safety) gate is installed to block operator access to moving parts while the machine is in normal production. Use interlocks (mechanical, electrical, hydraulic) that prevent the mold from closing when the gate is open.
- Do not remove, alter or attempt to otherwise bypass a safety interlock.
- Do not attempt to reach around, under or over a guard. If a person standing on the floor can reach over the machine into the mold area, install a top guard that is fixed or interlocked.
- Access the mold cavity via the operator's gate and do not remove a fixed guard during normal operation.
- Provide training on the safety hazards and features of the injection molding machine for all employees who will operate or work with it.
- Lockout/tagout the machine prior to servicing and maintenance work.

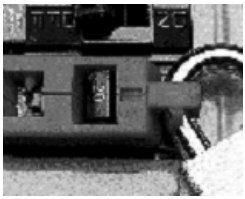
The "Big Four Hazards"—Falls, Electrical, Struck-By and Caught-In—are found in general industry as well as construction. Ensuring that proper safety measures are taken will prevent serious injury or death. NCDOL offers many educational programs and publications to help inform workers of the hazards in their workplace. We welcome your questions and want to help you in your efforts to ensure workplace safety.

**Implementing a lockout/tagout program in your facility can prevent injuries from the Big 4 as discussed in this booklet.**

Lockout/tagout (LOTO) refers to specific practices and procedures to safeguard employees from the unexpected energization or startup of machinery and equipment, or the release of hazardous energy during service or maintenance activities. Nationwide, approximately 3 million workers service equipment and face the greatest risk of injury if lockout/tagout is not properly implemented. Compliance with the lockout/tagout standard (29 CFR 1910.147) prevents an estimated 120 fatalities and 50,000 injuries each year. Workers injured on the job from exposure to hazardous energy lose an average of 24 workdays for recuperation.

Here are some examples of LOTO types of devices:





*Use devices like these to control all types of energy, including mechanical, hydraulic, pneumatic, chemical, thermal and any other energy that may be stored by equipment.*

- The unexpected start-up or release of stored energy during servicing and/or maintenance of machines and equipment could cause injury. Establish a program and use procedures for affixing lockout or tagout devices to energy isolating devices. The established program must consist of:
  - An energy control procedure
  - Employee training
  - Periodic inspections
- Injuries happen when equipment energy is not properly controlled. What can you do? Ensure employees comply with procedures established in the employer's lockout/tagout program. A free sample program is available at **www.nclabor.com/osha/consult/sample_programs.htm**

Take the following steps to protect yourself if you install or service equipment and systems:

- Follow OSHA regulations.
- Identify and label all sources of hazardous energy.
- Before beginning work, do the following:

1. De-energize all sources of hazardous energy:
—Disconnect or shut down engines or motors.
—De-energize electrical circuits.
—Block fluid (gas or liquid) flow in hydraulic or pneumatic systems.
—Block machine parts against motion.

1.1. Block or dissipate stored energy:
—Discharge capacitors.
—Release or block springs that are under compression or tension.
—Vent fluids from pressure vessels, tanks or accumulators—but never vent toxic, flammable or explosive substances directly into the atmosphere.

1.2. Lockout and tagout all forms of hazardous energy including electrical breaker panels and control valves.

1.3. Make sure that only one key exists for each of your assigned locks and that only you hold that key.

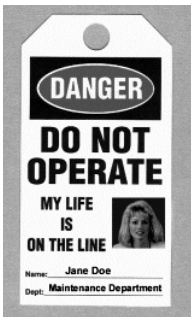
1.4. Verify by test and/or observation that all energy sources are de-energized.

1.5. Inspect repair work before removing your lock and activating the equipment.

1.6. Make sure that only you remove your assigned lock.

1.7. Make sure that you and your co-workers are clear of danger points before re-energizing the system.

2. Participate in all training programs offered by your employers.



***Sample tag***

Only the worker who installs a lock and tag should remove them after work is complete and inspected.

## Available Industry Guides:

#1. *Safety in Confined Spaces*
#2. *Procedures of the N.C. Safety and Health Review Commission**
#3. *Machine Safeguarding*
#4. *OSHA in North Carolina*
#5. *Persons Employed in Cotton Dust Environments**
#6. *Lead Exposure in the Construction Industry**
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#11. *Radio Frequency Hazards With Electric Detonators**
#12. *Forklift Operator Training*
#13. *Safe Storage of Explosive Materials**
#14. *OSHA Excavations Standard*
#15. *Developing and Maintaining an Effective Hearing Conservation Program*
#16. *Construction Jobsite Safety and Health/Guía de Seguridad y Salud para el Trabajo de Construcción*
#17. *Asbestos for Industry*
#18. *Electrical Safety*
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#28. *Eye Wash and Safety Shower Facilities*
#29. *Safety and Health in Feed and Grain Mills**
#30. *Working With Corrosive Substances**
#31. *Formaldehyde**
#32. *Fall Prevention in Industry*
#32s. *Guía de Protección Contra Caídas en la Industria (Spanish version of #32)*
#33. *Office Safety and Health**
#34. *Safety and Health in the Poultry Industry**
#35. *Preventing Heat Stress*
#38. *Safe Scaffolding*
#40. *Emergency Action Planning*
#41. *OSHA for Small Businesses in North Carolina*
#41s. *Guía OSHA para Pequeños Negocios en Carolina del Norte (Spanish version of #41)*
#42. *Transportation Safety*
#43. *Combustible Dusts*

***Available in PDF format only.**

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