Module 00101
Session Three

Struck-By, Caught-In or Between, and Energy Release Hazards
Session Three Objectives

When trainees have completed this session, they should be able to do the following:

3. Identify and explain how to avoid struck-by and caught-in-between hazards.
   a. Identify and explain how to avoid struck-by and caught-in-between hazards.
   b. Identify and explain how to avoid caught-in and caught-between hazards.

4. Identify common energy-related hazards and explain how to avoid them.
   a. Describe basic job-site electrical safety guidelines.
   b. Explain the importance of lockout/tagout and describe basic LOTO procedures.
Performance Tasks

Inspect a typical power cord and GFCI to ensure their serviceability.

*Man Struck, Killed By Falling Tape Measure*
3.1.1 falling Objects

WORKERS ARE AT RISK FROM FALLING OBJECTS WHEN THEY ARE BENEATH MACHINERY AND EQUIPMENT SUCH AS CRANES, SCAFFOLDS AND LADDER OR WHEN WORKING AROUND STACKED MATERIALS. WHEN PERFORMING OVERHEAD WORK, BE SURE ALL TOOLS, MATERIALS, AND EQUIPMENT ARE SECURED TO PREVENT THEM FROM FALLING ON PEOPLE BELOW. USE PROTECTIVE MEASURES SUCH AS TOE BOARDS, DEBRIS NETS, CATCH PLATFORMS, OR CANOPIES TO CATCH OR DEFLECT FALLING OBJECTS.
3.1.1 falling Objects

• MANY WORKERS ARE HURT OR KILLED BY FALLING STACKS OF MATERIAL. DO NOT STACK MATERIALS HIGHER THAN 4:1 HEIGHT-TO-BASE RATIO.
3.1.1 – Falling Objects

Use tool lanyards when working at height. When working near machinery and equipment such as cranes, never stand or work beneath the load. Barricade hazard areas where rigging equipment is in use, and post warning signs to inform other workers of falling object hazards.
3.1.2 – Flying Objects

• Use eye and face protection.
• Ensure that protective guards are in place and in good condition.
• Make sure you are trained in the proper operation of pneumatic and powder-actuated tools.
• Use shielding to block flying debris.
• Ex: chipping, grinding, brushing and hammering
3.1.3 – Vehicle Hazards (1 of 2)

- Stay alert at all times and keep a safe distance from vehicles and equipment.
- Maintain eye contact with vehicle or equipment operators to ensure that they see you.
- Never get into the blind spots of equipment operators.
- Keep off of mobile equipment unless authorized.
- Wear reflective or high-visibility vests or other suitable garments.
- Never stand between pieces of equipment unless they are secured.
- Never stand under loads handled by lifting or digging equipment, or near vehicles being loaded or unloaded.
When a vehicle is operated indoors, the carbon monoxide in the exhaust can kill or sicken anyone in the vicinity unless there is good ventilation. Make sure there is adequate ventilation before operating a motorized vehicle or equipment, such as a generator, indoors.
3.2.1

- Trenches and excavations are common hazards, especially in construction and pipeline work. Anyone working in or around a trench or excavation must know and follow safety procedures aimed at protecting workers from cave-in.

HAZARDS INVOLVED
- Cave-in
- Water accumulation
- Falling objects
- Collapse of nearby structures
- Hazardous atmospheres produced by toxic gases in the soil.
• SOIL CONDITION CAN CHANGE, SO THEY MUST BE CONSTANTLY EVALUATED. THERE ARE CERTAIN FACTORS THAT COULD CHANGE THE SURROUNDING OF THE SITE. SOIL TYPES IS A KEY FACTOR IN DETERMINING THE TYPE OF PROTECTIVE SYSTEM NEEDED TO ENSURE THAT THE TRENCH WILL BE SAFE. BENCHING SYSTEMS CANNOT BE USED WITH TYPE “C” SOIL.
3.2.1 – Excavation Safety (1 of 3)

**WARNING!**

Just 2 to 3 feet (0.6 to 1 m) of soil can put enough pressure on your lungs to prevent you from breathing. Each year in the US, more than 100 people are killed and many more are seriously injured in cave-in incidents. The chances of a trapped worker being killed can be as high as 50 percent.

<table>
<thead>
<tr>
<th>Name</th>
<th>Type/Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid Rock</td>
<td>Excavation walls stay vertical as long as the excavation is open.</td>
</tr>
<tr>
<td>Type A Soil</td>
<td>Fine-grained, cohesive: clay, hardpan, and caliche. Particles too small to see with the naked eye.</td>
</tr>
<tr>
<td>Type B Soil</td>
<td>Angular rock, silt, and similar soil.</td>
</tr>
<tr>
<td>Type C Soil</td>
<td>Coarse-grained, granular: sand, gravel, and loamy sand. Particles are visible to the naked eye.</td>
</tr>
</tbody>
</table>
3.2.1 – Excavation Safety (2 of 3)

SLOPING AND BENCHING FOR TYPE B SOILS

(A) SLOPED TRENCH

(B) BENCH TRENCH

\[ \text{rise} : 1 \]

\[ \text{fall} : 1 \]

\[ 20' \ (6.1 \text{ M}) \text{ MAXIMUM} \]

\[ 4' \ (1.2 \text{ M}) \text{ MAX.} \]
SOIL CONDITION CAN CHANGE, SO TO BE SAFE TREAT SOIL AS IF IT IS TYPE “C” SOIL.

A COMPETENT PERSON MUST INSPECT EXCAVATIONS DAILY AND DECIDE WHETHER CAVE-IN OR FAILURES OF PROTECTIVE SYSTEMS COULD OCCUR, AND WHETHER THERE ARE ANY OTHER HAZARDOUS CONDITIONS PRESENT.
Support systems like shoring or shielding must be used to support the sides of a trench and prevent soil from caving in. Shoring are made of metal or wood.
3.2.2 – Guards (1 of 2)

CARE OF TOOL AND MACHINE GUARDS

• Do not remove a guard from a tool or machine except for cleaning purposes, changing a blade, or performing other service.

• Make sure the machine is turned off and tagged out during servicing.

• When cleaning or maintenance is finished, replace the guard immediately.
3.2.2 – Guards (2 of 2)

- Do not use any material to wedge a guard open.
- Only use attachments that are specifically designed for that tool or machine.
Electric Cutting Machine
3.2.3 – Pinch Points

There are many potential pinch points on heavy equipment as well as other places on the job site.
3.2.3 – Crushing Hazards

Any type of moving heavy equipment can trap and crush a worker in the wrong place.
## 4.1.0 – Electrical Safety

**WARNING!**

Less than one amp of electrical current can kill.
Always take precautions when working around electricity.

<table>
<thead>
<tr>
<th>Current</th>
<th>Common Item/Tool</th>
<th>Reaction to Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.001 amps</td>
<td>Watch battery</td>
<td>Faint tingle.</td>
</tr>
<tr>
<td>0.005 amps</td>
<td>9-volt battery</td>
<td>Slight shock.</td>
</tr>
<tr>
<td>0.006 – 0.025 amps (women)</td>
<td>Christmas tree bulb</td>
<td>Painful shock. Muscular control is lost.</td>
</tr>
<tr>
<td>0.009 – 0.030 amps (men)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.050 – 0.9 amps</td>
<td>Small electric radio</td>
<td>Extreme pain. Breathing stops; severe muscular contractions occur. Death may result.</td>
</tr>
<tr>
<td>1.0 – 9.9 amps</td>
<td>Jigsaw (4 amps); Sawsall® or Port-a-Band® saw (6 amps); portable drill (3 – 8 amps)</td>
<td>Ventricular fibrillation and nerve damage occur. Death may result.</td>
</tr>
<tr>
<td>10 amps and above</td>
<td>ShopVac® (15-gallon); circular saw</td>
<td>Heart stops beating; severe burns occur. Death may result.</td>
</tr>
</tbody>
</table>
4.0.0 ENERGY RELEASE HAZARDS

ELECTRICAL SAFETY IS A CONCERN FOR ALL WORKERS, NOT JUST FOR ELECTRICIANS. GROUNDING IS A METHOD OF PROTECTING HUMANS FROM ELECTRICAL SHOCK. BY GROUNDING, A TOOL TO ELECTRICAL SYSTEM, ALLOW RESISTANCE PATH TO THE EARTH IS INTENTIONALLY CREATED. THE THREE WIRE SYSTEM IS ONE OF THE MOST COMMON SAFETY GROUNDING SYSTEMS USED TO PROTECT YOU FROM INCIDENTAL ELECTRICAL SHOCK.
4.1.2 – GFCI

**CAUTION**

- Do not plug a GFCI-protected device into a GFCI-protected circuit.
- Always test a GFCI before use.
DOUBLE INSULATED TOOLS USE A TWO-WIRE POWER CORD WITH NO GROUND PIN. ONE PRONG OF THE PLUG IS LARGER THAN THE OTHER SO IT CAN ONLY BE CONNECTED TO A POLARIZED RECEPTACLE. **DOUBLE INSULATED TOOLS USE ONLY POLARIZED RECEPTACLES.**

**Polarized receptacles** have a smaller "hot" slot and a larger neutral slot, ensuring that the electrical currents flow along the appropriate wires in the circuit; hot along hot, neutral along neutral.
4.1.3 – Electrical Safety (1 of 2)

ELECTRICAL SAFETY SUMMARY

All tools used in construction are ground-fault protected.
Make sure that panels, switches, outlets, and plugs are grounded.
Never use bare electrical wire.
Never use metal ladders near any source of electricity.
Inspect electrical power tools before you use them.
4.1.3 – Electrical Safety (2 of 2)

ELECTRICAL SAFETY SUMMARY

- Never operate any piece of electrical equipment that has a danger tag or lockout device attached to it.
- Never use worn or frayed power cords. If the cord is frayed or worn, disconnect power and dispose of the cord.
- Make sure light bulbs have protective guards to prevent accidental contact.
4.1.4 – Overhead Power Lines

HIGH-VOLTAGE POWER SOURCES

A common cause of electrical shock is coming into contact with overhead wires with metal ladders, cranes, or excavating equipment. A distance of at least 10 feet (3 m) must be maintained from any conductor carrying 50,000 volts or less. Greater distances are required for higher voltages.
4.2.0

- FAILURE TO DISABLE MACHINERY BEFORE WORKING ON IT IS A MAJOR CAUSE OF INJURY AND DEATH ON A JOB SITES. **LOCKOUT/TAGOUT** PROCEDURES SAFEGUARD WORKERS AGAINST UNEXPECTED RELEASES FROM VARIOUS ENERGY SOURCES.

- EACH LOCK HAS ITS OWN KEY, AND THE INDIVIDUAL WHO APPLIES THE LOCK KEEPS THE KEY. **THE PERSON WHO APPLIED THE LOCK** MUST BE THE ONE TO REMOVE IT.
4.2.0 – Lockout/Tagout (1 of 2)

Depending on the device to be locked out…

(A) ELECTRICAL LOCKOUT

(B) VALVE LOCK

(C) PNEUMATIC LOCKOUT
4.2.0 – Lockout/Tagout (2 of 2)

...a unique locking device may be required.

(A) ELECTRICAL PLUG LOCKOUT

(B) CIRCUIT BREAKER LOCK

(C) BALL VALVE LOCKOUT

(C) ELECTRICAL SWITCH LOCKOUT
Ground
The conducting connection between electrical equipment or an electrical circuit and the earth.

Ground fault circuit interrupter (GFCI)
A device that interrupts and de-energizes an electrical circuit to protect a person from electrocution.

Lockout/tagout (LOTO)
A formal procedure for taking equipment out of service and ensuring that it cannot be operated until an authorized person has removed the lock and/or warning tag.
Wrap Up – Trade Terms (2 of 3)

Proximity work
Work done near a hazard but not actually in contact with it.

Shielding
A structure used to protect workers in trenches.

Shoring
A support system designed to prevent a trench or excavation cave-in.
Signalizer
A person who is responsible for directing a vehicle when the driver’s vision is blocked in any way.

Spoil
Material such as earth removed while digging a trench or excavation.
Next Session…

PPE AND SITE SAFETY

Read Sections 5.0.0 through 6.5.0. Complete the 5.0.0 and 6.0.0 Section Reviews.