Electrical Transmission & Distribution Partnership

Continuing Education Training

-Line of Fire

Presenter Guide

-1st Quarter 2019

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Introduction

The Line-of-Fire continuing education course is a facilitator led process. The facilitator may choose to augment the material with videos, handouts or other media to enhance the learning experience. The facilitator may want to incorporate visual aids to enhance the presentation.

Using this material combined with practical experience, good presentation skills, and knowledge of adult learning techniques, the facilitator has a greater opportunity to deliver the information effectively.

Microsoft® PowerPoint® combined with good instructional skills and instructor/student dialogue help with information retention and understanding. PowerPoint® presents the information to the attendee and the facilitator summarizes the content of the slides. It is critical to engage and involve the attendee in the process. Ask open-ended questions that will elicit conversation and discussion, but be cautious to maintain control of the discussion.

Conversation and scenarios are good, but can cause the discussion to run long. If it seems like the group is losing focus during the course, the facilitator can direct the group back on track by using comments like “This is a great discussion, but let’s get back to the subject at hand”.

Another tool is the “Parking Lot” which is simply a newsprint chart or dry erase board or note pad where the facilitator records unanswered questions during the meeting and that may require more research. It is vital to capture any ongoing discussions or questions on the “Parking Lot” and follow up when the information is known.

Deliver this continuing education module in the first quarter of 2019. Delivery time is approximately 1 to 1.5 hours in one setting, or divided-up into three, twenty to thirty minute settings. There is text animation on most of the slides. Text will appear by varying levels on mouse clicks. It is critical that the facilitator makes him or herself familiar with the material prior to delivery.

At the end of this document are two handouts regarding Line-of-Fire safety. The presenter can use these handouts as well as relevant examples in conjunction with the PowerPoint® presentation to augment the materials. The handouts may serve as stand-alone documents. There are accompanying video clips to augment the presentation.

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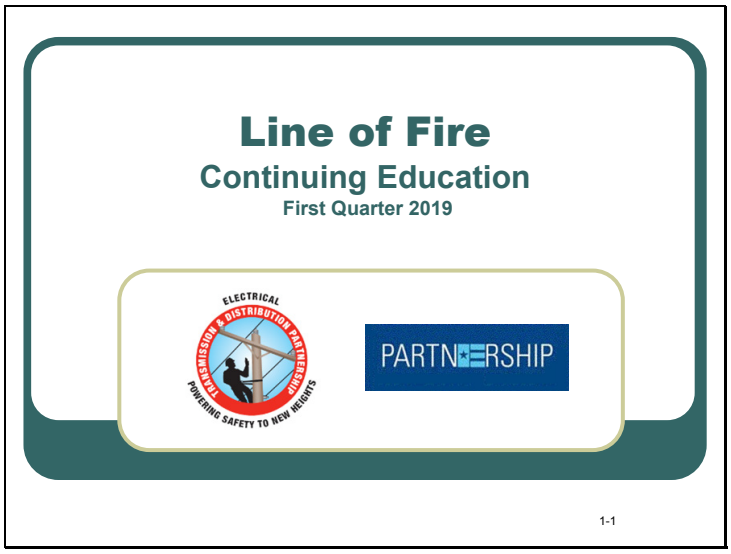
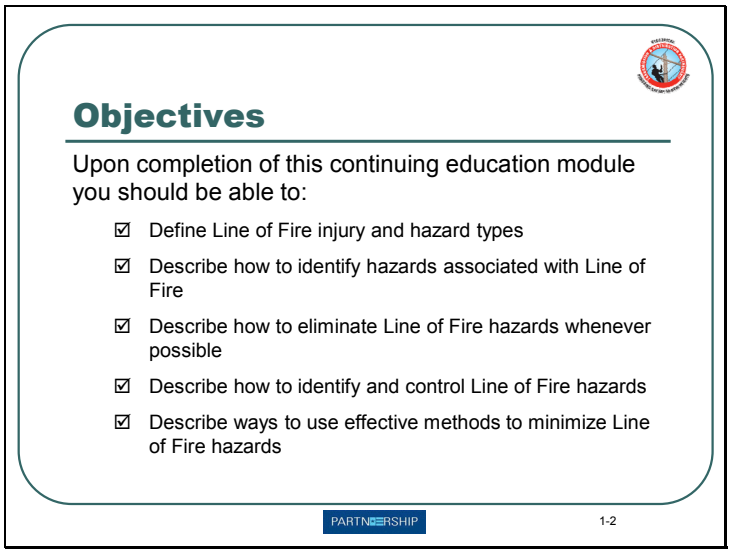
Slide 1-1



Introduce the module. Explain that the intent of this presentation is as a continuing education training topic related to certain aspects from the ET&D 10-Hour OSHA training class, the OSHA Partnership Best Practices, and/or incident trending analysis. OSHA has determined that there are four main safety hazards, excluding transportation incidents that account for a majority of all construction worker deaths each year on the jobsite. Dubbed the "Fatal Four" by OSHA, they include falls, electrocutions, struck-by, and caught-in or between hazards. In 2016, 63.7% of all fatalities at construction sites were from one of OSHA's Fatal Four. This training focuses on struck-by and caught-in/between hazards (aka "Working in the Bite") and how to prevent and protect against them. Caught-in/between hazards are caused when a worker is compressed between or is caught in equipment or objects. It also includes when a worker is killed by being caught, struck or crushed from materials, equipment, or a collapsing structure. According to OSHA, accidents caused by being caught in or between objects accounted for 72 construction worker deaths in 2016, which is 7.3% of the 991 fatalities that occurred on construction sites.

Slide 1-2



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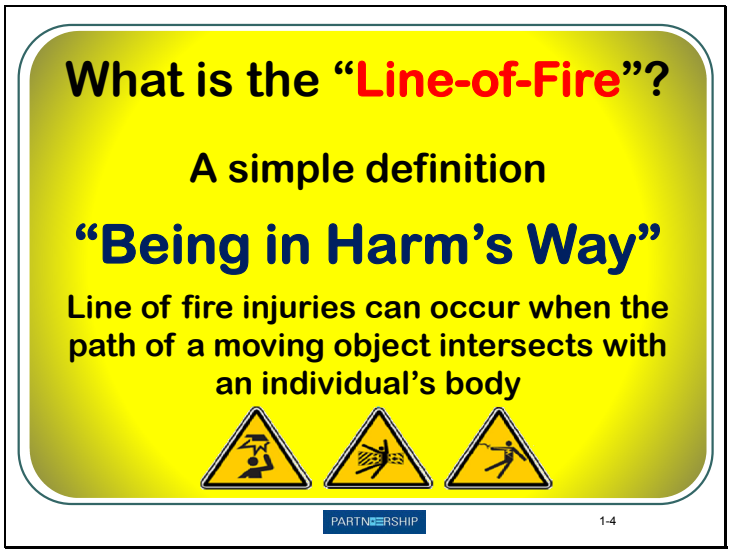
Explain that this is the 2019 first quarter. Explain the objectives of this course and the duration.

Slide 1-3

State that the following section will discuss struck-by hazards.

Slide 1-4



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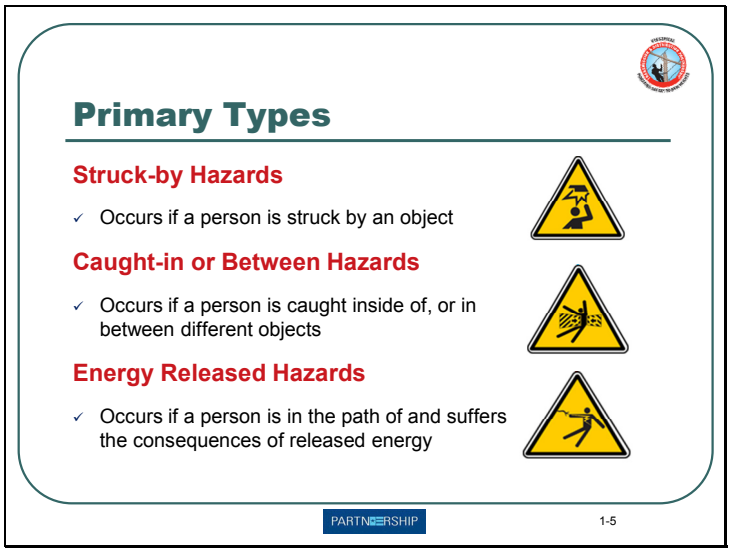
A simple definition of "line of fire" is being in harm's way. Line of fire injuries occur when the path of a moving object intersects with an individual's body. Three major categories of line of fire incidents are caught-in or between incidents, struck-by incidents, and released energy incidents. There are many specific examples of hazards for each of these categories.

Slide 1-5



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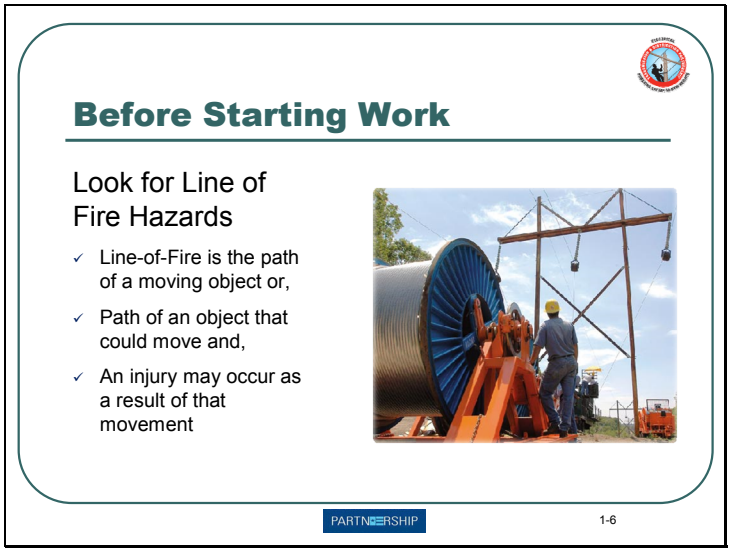
Explain that it is important to remember that Line-of-Fire hazards are one of the most deadly hazards found in Construction, second only to Slips, Trips, and Falls. A few quick examples for each category:

- Caught-in or between- A person is standing between a wall and an excavator. When the excavator spins around the counter weight pins the worker against the wall. Another example would be a worker placing his hand too close to a rotating gear and gets it pulled into the gear.

- Struck-by- A pedestrian struck-by a moving vehicle. An object falling from a higher level striking a person at a lower level.

- Released energy- A pipe releasing hot steam from a valve that is being removed, metal banding snapping back at a worker after being cut, current flow through the body are examples of released energy.

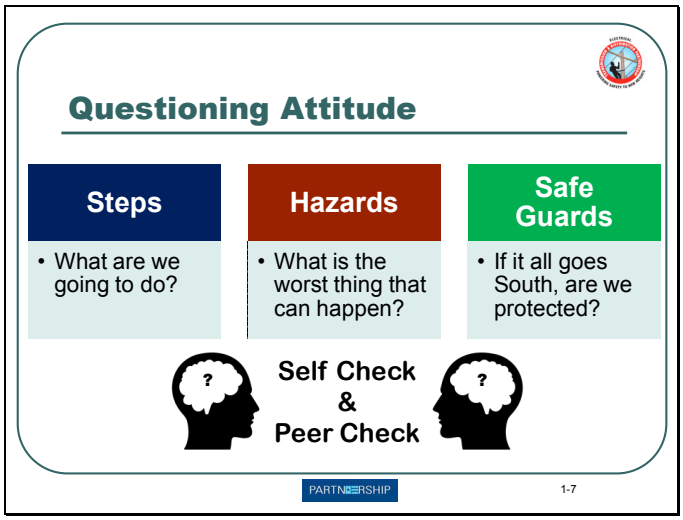
Slide 1-6



Slide has animation

Explain that at its most basic level, the Line-of-Fire is the path of a moving object that could potentially injure you, or the potential path of an object that may move. Explain how important job planning and a thorough job brief are when identifying Line of Fire hazards. Explain and discuss ways to identify Line of Fire hazards on the job before work begins. Ask the group to discuss the first time they may have performed an unfamiliar activity. Ask them if while learning the steps to perform safely that activity, they allowed themselves the time to make sure the task was performed safely.

Slide 1-7



Teamwork

Is what makes the

Dream Work

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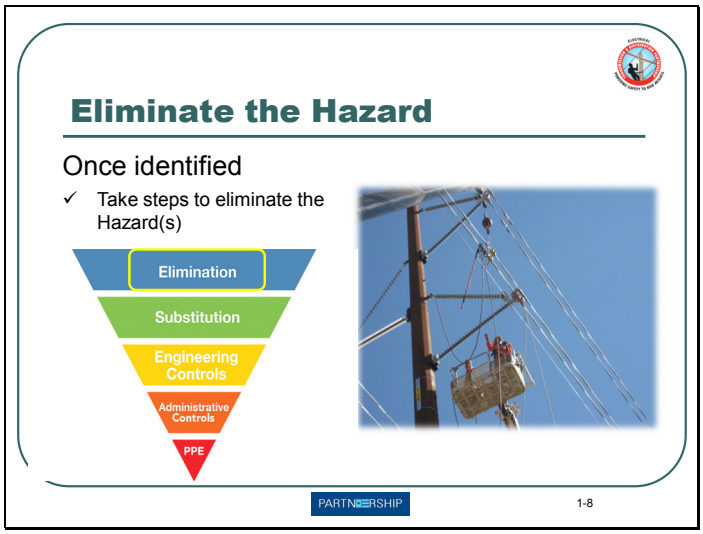
Ask the group if they have ever seen the "Steps", "Hazards", "Safeguards" model before? The desired answer is "yes". These are the three basic steps to a job hazard analysis. Explain that a questioning attitude helps to prevent "group think" by encouraging diversity of thought and intellectual curiosity. It challenges the entire group to get clarification when something comes up that does not seem right. Check yourself and have someone else check your conclusions. Remember, two heads are always better than one. Teamwork makes the Dream work!

Slide 1-8



Elimination of the Hazard should always be the First Consideration

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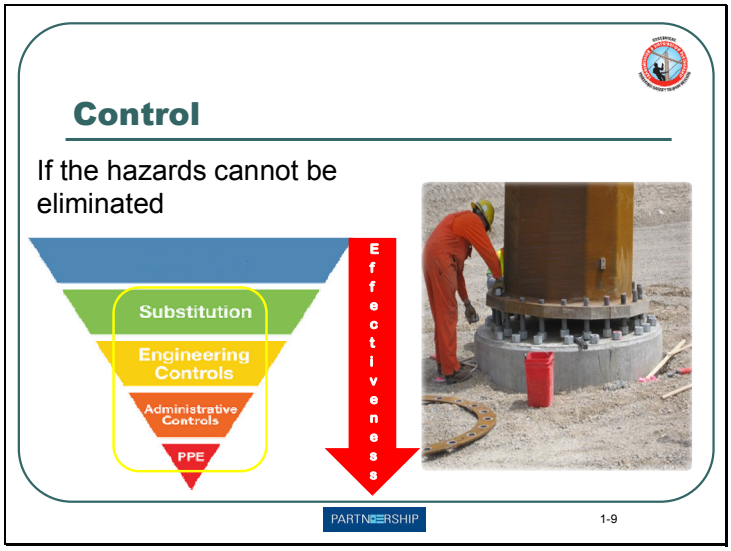
Explain that there are many Line of Fire hazards out there that are easy to identify. The longer we work around a hazard (or in this case the more we place ourselves in the Line-of-Fire) and suffer no negative consequences the less we respect a hazard's ability to harm us.

The best way to avoid line of fire incidents is to eliminate the hazards that cause these incidents whenever possible. By eliminating the hazards, there is no chance that you or anyone else in the work area can be injured by that hazard.

Slide 1-9



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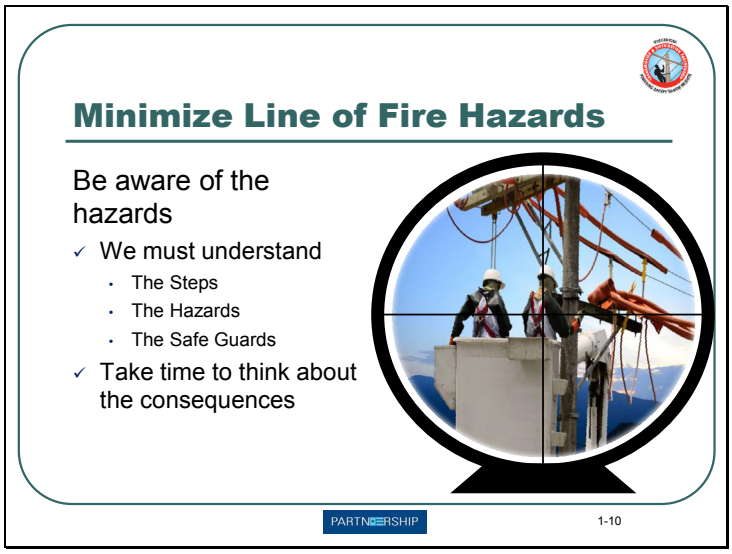
State that if it is not possible to remove the hazards, we must mitigate them. Explain the hierarchy of controls. State that elimination is the most effective. For example, use proper personal protective equipment to avoid exposure. Explain that PPE is the last line of defense. Do not rely just on your PPE to avoid injury. Think about the L.O.F. hazard and how to mitigate. States that some great question to ask are: Where is the person located in relation to the hazard? What is the worst-case (everything goes wrong) scenario of the task? How can we protect ourselves from the hazard? When elimination is not possible, engineering controls are the next best choice in protecting yourself from line of fire incidents. Some engineering controls that could protect you from line of fire incidents include physical barriers, guarding around moving parts, and toe boards on elevated work platforms to prevent objects from falling to the area below. There are many other possible engineering controls that could be used depending on the specific hazard. Total elimination of hazards is not always possible and engineering controls may not be feasible or they can fail.

Slide 1-10



Ask the question: "Can all hazards be eliminated?" Most of the group will answer "No". Explain that almost all hazards can be eliminated if we choose to do absolutely nothing. Then state that if we choose to live and function in this world we must accept the fact that we will be exposed to hazards. Because of this reality, it is important to decrease your chance of being a victim of line of fire injuries by not putting yourself in harm's way in the first place. Understand the work tasks that are going on around you and the associated hazards. Ask yourself what is the worst that can happen or what will happen if a certain safeguard fails. Recognize line of fire hazards and act accordingly. Explain the importance of body position when line of fire hazards exists. Explain that organizing the jobsite and providing unobstructed and easy access to equipment can prevent Line of Fire hazards.

Slide 1-11

Explain that the following section will review “Struck-by Hazards”

Slide 1-12

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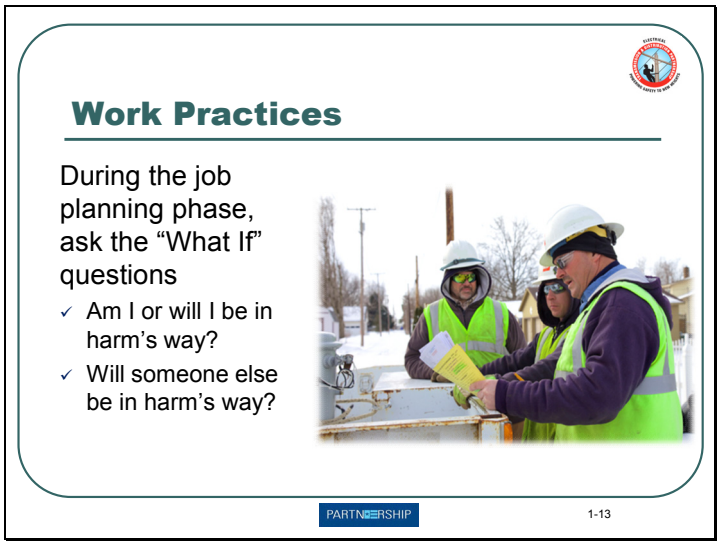
Slide has animation

Explain that anyone around moving vehicles has the potential of becoming struck-by. Be sure spotters stay to the side of trucks and never put themselves directly behind a reversing vehicle. If you do not have a spotter, the driver must perform a 360 walk-around prior to first move from park. Anytime a blind spot appears during moving a vehicle, the driver must stop and walk around or ask for assistance.

Slide 1-13



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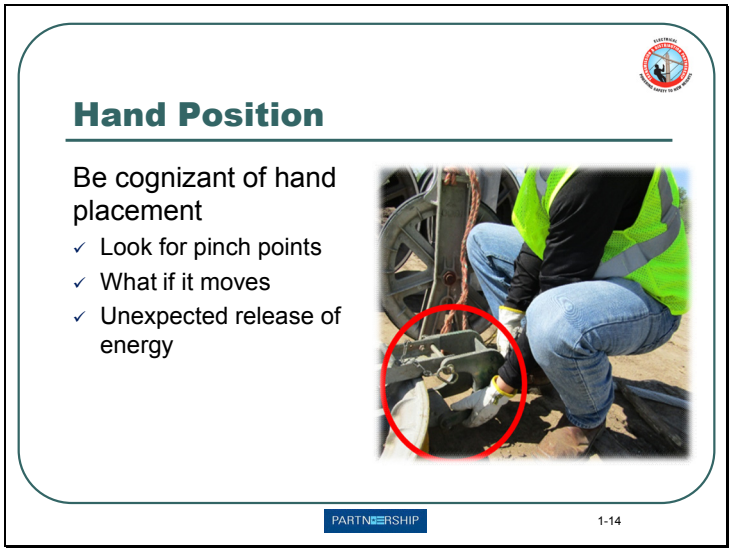
STOP, THINK, ACT, REVIEW (STAR Principle): Ensure that you and others do the right thing BEFORE taking action. Consider "what can happen". Place yourself in a safe working position when conducting your task. Always ask yourself, "Am I, or is someone else in harm's way"? Have a questioning attitude: consider the "what if's" prior to taking any action or making any decision. During job briefing, discuss proper distances and identify all pinch points and line of fire. Understand and know when to use Stop Work Authority.

Slide 1-14



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State the necessity of being aware of hand placement, especially the non-dominant hand. Identify possible pinch points and other "Line of Fire" hazards.

Ask yourself, what will happen when or if this moves? Will someone be in the path of movement?

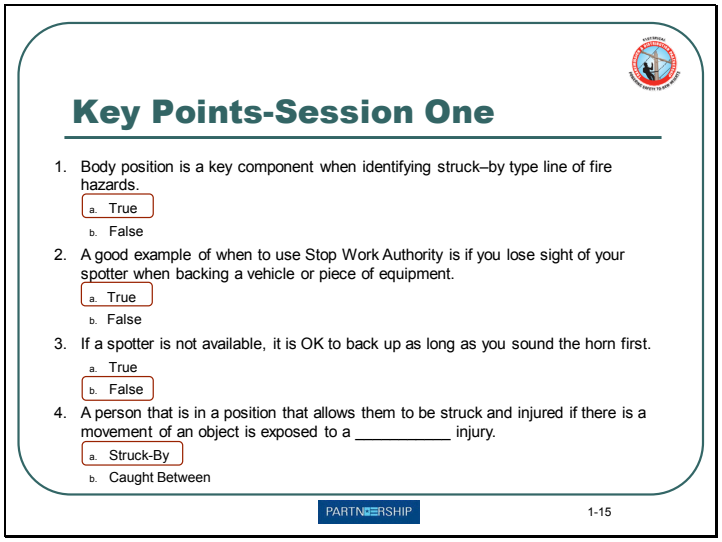
Think about the consequences of where you place all or part of your body at all times.

- Fingers/Hands in Pinch Points
- Under suspended loads
- Struck by hand tools
- Electrical contact

End section one

Key Points Session One

Slide 1-15



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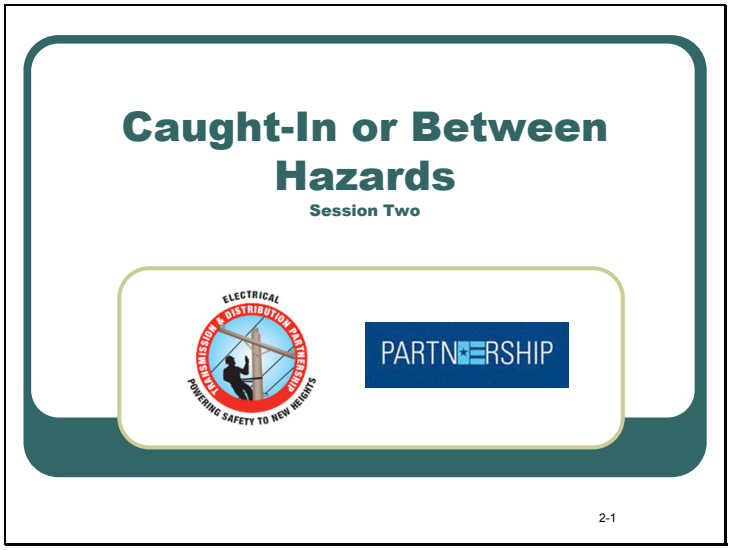
The presenter should have touched on the following items when Explaining session one:

1. Body position is a key component when identifying struck–by type line of fire hazards.
   a. True
   b. False
2. A good example of when to use Stop Work Authority is if you lose sight of your spotter when backing a vehicle or piece of equipment.
   a. True
   b. False
3. If a spotter is not available, it is OK to back up as long as you sound the horn first.
   a. True
   b. False
4. A person that is in a position that allows them to be struck and injured if there is a movement of an object is exposed to a _____ injury.
   a. Struck-By
   b. Caught Between

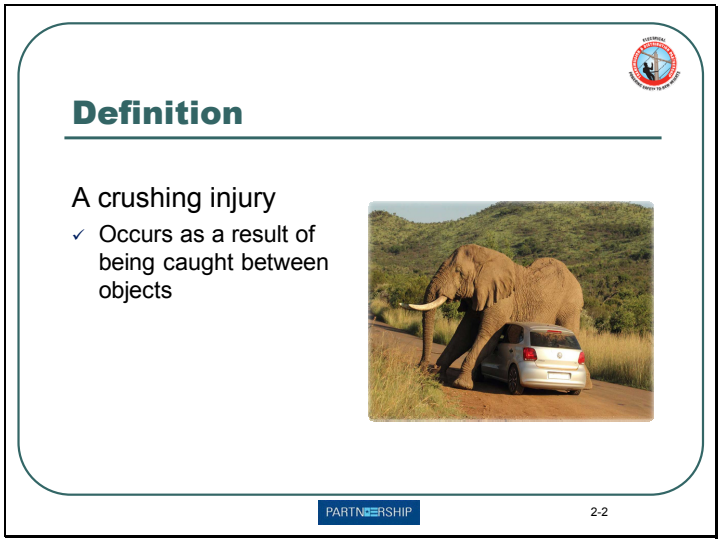
Begin Session Two

Slide 2-1



Explain that the following section will explain “Caught Between Injuries”

Slide 2-2



The key factor in making a determination between a Caught-in or between event and a Struck-by event is whether the impact of the object alone caused the injury. When the impact alone creates the injury, the event should be considered a Struck-by event. When the injury is created more as a result of crushing injuries between objects, the event should be considered as a Caught-in or between event.

Slide 2-3

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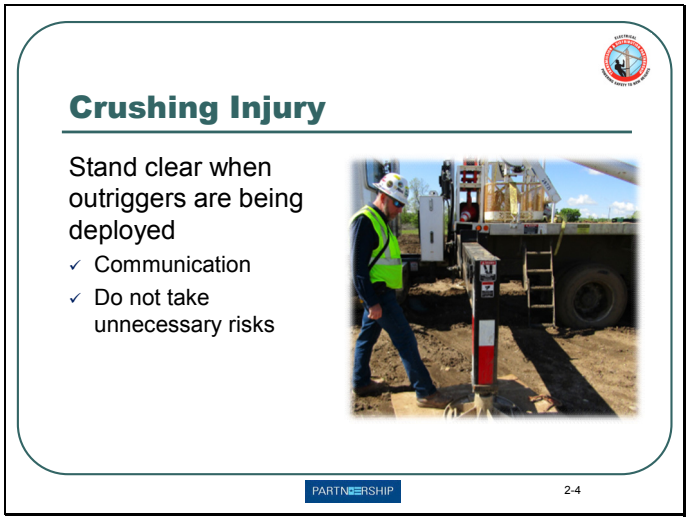
Explain that of the 644 ET&D Partner OSHA recordable injuries in 2017, 69 were reported as caught-in or between incidents.

Slide 2-4



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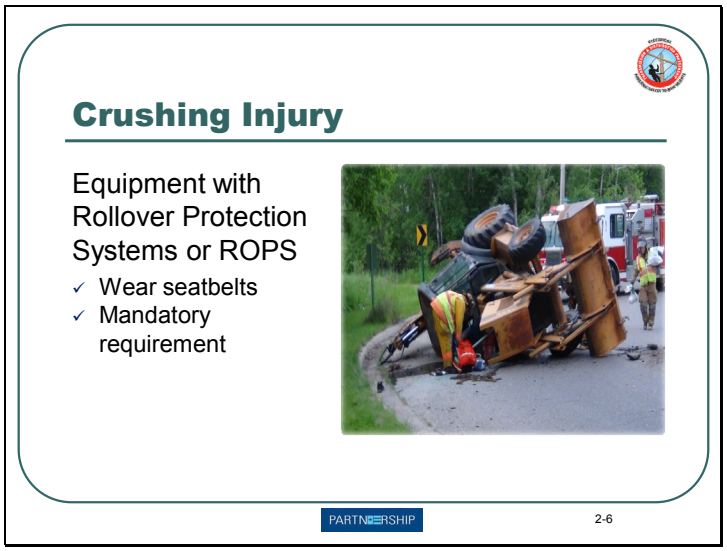
Explain that communication is key to prevent struck by injuries when deploying outriggers. Assign spotter to ensure outrigger area is clear. Use outrigger pads. That way a person is more aware that they may be placing their foot in the danger zone. Explain that the second picture illustrates an unnecessary risk. Good examples to use are when linemen are taking up old conductor using mechanical means such as the power take off on the line truck, their fingers can be trapped in the wheel. The same goes for any pulling equipment/cable reel. Anytime a block and tackle or rigging is used to lift a transformer their fingers can be caught in the sheave. If one person is lowering the outriggers and not paying attention, it could crush a crew person's foot.

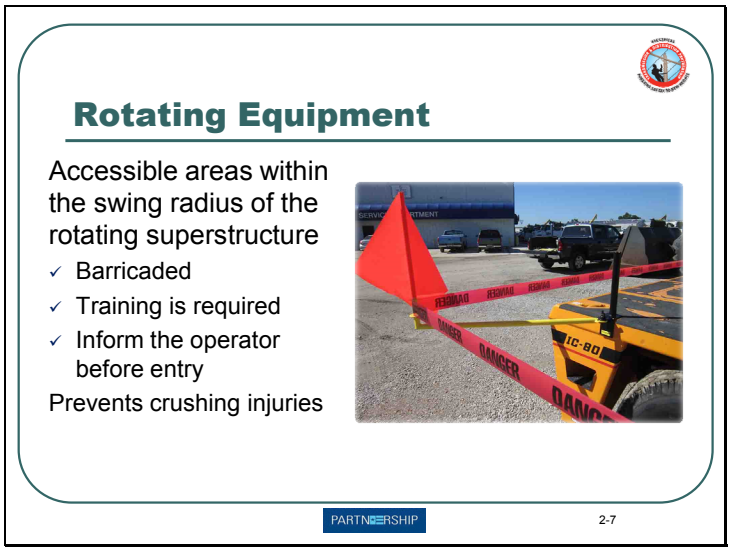
Slide 2-5



Slide has animation

Seatbelts must be worn by operators using equipment that has rollover protection. A National Institute for Occupational Safety and Health (NIOSH) review of the Bureau of Labor Statistics (BLS) Census of Fatal Occupational Injuries (CFOI) data identified 346 deaths associated with excavators or backhoe loaders during 1992-2000 [NIOSH 2002]. Review of these data and of NIOSH Fatality Assessment and Control Evaluation (FACE) cases [NIOSH 2000, 2001] suggests two common causes of injury: (1) being struck by the moving machine, swinging booms, or other machine components; or (2) being struck by quick-disconnect excavator buckets that unexpectedly detach from the excavator stick. Other leading causes of fatalities are rollovers, electrocutions, and slides into trenches after cave-ins.

Slide 2-6

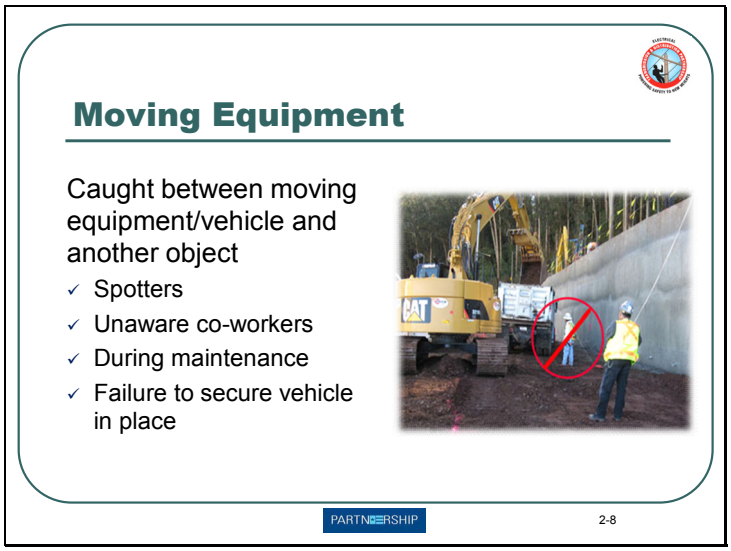


ⓘ Consider showing the accompanying OSHA "Struck-By" video here. The video run-time is 3 minutes, 27 seconds.

Slide has animation

According to the OSHA crane standard, 1926.1424, where there are accessible areas in which the equipment's rotating superstructure poses a reasonably foreseeable risk of striking and injuring an employee or, pinching/crushing an employee against another part of the equipment or another object, to prevent employees from entering these hazard areas, the employer must train each employee assigned to work on or near the equipment ("authorized personnel") in how to recognize struck-by and pinch/crush hazard areas posed by the rotating superstructure. The employer must also erect and maintain control lines, warning lines, railings, or similar barriers to mark the boundaries of the hazard areas. Exception: When the employer can demonstrate that it is neither feasible to erect such barriers on the ground nor on the equipment, the hazard areas must be clearly marked by a combination of warning signs (such as "Danger--Swing/Crush Zone") and high visibility markings on the equipment that identify the hazard areas. In addition, the employer must train each employee to understand what these markings signify. In addition, before an employee goes to a location in the hazard area that is out of view of the operator, the employee (or someone instructed by the employee) must ensure that the operator is informed that he/she is going to that location. Where the operator knows that an employee went to a location the operator must not rotate the superstructure until the operator is informed in accordance with a pre-arranged system of communication that the employee is in a safe position. Where any part of a crane/derrick is within the working radius of another crane/derrick, the controlling entity must institute a system to coordinate operations. If there is no controlling entity, the employer (if there is only one employer operating the multiple pieces of equipment), or employers, must institute such a system.

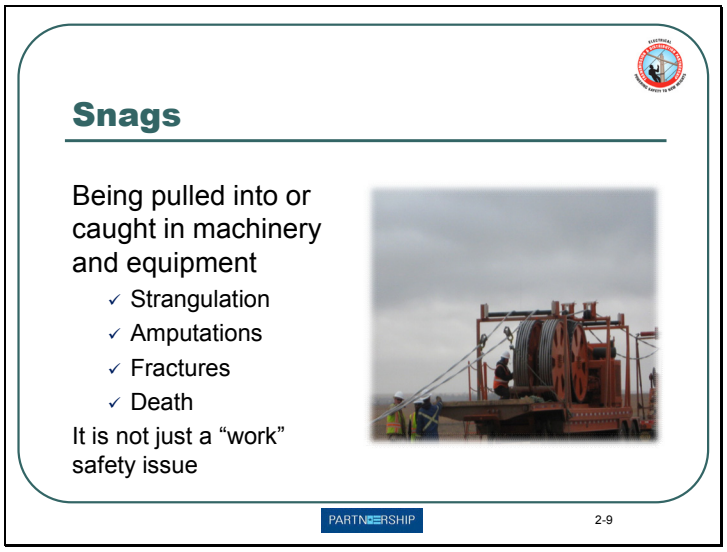
Slide 2-7

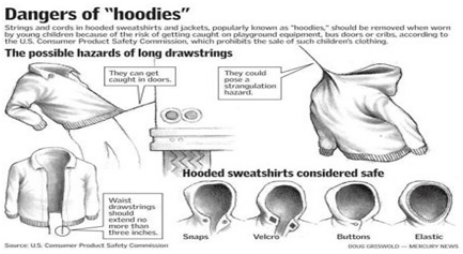


Slide has animation

Explain that anyone around moving or improperly secured equipment and vehicles has the potential of becoming caught-between it and a stationary object. Stop operation if spotter cannot be seen or anyone walks into hazardous area. Explain that the picture shows the potential for an injury. The one worker may not be in plain view of the operator.

Slide 2-8





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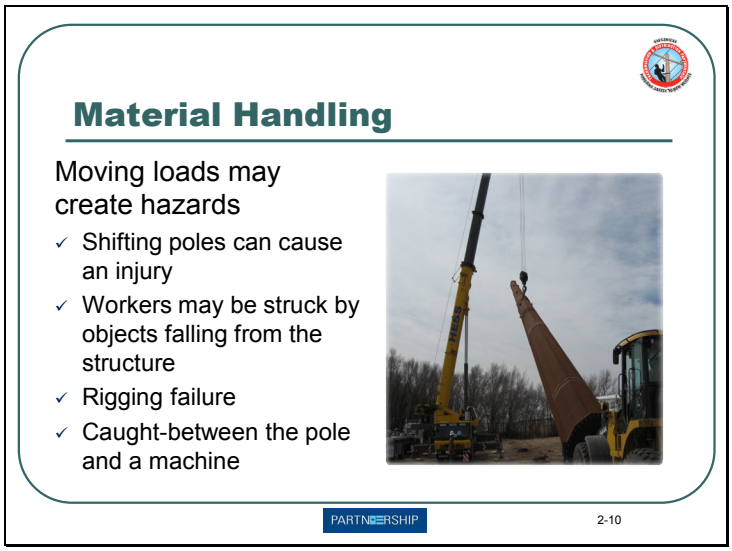
State that almost all sites use machinery that has moving or rotating parts. All of that equipment, at some time requires maintenance or repair. If machinery is not properly guarded or de-energized during maintenance or repair, injuries from caught-in or between hazards may result. These injuries range from amputations and fractures to death. When machines or power tools are not properly guarded, workers can get their clothing or parts of their body caught in the machines. If machines are not de-

energized (locked-out) when they are being repaired, they may cycle or otherwise start up and catch a worker's body part or clothing and cause injury or death. State that we should never wear loose clothing around moving machinery. A simple thing like the hood string on a sweatshirt or coat could cause a severe and even fatal injury. Cable pullers offer multiple opportunities for crushing injuries, often resulting in amputations due to the extent of the damage caused to bone and tissue. State that safety is not just an "at work" issue. Safety at home is as critical as safety at work. Think about your children as well.

Slide 2-9



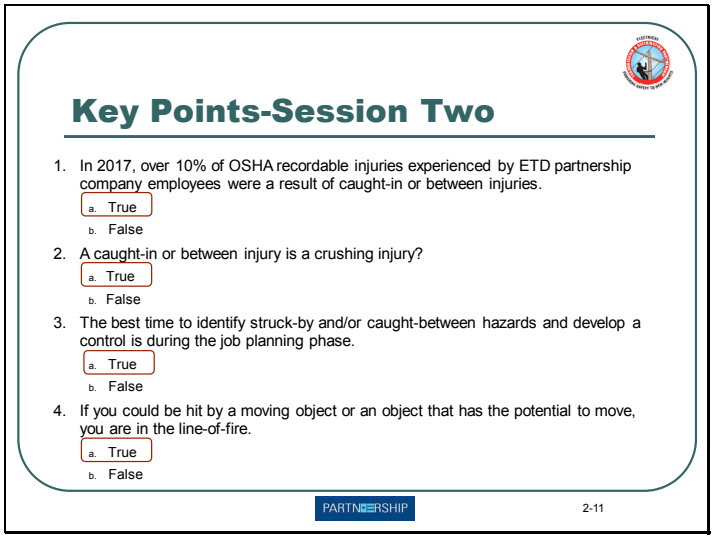
Slide has animation

State that everyone must maintain proper distance during pole handling tasks. Always chock/block downhill side of staged poles. Be aware of the Line of Fire hazards. Discuss the policies and procedures your company has in place to prevent the various types of crushing injuries mentioned. Make sure that your crew has received the appropriate training in order to identify these hazards and correctly implement site and task specific protective measures to eliminate them. Areas of concern here are the possible loss of the load, possible crushing injury from being caught-between the pole and the crane or other equipment, and possible struck-by injuries resulting from objects falling from the pole. This could include tools that were left behind, loose hardware, and/or dirt clods falling from the elevated structure.

End Session Two

Key Points Session Two

Slide 2-10



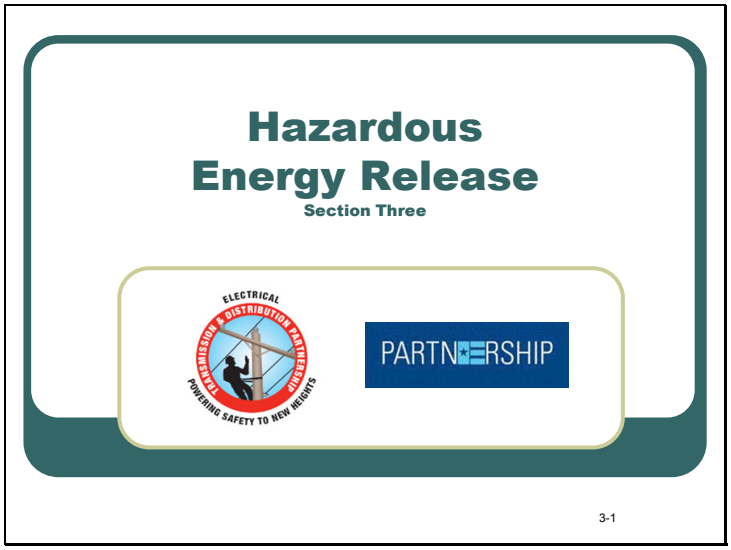
Slide has animation

The presenter should have touched on the following items when explaining session two:

1. In 2017, over 10% of OSHA recordable injuries experienced by ETD partnership company employees was a result of caught-in or between injuries.
   a. True
   b. False
2. A caught-in or between injury is a crushing injury?
   a. True
   b. False
3. The best time to identify struck-by and/or caught-between hazards and develop a control is during the job-planning phase.
   a. True
   b. False
4. If you could be hit by a moving object or an object that has the potential to move, you are in the line-of-fire.
   a. True
   b. False

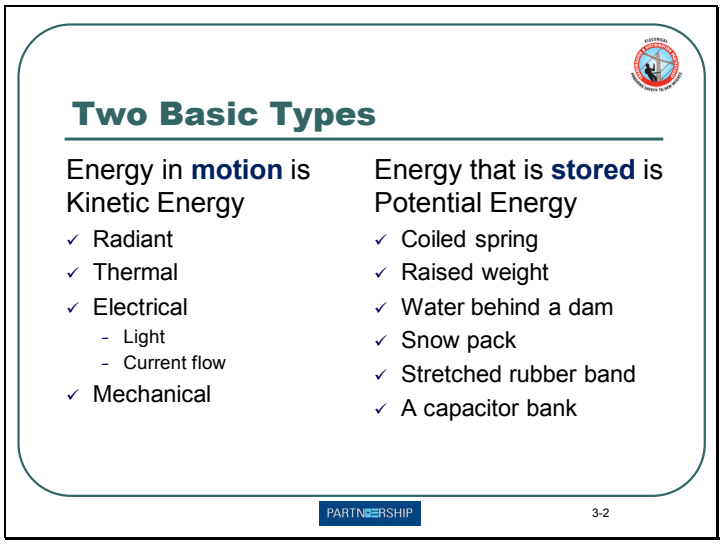
Begin Session Three

Slide 3-1



Explain that the following section will discuss and explain “Hazardous Energy Release”.

Slide 3-2



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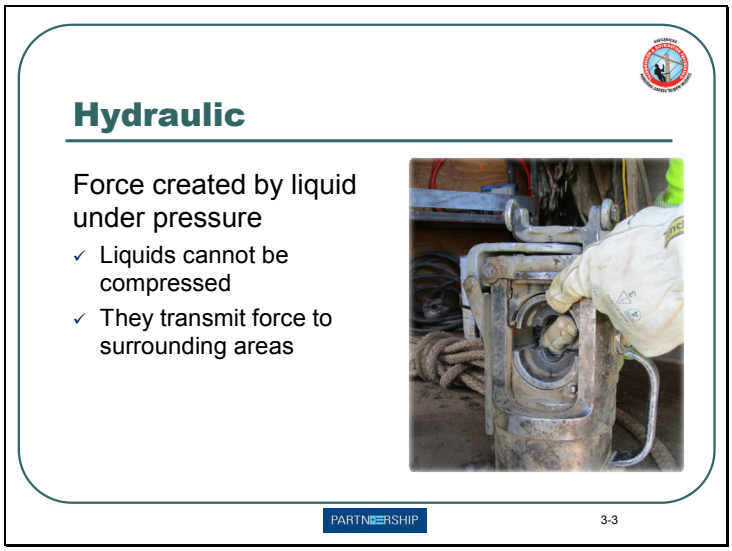
Explain that Objects can have stored, or potential, energy when work has been done (such as raising an object in the air) or by virtue of their position (such as sitting at the top of a hill). Potential energy changes to kinetic energy when the object moves. Kinetic energy is a form of energy that results from an object's motion. An example of kinetic energy is an airplane in flight. The airplane has a large amount of kinetic energy due to its large mass and fast velocity. When an object moves, it possesses kinetic energy. There are five types of kinetic energy - radiant, thermal, sound, electrical (light) and mechanical (motion). Potential energy is the energy an object has because of its position, rather than its motion. A great example of stored energy is tree limbs during storm restoration. Many lineman trim tree branches that are twisted pinched etc. and have stored energy. When they start to cut the limb, the limb may snap back at them. The same applies to poles and cross arms on the ground during storms. An object held in a person's hand has potential energy, which turns to kinetic energy, the energy of motion, when the person lets it go, and it drops. In every scenario, usually both forms of energy are present.

Slide 3-3



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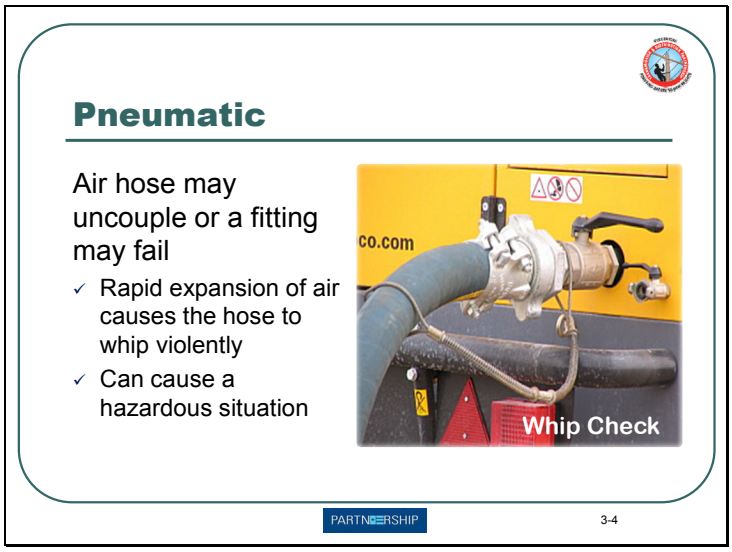
State that hydraulic pressure is the force that liquid is acting on some area. This pressure results due to an existing property in liquid, which is compressibility. Liquids are incompressible, so they transmit force across their molecules to the surrounding or contacting area. We must be aware of paths where energy passes from one location to another. This energy may be in the form of something under tension, hydraulic, pneumatic, pressure, flying parts, or whipping hoses

Slide 3-4



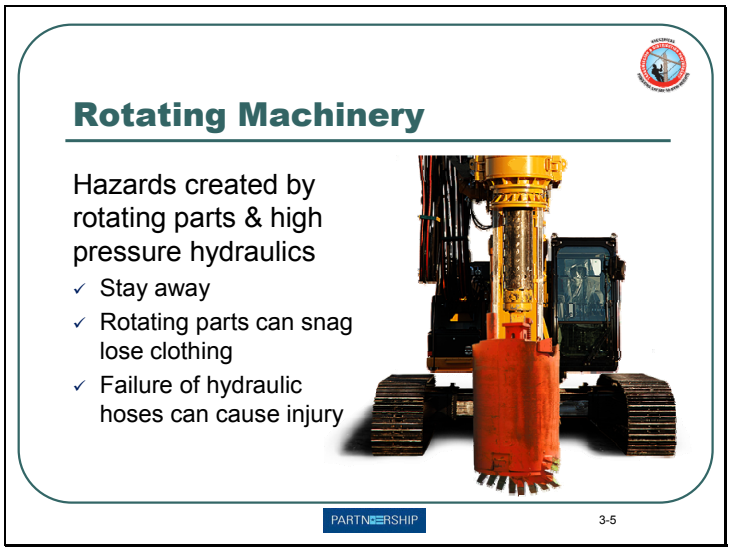
ⓘ Consider showing the accompanying "Whip check" video here. The video run-time is 12 seconds.

Slide has animation

Explain that when a pressurized air hose becomes accidentally uncoupled or a hose or fitting failure occurs, the rapid expansion of air causes the hose to whip violently creating a potentially lethal situation. Use whip checks to help prevent injuries or accidents resulting from hose or coupling failure. A whip check extends across the hose fittings to give standby safety for hose.

Simply pull back the spring and slip the loops of the whip check over each hose before connection to provide a safety backup in the event of a hose connection failure. State that whip checks on airline hoses are easy to use, low cost, safety cables to help prevent injury if a hose connection separates. They can attach hose to hose or hose to equipment. They are highly resistant to rust and corrosion and do not require any tools to install.

Slide 3-5



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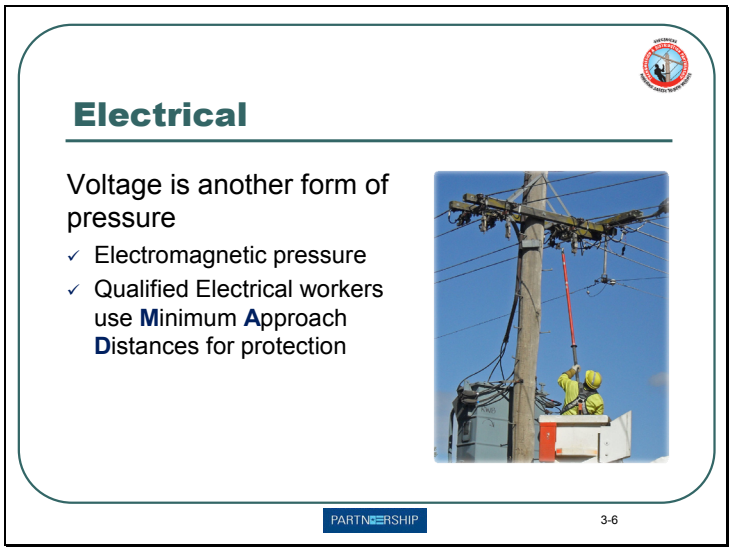
State that a wide variety of mechanical motions and actions may present hazards to the worker. These can include the movement of rotating members, reciprocating arms, moving belts, meshing gears, cutting teeth, and any parts that impact or shear.

Slide 3-6



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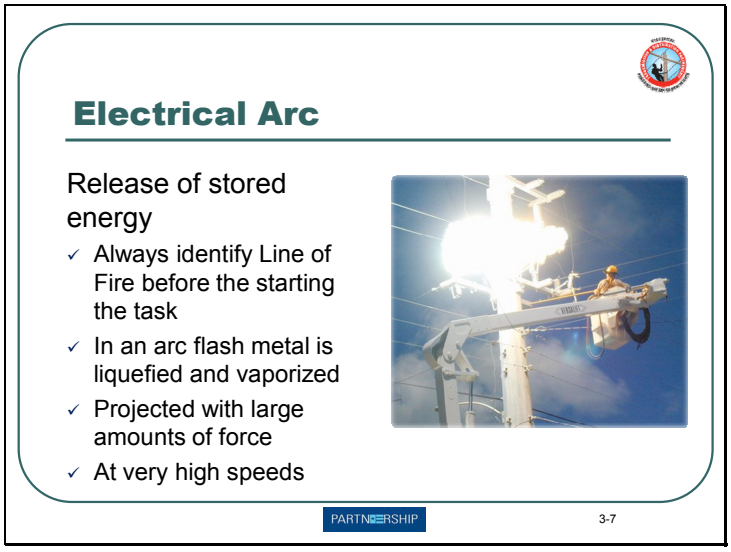
Explain that voltage is the pressure from an electrical circuit's power source that pushes electrons (current) through a conducting loop. This enables work to occur. In brief, voltage = pressure, and it is measured in volts (V). One method of protection from voltage is to maintain the minimum approach distance for that voltage. Minimum approach only applies to qualified electrical workers. Non-electrically qualified workers must maintain 10 feet of clearance from any exposed parts energized at 50,000 volts or less. This spacing increases if the voltage is or could be higher than 50,000 volts.

Slide 3-7



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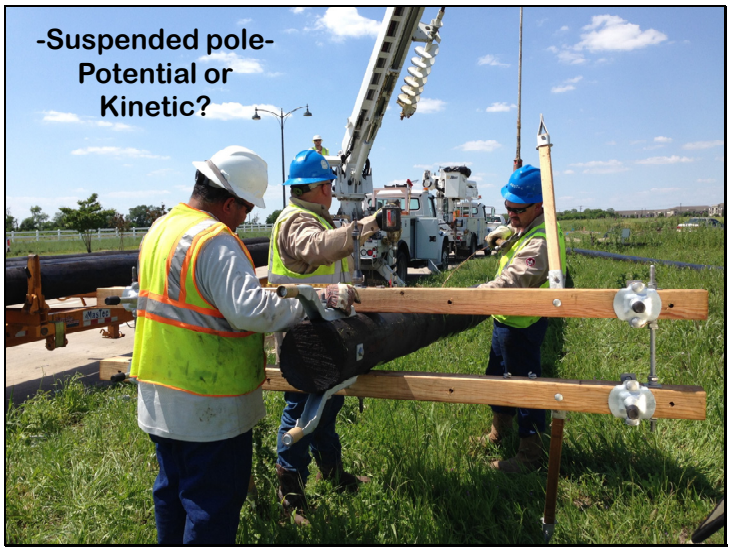
Discuss the importance of position and distance when conducting a critical tasks. Explain that we should never work in a position where we are directly below the work area. If there is equipment such as a switch or cutout breaking, we could be struck by the projectiles. Also state that in an arc metal liquefies into molten droplets, which can ignite clothing and cause severe burns. Two or three drops of molten metal are unlikely to cause a clothing fire, and an individual "spot fire" can be easily patted out if it occurs. However, real-world arc flashes create thousands or tens of thousands of molten metal projectiles, meaning a worker is likely to be hit with 2,000 or 3,000 drops, not two or three. That quantity of molten metal can easily cause a large, aggressive clothing fire the victim cannot simply pat out with their hands. Ask attendees for additional examples. An electric arc, or arc discharge, is an electrical breakdown of a gas that produces an ongoing electrical discharge. The current through a normally nonconductive medium such as air produces plasma; the plasma may produce visible light.

Slide 3-8



-Stowed Auger-
Potential or Kinetic?

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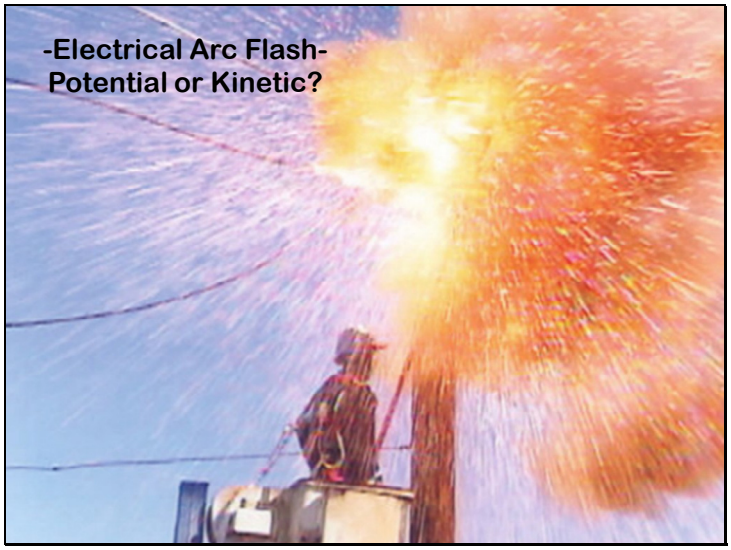
Ask the group if the suspended pole is kinetic or potential energy. The desired answer is “Potential” energy. Then ask the group if the energy classification would change if the pole fell? The answer is “Yes” because the pole is energy in motion. The moving pole is an example of kinetic energy. Then show the group the picture of the arc flash explosion. Ask them to identify the energy classification. The desired answer is kinetic energy because electricity and light are both examples of kinetic energy.

Slide 3-9

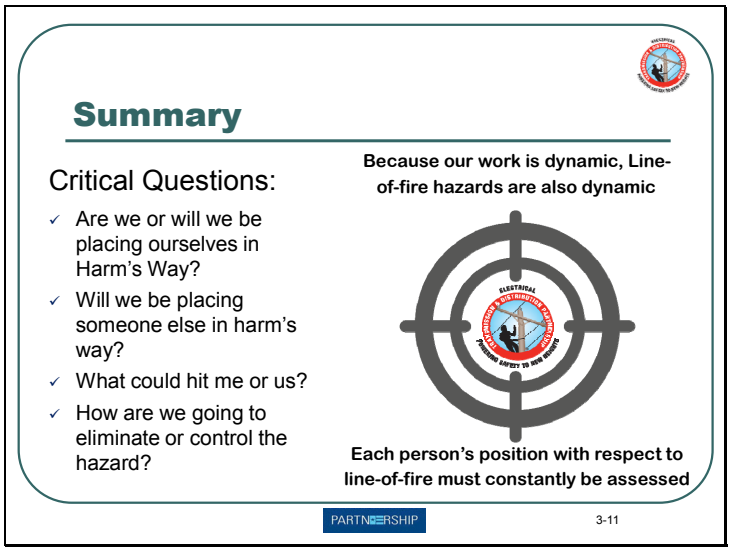


Show the group the picture of the arc flash explosion. Ask them to identify the energy classification. The desired answer is kinetic energy because electricity and light are both examples of kinetic energy.

Slide 3-10

Ask the group if this picture illustrates kinetic or potential energy. This one can be tricky. When the helicopter and load are both moving together, the energy is kinetic. The load under the helicopter is part of the total mass. When the helicopter moves the suspended tower moves. Once the tower is placed, and the helicopter cuts the tower loose, the stationary tower now represents a potential energy source.

Slide 3-11



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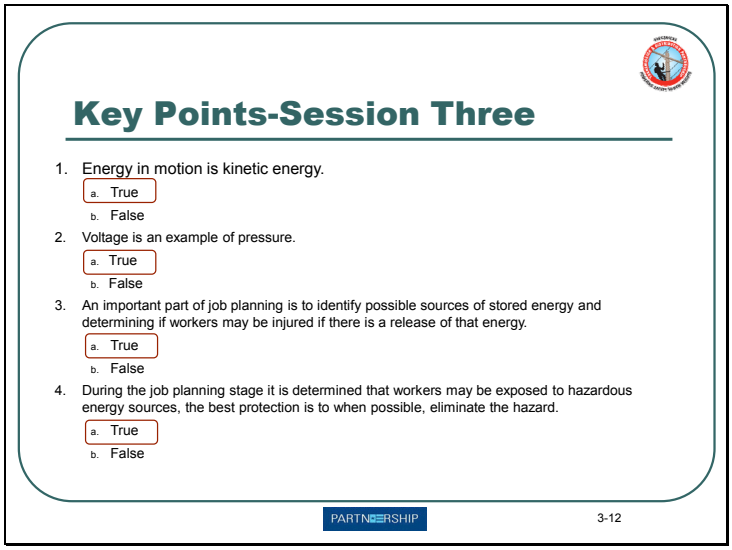
State that everyone on the jobsite must ask him/herself the question, "what could hit me?" It is crucial for worker and civilian safety that we ask these questions and involve everyone in the process. This awareness of each person's position with respect to the line-of-fire must be assessed regularly, as the line-of-fire can change its position every time the person does, and every time the work moves.

End Session Three

Session Three Key Points

Slide 3-12



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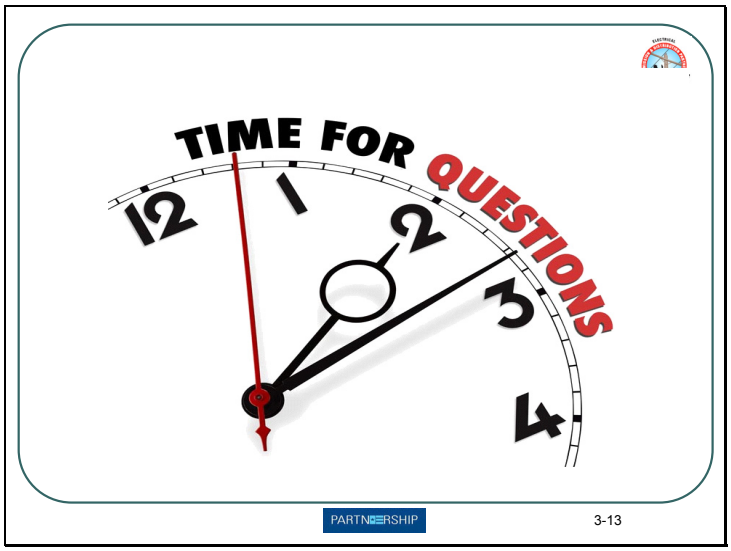
The presenter should have touched on the following items when explaining session three:

1. Energy in motion is kinetic energy.
   a. True
   b. False
2. Voltage is an example of pressure.
   a. True
   b. False
3. An important part of job planning is to identify possible sources of stored energy and determining if workers may be injured if there is a release of that energy.
   a. True
   b. False
4. During the job planning stage it is determined that workers may be exposed to hazardous energy sources, the best protection is to when possible, eliminate the hazard.
   a. True
   b. False

Slide 13



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Ask for questions. Once complete thank the attendees and close the session.

ⓘ Following pages contain the supplemental handouts.