Understanding Irrigation Electrical Safety for NRCS Employees: Part 2 - How to be Safe in the Field
On-demand Captions (unedited)

>> Welcome to today's conservation webinar. My name is Holli Kuykendall and I'm the national technology specialist for NRCS' East national technology support center in Greensboro North Carolina. Parts one and two of this electrical safety training were recorded in Argus 12 2016. Today's webinars -- to earn CE use -- to earn CEU oh -- CEU, into your certification credentials and you will receive your certificate by email. We encourage all participants to complete the webinar using the step 2 process. Completing the webinar invites an opportunity to rate it using a 5 star system and you can submit optional comments that are helpful to our webinar program rating the program top please focus on the technical training provided by today's presentation and what you learn by participation. I want to thank southern region for partnering with NRCS to offer today's webinars as it NRCS science and technology webinar training. I'm pleased to turn the webinar over to Jerry Walker, he's a central manager support Center management engineer located in fourth work -- Fort Worth Texas.

>> Thank you Holli. I would like to address our audience first with a few paragraphs. Many of the NRCS employees find themselves close proximity to equitably powered irrigation equipment during normal planning activities. Some employees as part of the job, will be required to check out certifier spotcheck electrically powered equipment and installations. Completion of this part 2 webinar in the companion part 1 webinar is understanding irrigation electrical safety for NRCS employees will inform employees a potential hazards and provide ways for them to protect themselves as they carry out their duties. NRCS employees is part of their job need to be in contact with energized equipment such as field testing, monitoring or troubleshooting irrigation equipment performance or operations. Will require additional face-to-face pressure and Bill training. Our instruction today is Greg Stark, assistant professor of practice biological and agricultural engineering department Texas A&M University in College Station, Texas. Greg grew up in a small farming community in south-central Nebraska. From the University of Nebraska -- Nebraska at Lincoln he started his career as a research engineer at the University of Nebraska assisting rule electrical in Kansas Nebraska with implementation of irrigation, low management and demand site programs. The surfer 10 years as the executive director of the Texas Agro business electric counsel in association investor owned electric utilities that serve as a liaison between the utility companies and agricultural business. Greg is a licensed professional engineer in Texas and for the past 15 years has split his time between his consulting practice at Texas A&M University as an assistant professor practice where he teaches courses on energy management and electronic control picked his consulting activities focus on the areas of energy management, power management. Greg has been heavily involved with irrigation equipment standards develop by the American Society of biological and agricultural engineers and adopted by the American National standards Institute as well as the irrigation industry. Greg we really appreciate you instructing today.

>> Thank you Jerry. Welcome back to part 2 of understanding irrigation electrical safety for NRCS employees. We talked earlier in the part 1 section about why we are concerned. A very high level overview of the main things we are concerned about. In part 2 we are talked about how to be safe in the field are particularly we want to talk about understanding the equipment and how it connects together, identifying suspect equipment installation, potentially unsafe conditions in hazardous conditions. As well as understand the safe work practices personal protective practices and personal protective equipment and how to apply them to keep yourself safe.

>> As we think about and irrigation system, it's going to contain typically one or more pumping systems is what -- as well as one of more distribution systems. From a electrical safety standpoint, having a

vision in your head in terms of how the system is put together helps us in terms of figuring out what we need to do to be safe. When I think about the pumping system or systems, I'm typically going to have one or more pumps electric motors, they will connect to the water distribution system and ultimately to the irrigation system to supply the water from the source to the system. In addition I have one or more irrigation distribution systems that could be of many different technologies or type. To apply that water to the target field or service. There could be a ditch irrigation guy dated pipe cost center pivots cut side roll systems Gun systems many different types of technologies used that involved electrical power equipment as well as electrical motors and drivetrains to move the system over and across the field. Understanding of both of those is important in terms of taking about electrical safety practices when working around the system.

>> The first then work practice that you need to think about when you are out on site is visually inspecting the system and area to make sure there are no obvious electrical safety hazards. Locate the disconnect switches for the irrigation equipment or understand what proximity or good geography they are located and in comparison to each other. Between the pump or pumps the irrigation machines, and any other ancillary equipment like to make nation injection equipment. Look for missing lives in enclosure covers exposing live electrical parts. We do not want to make you and electrical inspector in this course but we want to remind you about the general visual things that an inspection should show you will bring off red lights and flashes in your mind of danger warning cut to say --, to say I don't want to get close to the system because I see things visually that are obviously potential safety issues are ready. We will look at damage from equipment or livestock on exposed electrical panels and courts. Much of this equipment sits out in fields throughout the winter months where people might be running cattle or other animals, those animals like to rub up against, lick, to Orlean on and scratch those panels because they are comfortable. Look for missing guards on molding and rotating equipment as well which can also be safety hazards. When I visually inspect the system, there are certain things that should come to my attention that I know I'm not correct that tell me, stay away, keep clear distance.

>> Look for damaged equipment and other hazards as you are doing that visual survey. Some of the things that we are typically looking for in the irrigation system are damaged insulation on cords and cables. That could include cords laying unprotected on the top of the ground or running over the ground where they do not have good protection. Noted -- noticed the graphic. We have a court that run up over the top of the Barb wire fenced around the post and back down. Probably to give it some stability, keep it out of the way from getting caught on equipment moving along a road side edge cut maybe to a portable irrigation machine or something else. Particularly, cables or cords run over our dryer fences, above the ground that are unprotected deserve a visual inspection to determine if there is any damage to the cable before you get close to it. Visually looking to see if you can see gouges or metal or places that are obviously damage become important here, another one of those factors is damaged enclosures. Lives they do not close or holes in big enclosures that will let the elements and water inside. Water leaking out of the enclosures. We know that water and electricity do not mix well without following certain rules. That becomes important. Enclosures or equipment laying unprotected on the ground exposed to the elements is also one of those visual clues that the system has problems and may not be safe as well as missing guards and covers. All of those damage equipments or other hazards should visually be looked for when you are walking near or up to a system.

Understanding Irrigation Electrical Safety for NRCS Employees: Part 2 - How to be Safe in the Field
On-demand Captions (unedited)

>> Irrigation system maintenance varies quite a bit by where we are. This is the second link in the irrigation safety chain involving maintaining properly installed systems in good shape. Number one digital and those systems to go in, be installed properly and be in good shape when they are installed. Once they are installed, the system can still fall into this -- disrepair if it is not maintained properly. That is a challenge in terms of maintenance that we do not always necessarily see with some of these irrigation systems. Many systems have been modified or repaired using substandard equipment's and some of my courses I have jokingly talked -- many of our AG owners and irrigators are very industrious. And industrious is a nice politically correct term for we can repair about anything and make it run would duck tape. Many of us in the AG community are proud of that fact that we are very industrious N-fixing those problems. The challenge is that some of those protections or some of those corrections and fixes that we do using unprotected conductors and connect -- connectors exposed to water and people can be hazardous. The use of grounding conductors can be a problem, and proper court or plug connections, as well as a protective motors exposed to moisture's and motors not attached a solid basis. In the graphic on the right, we see all of these different concerns in the example. We have unprotected conductors here , coming and that are not fixed, running over the ground. There is no equipment grounding conductor. I know you are not experts, I can tell this by counting the number of wires and looking at the color of the wires here that are exposed going into the motors. Which would tell me this motor cannot fail in a safe manner. This is a and proper court connection because it is not approved for outside wet or damp areas. This is the unprotected motor with a cover that is off of it with wires go and cut letting moisture go into the external parts and we do not have a solid days anchored to the ground concrete to keep the motor from jumping when it starts. So visually I see five things related to motors, that motor and installation before I walk up to it that sets the bells and whistles off in my head say this could be an unsafe installation. I really want to start being careful and get my guard up.

>> Damage electrical power cords are one of the key areas to look for in irrigation systems. They tend to be a big challenge of their because they are not typically installed correctly using the correct materials. In the graphic we see unprotected boards exposed to damage from animals, from equipment that might drive over the area, it might have been done temporarily to get a system up and running with the intent before next season will come back in entrance those underground like they are supposed to be interested not happen. We are looking for cords run unprotected on top of the ground exposing them to damage. Obvious physical damage to the outside of the court. Areas of damage where the conductors inside the insulation are exposed that we can visually see the shiny metal. Areas that have been covered with electrical tape or similar materials. Or indoor extension cords with an outer coverings that were never meant to be used outdoors on irrigation system subjected to physical damage. Again, visually, there are clues they are the tell us there is a problem here. The system was not installed or maintained correctly.

>> Contrary to popular opinion, electrical tape is not meant to fix extension or power cords with gouges or cuts expire -- exposing bare wires. In the graphic you can see where this court has been taped with electrical tape. While being industrious, that might make the system work temporarily. The challenges that electrical tape does have useful purposes and concealed wiring where it is not expose, but it is not meant for expose wiring, especially in wet areas it is not rated as an insulating material. And it is not watertight. In the graphic with the irrigation system is probably okay the first 20 minutes water is being dumped on it but after that, it is not going to be watertight and will have problems it could leak electricity and start producing shocks and other various hazardous situations. Another visual things that

should set off bells and alarms in our heads to say, we need to be paying attention. Where seeing -- we are seeing obvious signs.

>> Another slide related to power cord insulation because it tends to be a huge problem with irrigation systems. In the graphic we can see some conductors running down to this pump and then running into the ground. They are not protected we see some electrical tape holding the conductors together and there is not a connection then to separate the sharp metal edges where they go through inside and out of sight. One power quarter conductor insulation is damaged, it can result in the equipment being energized from the bear electrical conductors contacted or coming in contact with humans, water puddles, damp soil or metal enclosures. Again, what do we identify as potential concerns from visual inspection of this insulation? Are the electrical conductors protected from damage? The answer is no. They should be in some kind of conduct is conduit or in -- enclosure. What might the tape around the wires mean? We might conclude it's just to hold the conductors together better or it might be they are covering up some problem of insulation on the conductor. To the electrical conductors go through a proper clamp for the purpose where the disappear or is that a sharp metal unprotected edge that could damage the conduct tours over the time. Those power conductors are not correct are subject to damage over time which could create a safe -- unsafe installation. Give them the mother test. With their mother allow them to wire things like that her house -- at her house. I had a mother that was on the all the time about my work product when I fixed things at the house. That would have not flown with my mother it had to be visual perfect and technically perfect. She knew if it looked shaky, that was not going to flight. When you asked that question, a lot of time you get that thought or a lightbulb comes on, saying had no. My mother or wife would not allow me to do that at the house. That is a pretty good indication it should not be done in the field as well.

>> Electrical power cords on equipment with multiple sides are problematic. Another issues we see is where cords enter motors on irrigation machines. In the graphic where this court on the center pivot is coming up to the tower motor, we find an area where we see lots of problems. The cords actually connect to the equipment itself. Power cord at irrigation systems are exposed to the elements in some cases physical damage so insulation is more prone to damage. Be alert for damage areas on the power cords exposing the conductors frequently where they connect to other equipment. Another frequent problem is lack of proper connectors supporting the court where he goes into the motors and other enclosures. Chart metal edgers at the entrance points can damage the conductor insulation. Over time, vibration and where will damage the insulation in the connector. Somebody will decide to fix that. They don't have the proper connector, so they will take the bad insulation off and put a whole bunch of tape around it or just put it in their temporarily with the thought to come back and fix it. It will never done properly. It becomes more dangerous the more that sharp edge of the electrical metal tears into the insulation. Those of visual power cord things that should always set off Dells and whistles in your mind that this is not right, this is something to note. Let the owner operator know you noticed and observed things Deco potentially be electrical issues because they are not correct on the system.

>> The similar but related idea in terms of those electrical safety hazards is broken, separated or corroded electrical conduit. Here the conductors were protected with conduit from physical damage but now the protection, the conduit, has become corroded, undone separated or broken. Concern here is the sharp metal edges on broken or separated electrical conduit can cut conductor insulation and caught -- cause electrical shorts to the metal conduit energizing any metal equipment or structure

connected to it. Notice in the graphic, the conduit connected has separated, it is physically broken. Normally this connection should be connected together with no air space between it Protecting the conductors inside. You can see that maybe this is gone on before or for quite some time and we have electrical tape coming up the -- covering up the insulation were possibly the metal edges have been breech the electrical insulation. This is a broken conduit joint again visually, before we check anything out tells us there are concerns if the system was not wired properly and was relying on the metallic conduit cut metal to metal conduit for equipment grounding conductor or safety path, the break in the conduit would render the equipment grounding useless if the conduit, this metal path was our safety path and he broke, this piece of equipment connected to it would not fail in a safe manner during a short circuit. More visual cues that even if the conductors are protected, if that protection has a problem, we could have an unsafe condition.

>> Another slide that illustrates that broken cost separated or corroded electrical connections. Notice the corrosion of this conduit coming out of the panel going to irrigation system. It is probably outlive its useful life. You can see that the flexible metal conduit not only has lost its plastic covering cut the plastic covering is gone and it's corroded such that the metal has become loose, rusted and is not consistent. Look for metallic conduit that is broken or pulled a parted joint exposing electrical wires inside to sharp metal edges possibly cutting into them. Sometimes the challenge for you is NRCS employees that are out there just to inspect systems or confirm or verify it is when new pumps or machines are installed. There is a lack of attention or lack of effort put in to the ancillary electrical infrastructure, the panels on the control boxes. That will require more money, more budget, more effort. We are changing out the system and the tendency for the owner operator or manager is to say that savable to -- let's save a few bucks and not change out at the time we put this new distribution system in the water or this new pump system. Even though the pump or distribution system is new and bright and shiny, and looks like it comp electrical infrastructure serving that irrigation system may not have an replaced, may need replaced and present a safety hazard. Those of visual things again.

>> The next slide shows electrical disconnect. We want to essentially visually then inspect to where the disconnects are. The disconnect is a fancy electrical jargon term for switch, power switch, on off switch. At disconnect -- a disconnect is a switch that allows us to turn on and off the power. Electrically powered irrigation pumps and systems or machines are both required to have an electrical disconnect, and on off switch with -- within sight of that equipment. The electrical codes and standards require that switch to be within 50 feet of the equipment to turn it on and off. Think about how AG produces operators managers or others, electricians, my try to argue that to the center of the center of it at the edge of the field in the winter where no crops are growing is within sight of, because I can see from the center of it point to the edge of the field of the road. The codes are clear that within sight of still mean within 50 feet. Just because I can see in the long distance does not mean it complies. So I cannot have a disconnect on off switch at the edge of the road of the field supplying power to the irrigation system that is a quarter mile aware -- away. This provides a convenient location to shut off the power for safe inspection, maintenance and repair of the equipment close to the equipment. One of your challenges as NRCS employees with finding the disconnect even if it is within 50 foot and within sight of the proper irrigation system, in the middle Sommer, weeds, crops and other things could have grown up above that disconnect height interfering with our line of sight. Technically, it should always be within the line of sight but may not in the middle Sommer when you have had a lot of good growing season and crops can obscure it. That is another visual thing that you are looking for.

Understanding Irrigation Electrical Safety for NRCS Employees: Part 2 - How to be Safe in the Field
On-demand Captions (unedited)

>> Locate the electrical disconnect for both equipment, the pump and or the irrigation machine that you are looking to inspect. Identify where they are and they exists. For any equipment you are going to inspect or see people work around doing maintenance and repair on. A look for labeling and evaluate the layout of the system, what controls what. The national electrical code requires the disconnect switches to be labeled for the equipment that they operate. To meet the electrical code, the irrigation machine disconnect should say irrigation machine disconnect, center pivot 1 disconnect. The pump disconnect should say irrigation pump disconnect for something similar to distinguish the disconnect for the pop from the disconnect of the irrigation distribution system or machine. Notice my bullet, how often do you suppose that happens in AG irrigation systems? That is one of those things on paper in NEC that sounds good from a safety standpoint, we say that helps people understand, but in practice in the field, it comes down to inspection requirements. You will probably see lots of irrigation equipment in the field where the disconnect switches are not labeled on the outside for what machine they actually control. The other factor is because of weather and exposure when the equipment was new it might have had a label on it, but sometimes those labels come off. When they come off the challenge is that many of our operators and owners or managers will not replace them. They understand it already which is -- and assumes everybody else should. If they are not labeled, and if you are unsure you can ask the land owner, the manager if you are unsure where those disconnects are located just to give you an idea of where the switches are.

>> Pumping system disconnect is important because that is the location that is used to deenergize electricity to the pumping system. The disconnect switch for the prompt and only control the pump motor and nothing else. Not the irrigation system. Equipment such as irrigation machines or fertilizer chemical and check theirs and other ancillary equipment should not be supplied from that pump disconnect through that switch. In some locations you might find that it has been for convenience. Every one of those devices should have its own disconnect that I can essentially shut off for that piece of equipment, locket and tag it out and know the power has been shut off at that point. Instead of going back upstream to the pump disconnect in assuming if I shut the pump off everything else is shut off. Which is not necessarily a good assumption. Similar to any other motor, that NEC requires the disconnecting switch be within sight of an within 50 feet of the motor. And the slide and graphic we have the irrigation pump motor cop pumping water out of the ground to the system in the background. Here we have the pump disconnect switch right by it in the actual switch on the panel enclosure used to disconnect the pump from electrical power, or connected to electrical power to allow it to run. Noticed the system, the irrigation system in the background would have a separate disconnect switch at the control point for the center pivot in this case to control or disconnect the irrigation machine.

>> The irrigation machine disconnect will typically be at that main point of electrical connection to the irrigation machine were ever that happens to be. The national electrical code requires an irrigation machine to have a disconnect switch with overcurrent protection, fuses or breakers capable of being locked in the open position at the point of connection of electrical power to the machine. The irrigation machine disconnect to a center pivot will typically be inside the main control panel. The major center pivot manufacture of electrical -- irrigation equipment like big guns or other removable devices, will typically have a control panel. You can see I am pointing to the main panel on the center pivot with my arrow you will -- my arrow. When I open the cover is the machine disconnect cut this handle switch which could be moved from the on to the off position or vice versa to disconnect electricity from the electrical source coming in to the center pivot equipment. That switch also is where you will find that

switch. Another very important disconnect switch that ensures if this which is in off position, then that irrigation machine has been put into the deenergize state. There also could be an optional disconnect not require, but -- to shut power off to that control panel for maintenance and repair. The switch at the machine is required in the manufacturer will put it in at the time of manufacturing. As a NEC employ you should understand and all system that switch could have failed and it might have been cheaper to mount a switch next to the concrete pad here to replace it. Sometimes an older systems you might see something that has been change from manufacturers conventions. -- Conditions. The machine disconnect switch should be within the main control panel for the irrigation machine it allows power to be turned off safely to the entire machine from one location. If I turn that disconnect switch to the off condition, every piece of electrical equipment associated with that irrigation machine, will be de-energized. It allows power to be locked off at that location for maintenance inspection and repair. Does it deenergize the pump or pumps serving that irrigation machine? Not necessarily. It does not have to. Although it could be set up that way so if the irrigation machine goes down, the pump is turned off so the system is not sitting there constantly pumping water in the same location. It doesn't have to be wired that way. The challenge with the irrigation system is, if I shut off the system at the irrigation control panel, I may not remove power to the pump, moving water through this metal system. To be sure I am completely deenergize I need to disconnect both the irrigation machine in the pump and any other ancillary service.

>> Think about if you were injecting chemicals in front of the irrigation machine. That means that that for negation or Kim edition system would have its own disconnect in front of the irrigation machine control panel that is required to be in the off position to ensure all the equipment was turned off.

>> There could be other switches and controls associated with both the pump and the irrigation machine. These could be for injection pumps, booster pumps or other automated control equipment. Switches should be mounted at a height to prevent the need for kneeling or climbing to operate the switch and controls. The NEC rules dictate that handles for disconnects must not be higher than 6 1/2 feet or Lord then 3 feet, so a normal person can reach them standing up. All switches are supposed to be permanently label for the function in use. We talked about that maybe not happening with some of this AG equipment. If you noticed the graphic, these switches are mounted. Could I bend over and switch them on and off, yes. If I was working on them, I might have to kneel down if those panels were opened up to look inside. We do not want to be on our knees were we cannot get away from something if it's a safety hazard. Those are other things to note that should send visual images in your mind saying, this is not right, the system does not meet the code. If this is not meet the code there may be other things that do not meet the code in terms of the installation and maintenance.

>> In adequate working spaces also one of those things that could be a visual thing to look at the tells you about the quality of the system. The NEC requires equipment to have adequate working space for people working on it or near. Mounting height is important. You should never have to bend over Cotney or lay on your back side or stomach to operate a switch or other control device. If you cannot stand up, and you have to bend over, Neil, lay on your back side or stomach to operate the equipment I do not get near that equipment. In my graphic here, what happened? This which was mounted to low cut the water distribution system is in the way so we cannot open the cover to inspect inside for a clear working space. That means people have to cram their head sideways, Neil, get on their sides do things that are unsafe to look into the panel.

Understanding Irrigation Electrical Safety for NRCS Employees: Part 2 - How to be Safe in the Field
On-demand Captions (unedited)

>> Electrical enclosures have visual cues as to their quality as well. The electrical boxes that enclose the electrical devices and wires are used to guard operators from live electrical parts. The electrical connections and switching mechanisms by insulation is use on cords and cables. Those electrical enclosures that serve the pump and control panel and irrigation machine control panel and other related electrical dot -- devices should be visually inspected. Irrigation generally requires weatherproof a waterproof enclosures. I don't expect to make you experts, visually, whether those panels are weatherproof a waterproof, but you should understand that an irrigation system that has enclosures with holes in it whether those were knocked out and left open, or rusted open, is not weatherproof or waterproof openings in the enclosures whether they were part of the box itself and not put with plugs back in them, or removed intentionally and not close, become visual signs that there is a potential safety issue. Looked for holes and openings that allow rodents and other water and other form materials to enter or accumulate in panels and other enclosures. A should not have openings that allow water, dirt rodents to get inside the enclosures. They should be solidly mounted to a physical structure for protection. Is this enclosure here sidedly -- solidly attest to a physical structure. No. It is not physically mounted to a structure to protect it, and there are openings allowing water dirt and debris insects and other conductive things inside their. You can see the cable connector isn't proper for the location. We have unprotected cables so again, this has all the makings of a hallmark of an unsafe condition should anything bad happen to the insulation or water get inside here. Proper connectors or termination should be used to protect the conductors from the sharp metal edges when they go in and out of the enclosure.

>> Irrigation machine circuit and system grounding is also important to grounding conductor or ground rod should exist at the disconnect for the pump and the irrigation machine. There should be some kind of copper ground wire running from the disconnect down to a ground rod at the earth. All irrigation machines whether permanently installed a portable systems should have a copper ground wire run from the control panel to an 8 foot ground rod installed in the soil. The primary purses -- purpose is lightning protection for the system. Issue run directly along this action and not raptor -- and not wrapped around the picture -- as picture -- pictured. We know the system is grounded from lightning protection here to give the lightning if it hit the metal irrigation system it easy path to get into the earth if we can see the wire.

>> If you suspect an electrical short our other problem due to a tingle, or other people have said he careful we have had a tingle or felt electricity, don't text -- touch the machine again. Contact the owner or manager and informed them of the incident and suggest they have a competent electrician to check the system for any problems. Document the date, time and location of both the shock and the communications to the owner or manager operator and keep it in your file on that particular system or owner. Those things become important. Yes we heard something, did some action about it.

>> The NEC electrical call article 120 establishes what an electrical safe work condition is. As you think about the inspection that you as a NRCS employee need to do on irrigation machines, this becomes important. The safest way to work on irrigation equipment is to deenergize that electrical equipment conductors are circa parts and walk -- lockout tag out those devices. Once I removed the power to the system, I have done my personal protective practice that gives me an idea that I am going to be safe. All electrical circuit conductors and circuit parts shall be considered energized until the source of energy is removed, at which time I can think about them being deenergize. Electrical conductors and circuit parks

that have been disconnected, but not under lockout/tag out tested, or ground it where appropriate, cannot be considered an electrically safe work condition and save work practices appropriate for the circuit voltage and energy level have to be used. Each employee under OSHA rules is responsible for identifying, documenting and implementing lockout/tag out procedures to safeguard the employes concept crunchers and others from unsafe exposure to a electrical hazards near the energized electrical conductors or parts likely to result in injury. Lockout/tag out requirements including temporary equipment and portable equipment. The first personal protective practice to create a safe condition is to turn the equipment off.

>> Lockout/tag out procedures become important. It's a PPP, required by OSHA and the rules explained in NFPA 70 E. It says always remove and disable the energy source or sources from equipment before inspection, repair or maintenance. The means of ensuring electrical and other energy is off and others cannot turn it back on accidentally is called lockout/tag out. It is the most basics safety work practice after visual inspection of area. Lock and tag are applied to the energy source so conduct tours are deenergize and equipment cannot come back on unexpectedly. In part 1 we talked about this automated irrigation equipment that can come back on unexpectedly. It automatically shuts off and it automatically comes back on. If I have locked out those disconnects, that equipment cannot come back on and give me an shock issue. The issue here why we use lockout/tag out is other people might notice that the system has been turned off and think they are being helpful turning it back on while you are inspecting, maintaining or repairing it. That is not on calming enema electrical accident. When he locker tag is not apply to the disconnect. Somebody shuts the system off that they do not lock or tag it out cut somebody comes behind them, they cannot see them, they think they are being helpful and turn the electricity back on when somebody else has their hand in a box and ink the power has been turned off. This applies to all sources of energy not just electricity in terms of protective work practices.

>> The idea here is I don't to shut the power off, I want to make sure with the protective device like a log that nobody can inadvertently turned the electricity back on during my inspection, maintenance or repair. Lockout/tag out features are given in -- it was down to procedure in your mind when you walk on someone's property that says analyze the equipment to determine where the energy system disconnect switches are that will remove all energy from the system. What are the devices that run and where are the disconnect switches in relation to each other. I am looking for the pump disconnect in the irrigation machine disconnect in the disconnects for any other ancillary equipment.

>> A qualified person shuts down the system turns the power off to remove the energy. I would argue that you as a NRCS employee I'm not a qualified person that should be shutting down the system, operating those disconnects that should be the owner, manager operator that is actually shutting down those disconnects, shutting down the energizing the system. To comply with lockout tag out rules, all people involved apply their own padlock to the controls or switch to indicate who is working on the system so it cannot be turned back on until everyone has finished their work. The idea is is is -- if everyone has their locking key, even if someone has removed their lock and laughed, the switch cannot be turned on until everybody on site has done their work and cleared all of the locks. Tax can be used in some instances under certain conditions in very complex operations or if a lockable disconnect is not provided. Because they are better than nothing. A tag doesn't prevent somebody from turning that switch back on like a log but a tag will at least alert somebody that somebody is turning on the system. It's better than nothing. In the graphic, you can see the application of both a lock in a tag. This worker

has locked this disconnect in the off position by applying a lockout device with their padlock on it, they have also applied to this lockout device a tag. That tag will give information about who applied it, the date, the time and what they are doing so that other people coming along understand what's going on. Only the person applying the lock or tag may remove it under normal conditions. That safety procedure is a part of what we call lockout tag out procedures after the visual inspections.

>> Lockout/tag out is commonly given in acronym of LOTO. It is the best way to ensure your safety. Your lock prevents others from reenergizing the system. You are the only one with the key combination to your lock or authorized to remove it unless certain conditions spelled out in a written policy have taken place. Your tag identifies you, the date you placed it, and what you are doing. People will have information when they walk up and see a machine that is not operating, the switch is in the off position, they get worried about their crops failing and want to get the system back running. Multiple locks and tags identify all the individuals involved in the work and operation of the system and ensures an organized, safe procedure.

>> Tags only can be used under OSHA rules is adding a lock mechanism creates a higher danger than simply using attack. I cannot think of a irrigation system reason that that would happen. It could happen in large refineries and industrial facilities where if I put a lock on the safety priced, that could be a concern in deadlock on the safety device might create more of a hazard then not locking it out. Allowances can be made within a written LOTO policy of the employee to allow for use of only a tag. It generally require specific written policies in a much higher level of safety training and safety meetings then if we use a lock. Everyone on site must understand the policies and rules and abide by them.

>> OSHA lockout/tag out principles can be divided into several work locations that my also apply to you as an employee inspecting an irrigation system. There are 3 different conditions where lockout/tag out rules vary. Individual control -- where no tag or lock are required on the disconnect all I have to do is shut the disconnect switch off to remove the power. I did not have to apply a lock or tag if the device, the disconnect switch is under my exclusive control, the individual performing the service and never left unattended. If I am the only one there I can always see the disconnect switch, and it is always within my arms reach to control it on site. I do not have to add a lock or tag to comply with OSHA's lockout/tag out rules. Typically, as employees you will not be the only individual on site. You will be accompanied thereby owner, operator or manager. If you are not the only one on site, that automatically voids that particular situation where you have individual control. Again, most times you are going to be looking for inspection at equipment that is not within reach of that main disconnect so that will not validate the rule. Most of the time simple LOTO approach, the straightforward set of conditions that may involve multiple people on the same site. There is generally one device to disconnect power for each piece of equipment. I will have a pump disconnect and irrigation machine disconnect, and any other ancillary service disconnects. I am going to disconnect for short time only one shift, typically less than eight hours etc., and I am not the only one on site in the switch is outside of my arms reach at any time I am on the site with other people. That will be the primary location or application of LOTO you are typically going to be involved with.

>> Complex LOTO involves multiple employees from multiple companies. Technically you might argue that the owner operator the irrigation system or manager car US the -- you as the in RCA spoke to meet the system, multiple machine, multiple energy sources, multiple shifts, and shift changes. Complex lockout tag out is really targeted toward large manufacturing facilities when a multiple ships -- shifts,

maintenance crews coming in doing shift work. If I was bringing down a power plant for six weeks of maintenance I would have 3 shifts today of electricians going in and out. They need to know who has what locked out all the time so that it is much more complex LOTO procedure. The simple LOTO rules are typically are what is going to be involved.

>> Complex rules require a written plan, requires multiple locks, methods to account for personnel when they are not on site cut when they leave to go home and they are not working, where they leave for parts or any other reason, and you are going to find AG produces have a written LOTO plan because of the exemption and that is always a challenge.

>> Always deenergize the equipment. Remove this source of energy that remove the concerns for electrical shocks, unplanned startups of equipment while people are inspecting are working, accidental or unexpected sudden starting of irrigation related equipment can be a major contributor to irrigation accidents. You must deenergize the equipment prior to physical inspection or working on equipment in order to do it safely to meet the OSHA guidelines. Lockout/tag out procedure should be followed. Remember, the manufacturers are required to put those warning labels on those devices that could start out unexpectedly if you don't turn the energy off to the system. Whether they are owners, operators or managers because you have probably in the past not seen many irrigators used lockout slot -- lockout/tag out procedures. This is one of the things you can explain to them, even if they don't use personal protective equipment while they are disconnect and the disconnect switch, you are going to use your lockout/tag out equipment and materials while you are on site getting close to the equipment.

>> A question for you to think about, which disconnects the pump are irrigation machine should be shut off while performing inspection, maintenance or repair on a irrigation system? You might be wet, you might be standing water, and you might have to touch the metallic parts of that system somewhere? The answer is, both the pump and irrigation machine disconnects should be shut off. And any other ancillary equipment booster pumps and things like that. The pump and irrigation machine in any other equipment may be electrically connected together through the metal piping, water in the pipes or puddles on the ground. Therefore, the irrigation pump and machine becomes a complex system because you have more than one energy source that could under certain conditions energize the system even though the other disconnect is in the off position because water and electricity do not mix well. Shutting both the pump and irrigation machine disconnects plus any other ancillary equipment ensures the entire system that interconnected is deenergize for safe work.

>> Once you have watched that system BD energized and all the different machine disconnects to make sure that in her connected systems have all been he energized, another good practice electrically, if you have to touch the metal equipment to read it cut to look at it, to find the ratings, verification is to -- back and the system. Make it a practice to always lightly brush the back of your hand against any metal components or any metal structure enclosure after they have been locked out or tag out before you ever think about grasping any metal equipment with the palm of your hand. In part 1 we talked about than that go threshold. If I grass things with the palm of my hand then there is a small amount of electricity still there. It could then essentially contract the muscles in my hand and frees me to whatever I have grass per grasping and energize metal structure will cause your hand to clamp around it. Notice in the graphic at the lower left, that would be an example of grabbing with the open palm. That is a big device, who was a smaller piper wire, if was electrified con that left-hand would grasp contract around it. If I back and the system like the slide on the right, once it's been deenergize to, if

there was a small voltage there giving me a tingle, it is not going to make my hand contract around it, I can pull a hand away when I feel that tingle. That is another one of those personal protective practices that becomes important even after you have gone through the idea of inspecting the insulation, looking for holes in the enclosures, making sure the equipment was installed correctly, the energizing all of the equipment disconnects, the backup to the backup to the backup. That is the orderly system that you are trying to put in place for your safety when you are on the site. Note the jewelry in the hand in the slide. That jewelry tends to be conductive as well and will concentrate on the person's extremities.

>> Another hazard we are concerned about and talked about it part 1 was entanglements. OSHA does not require driveshaft covers on center pivot irrigation machines %. The reason -- in this graphic I am showing a center of it would drive line covers over the power drive take off between the motors and the wheels, the reason that ocean says those are not required is the cause is a relatively slow rotation speed of the power driveline. The operator is supposed to disconnect the power prior to any maintenance or repair work on that system OSHA expects you to use lockout/tag out procedures before you or they operator essentially do anything around that location. Most manufacturers install them even though they don't have to to prevent crop Ravitch. If I put the telescoping cover on the driveline, it will limit the amount of crop that wraps around the connection when the crop gets higher. Never attempt to remove vegetation or other form materials from equipment that has not had LOTO applied even if you are trying to just be helpful. What is our safety concern then? The AG exemption to OSHA lockout/tag out. You will find producers that do not care about lockout tag out, and the essentially will not turn the power off. They will take baby equipment off or take you out there without turning the power off. What is the issue there in terms of telescoping covers, when you see machines without the covers, make sure you know you have followed your lockout tag out procedures before you get close to those towers.

>> Other PPP for electrical hazards, lightning. As a NRCS employee cut you may or may not be out there when the weather is bad. Obviously, if you are in the middle of a storm and you see lightning, do not be out in the feel. -- Field. The concern here with the metal irrigation systems is we take a quarter-mile system or longer of metal pipe, we mounted on electrically driven wheels, we connected to a water pumping system, connected deep into the ground and we have made probably the best effective lightning rod that we could make out of that irrigation system. Another one of those personal protective practices is to stay away from self repelled irrigation machines during storms. Just keep out , keep a distance because that is the challenge here. We have that huge lightning rod and it is not a question if this center pivot gets it but when. Large metal irrigation structures of all types make good half to ground soil and tend to be large lightning receptors due to their height in the fields. If you are in close proximity to those during the lightning strike, then lightning can shoot out the system through the ground in an on hazardous electrical condition.

>> Another PPP related to irrigation, although typically not to NRCS employees doing inspections But you never know what you get asked to do while you are out there is overhead power lines. Irrigation concerns with overhead power lines include, lifting aluminum irrigation pipe into overhead power lines. I grew up in south-central Nebraska and and irrigation area where I learned early on for the firm I work for, and irrigation pipe was 30 foot long and uninsulated electrical power lines were 22 feet tall where I grew up. Under the 30 foot aluminum pipe would touch a 22 foot overhead powerline easily if it was stood up on its hand to try to get dirt and debris in rodents out of there. If it fell over toward the powerline that was not a good situation. Standing on irrigation systems while performing maintenance

near overhead power lines is a problem, lifting overhead pipe over power lines is a problem, well drilling trucks and bones close to power lines are all electrical safety hazards we see and irrigation. Be aware of your surroundings and the locations of overhead power lines on the property you are working on or near.

>> We have a specific electrical hazard and that is spring water from irrigation system onto power lines. In the graphic you can see the end gun here on this irrigation system is on and you can see the stream of water that is spring out up onto the powerline in the Transformers on the pole. Do not touch any irrigation system while they are spring water our -- water on power lines. Alert the system owner and or the power company when you see something like this. Study -- studies have been done back in the 1970s that showed that that water stream can conduct electricity based on the distance, the stream size, and the amount of water coming out of that and gone particularly the water conductivity and the voltage. Those are all variables that affect the amount of current carried when it irrigation system sprays a powerline. Under certain conditions mentioned above the electricity from that powerline can travel through the water stream to the metal system of the irrigation system making its metal parts inherently dangerous. The more refined and closer, the less dispersed the water stream. The more conduct of the water in the shorter the distance here, the more of that electricity will flow through that strain to the system. That's another one of those concerns, that is a visual one, we do not have the measure anything. If you turn the power off we know the systems not running, and we know the stream isn't going to be conducting water from the power lines using LOTO.

>> Arc//we want to talk about to close the loop in terms of those electrical safety practices. We have talked about what electricity does throughout the course, we talked about shock and startle hazards, we talked about unexpected equipment startups. We talk about lockout/tag out procedures to ensure equipment is the energized for inspections, maintenance and repair. The final category that we need to think about how you are going to handle this protective practice when you step on a site is called art/or art -- arc blast concerns, where that arc or flash from a piece of equipment may not electrocute her shock us, at the heat cut the flash could blind us, deafen us or give us burns from the shrapnel in the heat. Prior to 19. Prior to 1980 most electrical safety people assume the major wrist of electricity was shock, electrocution. In 1982 in individual named Doctor Ralph Lee wrote an electrical paper called the other electrical Hazor electrical arc last burns. Going out looking at electrical injuries, Doctor Lee made the case to in many as 80% of electrical industries -- injuries resulted not from shocks but Arc Flashfrom. Even if there was no electrical shock to the person. Because of this realization in this raising the idea, the awareness of Arc Flash safety began to grow in the industry. In 1990 OSHA updated their electrical rules to recognize the need Arc Flashnot just for electrical shock protection but for protection. NFPA 70 E was revised to include the calculations necessary to establish protection boundaries including the PPP and the PPE necessary under certain conditions. In the last decade, NEC rules referred to Arc Flash reductions as well as PPP and PPE for various conditions. To lockout tag out, visual Arc Flashinspections you need to know safety guidelines, and rules and as we talked about, under certain conditions. The challenges if you look at the graphics you can see the burnt hands. You can see the flash, the arc between the person in the lower right-hand person in the electrical panel. This person was not wearing protective equipment, shrapnel, heat, light, all of those things get injured a person.

>> Why are people talking about it? It is relatively new in the grand scheme of things. I recognize 19 I recognize 1980, 1990 are not relatively new. As an electrical safety professional, if you argue that has

been quite a long time, it is finally being in force. That has what has gotten people's attention. Safety has existed on paper for quite some time. OSHA and others and employers are now in forcing it like never before because of the frequent code in standard changes. That's why you start hearing about things that people think might be new even though it has been around a while because they are finally being in force. OSHA -- compliance require it. Because of that disability, Arc Flash safety is a very hot topic. Article 110 of NFPA 70 E says multi employer relationships. Contractors, subcontractors others -- somebody not employed by the owner working on the site. I would argue that when you are out with one of the clients, working within irrigator, owner operator or manager, as the NRCS employee you have a relationship going on. Outside personnel on the employer side, whenever those outside servicing personnel are to be engage in activities covered by the scope and application the on-site employer and the outside employer shall inform each other of existing hazards, personal protective equipment, clothing requirements, safe work practice procedures, and emergency evacuation procedures applicable to the work being performed. That coordination shall include a meeting and documentation. That is the challenge with AG operator that is OSHA exam. They may not have heard of this before and that becomes a challenge for you is the NRCS employee how I might going to handle the people issue when I am working with irrigation operators there have no clue of what you are talking about with lockout tag out procedures, or Arc Flash safety. The owner operator must conduct a study to identify the type of Hazzard has a Gordy and necessary PPE for employees and others to perform their job safely.

>> Arc FlashThe analyst terms the amount of worst-case energy available shouldn't arc flash occur. The study information is used to determine values that need to be on the label. The boundary distances for employees the energized and energize and the type of PPE that is required to work within that boundary NFPA 78 requires that the following types of electrical equipment in locations other than homes be marked with an arc flash label. Most irrigations will be 240 V or both -- faults or above. Switch and disconnect panels, the pump and irrigation missing in other ancillary equipment. Control panels for pumps and irrigations machines. General and closures, motor control centers for pump and irrigation machines , in addition, some employers are labeling electrical equipment that are not included in the above list, but may require that live work be done with the center -- system energize. The employer does a study. From that study we figure out what the arc flash danger is for that equipment. From that we figure out the arc flash label cut the boundaries in the type of PPE required. Going to the graphic, NFPA 70 E defiance has at risk for clothing requirements. This clothing category are zero through 4. The higher the number, the more electrical protection you need. Once you get to Hazzard category 1, you have to have flame resistant clothing. There are designations for how much heat that flame resistant closing can have an ultimately when you get to the highest category risk 4, you end up with suits with rubber boots, rubber gloves, looking like an alien to go in there and work on the equipment.

>> That is the idea of arc/safety. Know what the safety is. Labeled the equipment so people know what they need before they have to work on the equipment so they can maintain their safety.

>> NFPA 70 E talks about using labels and signs for electrical safety. They are required by OSHA in general to warn about the hazards. NFPA 70 E requires the use of labels to warn about arc flash hazards. They can also but don't have to provide other safety procedures. They remind you about permits, written requirements, LOTO procedures, maintenance information and communicate other information where it is needed. In my example, arc flash warning label, it gives me the warming that there is electrical hazard. It says arc flash and shock hazard appropriate PPE required. It tells me that

the flash has her boundary is hundred and 80 inches. If you are NRCS employee and see that label you know you should not be closer then hundred 80 inches from that enclosure or that piece of equipment while it is still energize to do inspection work. The second item it gives their is a energy amount that your flame resistant clothing needs to have or higher if you want to get closer than 18 inches to that equipment. In this case 37.4 in terms of the heat rating.

>> The next one is the shock hazard when covers our removes the tells us what the voltage is that that equipment operates and what we can be exposed to if the equipment was energized. A gives us the rating class if we are going to work on it with rubber gloves which shouldn't be an issue for you. The limited approach distance of 42 inches. In the restricted and prohibited approach differences -- distances with the equipment energized by qualified people. Notice we have used some new terminology there. Approach boundaries car restricted approach and prohibited approach. Those are things we figure out based on both just type of equipment that tell us how close we can get to the equipment. Our/label is required by OSHA -- the labels have to be located here. The NEC requires that labels be located so they are clearly visible to personnel before beginning maintenance or inspection. Workers must be able to see and read the label before they are exposed to an arc flash hazard. This includes workers who might not be involved in working on the equipment but just passing through the area or they are to observe which might include you as a NRCS employee. Labels must be large enough to be legible at distances up to several yards depending on the severity of the hazard. The label should be in a rattle Billy visible location on the outside of the enclosure where you do not have to touch anything metal to read it to determine what the arc flash hazard is expect the question I want you to think about in your mind -- do labels ensure safety? Of course not labels do not, they simply help and warn us so we can think about compliance with PPE and PPP that help better ensure safety.

>> Just because something is labeled does it mean it is going to be safe it is giving us information about the safety practices we need to employ around that equipment. The source of electrical power affects the hazard level and equipment must be assessed in the situation it will be used. NFPA 70 E requires that one of the following must be included on the label. Be available incident in -- available energy and corresponding working distance. The highest hazardous a risk category, the minimum arc rating of required coding I will be a number, or the minimum required level of PPE in terms of flame resistance or hazard location. One of those is required. Why don't manufacturers put arc flash labels on equipment you see on irrigation machine? Why don't they irrigation equipment manufacturer simply place those on at the factory, arc flash labels must provide information specific to the electrical equipment, installation and environment. In engaged -- the irrigation manufactures doesn't know all of those the parables when that equipment leaves the factory are typically, these labels must be printed after the equipment is installed based on site-specific information for the actual electrical system the equipment is installed for. NFPA 70 letter he required labels can be very generic. Many safety consultants and training companies have libraries have arc flash labels. A producer could used to satisfy the conditions. There is our challenge when we think about and NRCS employee going out to an irrigation site. There is the ocean AG exemption, there's this idea I own, operate and maintain manage my own system, I do not have to lockout tag out, I probably have not done in arc/safety study so have not put safety labels on my enclosures. We have all the necessary ingredients for you to not have all of the safety procedures we would like to have in place with the backup, to the backup to the backup.

Understanding Irrigation Electrical Safety for NRCS Employees: Part 2 - How to be Safe in the Field
On-demand Captions (unedited)

>> I hear when I am teaching classes, you are talking about working on energized equipment where the art/-- arc flash that we have lockout tag out that we work on the equipment on energized. Think about that do you think because you only dude the energize work, inspection maintenance repair no arc/consideration is necessary? The process of the energizing the energy to the pump or irrigation system or other ancillary equipment by the owner operator or manager, is by definition energized work to operate the disconnect to get the power off. When someone goes through and performs lockout/tag out procedures, they are required at least by OSHA and NFPA 70 rules to adhere to arc/safety. For that short window of time when the equipment is being the energized, before it is locked out and tagged out, arc/protection ideas must be insured.

>> The arc flash mitigation goal is to reduce the energy in the appropriate PPE to a level that permits normal task to be performed on the equipment safely. I can do that I reducing the arc/energy levels by turning off the power or having somebody who is qualified and has the equal -- correct equipment or obligation to turn the power off safely do that. Locate yourself or other workers so you are not subject to harm. While that owner operator or manager is disconnecting the power and locking and tagging it out, how would I perform my own arc/safety, I stay far enough away from the equipment that I meet the boundaries. I do not get close to that equipment and go inside my approach boundary until I am sure the owner manager operator has locked out and tagged out the equipment. Those are things we can think about in terms of, there's this OSHA exemption, I may not see labels on the equipment, how do I instill in myself and maintain arc/safety within the rule, it's up to me to make sure I do not get close to that equipment until it is deenergized.

>> The idea of qualified and unqualified employees become important when you start reading the rules. Qualified and unqualified is defined as workers who know the equipment, understand how the equipment operates, know the hazards, understands the hazards and what PP P and PPE they need to be safe. Different types of people are defined differently. That highlights the major differences it's knowing the hazards, recognizing the hazards and knowing what to do about them. A qualified person must not only have the necessary work skills they have to be trained and have the ability to recognize and respond appropriately to any hazards presence from -- present from the equipment. You are not qualified to be operating machine disconnect the end -- the interaction them without PPP and PPE or born further to work on my parts or work within restricted report -- parts.

>> You have to understand we would juju is a unqualified employee -- we will consider you as it unqualified employee. Is someone is assisting a qualified worker, the assistant is outside the boundary, must be using arc/personal equipment. If the assistant is outside the arc/boundary, no protection is required by you the NRCS employee doing the assistance. Is the assistance is outside the restricted approach boundary then shock protection is not required by NFPA 70 E either. It is still a good work practice for the system to use appropriate PPE. You might have to hand something to the worker within the arc/boundary and that could be a shock hazard. You are dealing with people where they not have a formalized safety program, they may be exempt from the ocean AG system, they may not want to do lockout/tag out and they do not use PPE while they are deenergizing the disconnect so you can work on them to inspect them, work on them safely.

>> Approach boundaries are employed. The rules talk about 3 boundaries. Limited approach boundary, which is the shock protection boundary to be cross but only qualified employees at a distant -- distance from a live part. Which is not to be cross by unqualified persons unless escorted by a qualified person.

Here the owner or managers can take you up to the boundary but you as the employee can go past. Restricted approach boundary. A shock protection boundary to be cross only by qualified persons which due to its proximity to hazards required the use of shock protection techniques and equipment when cross. You should not be going within the restricted approach boundary even if the owner, manager operator does unless you have the appropriate safety equipment and practices. The prohibited approach boundary cross only by qualified persons essentially that require life parts. Is appropriate on irrigation system on the things you will be doing.

>> There is a table that talks about these boundaries. Notice across the top of the table. The/protection boundary, the Limited approach boundary, restricted approach boundary, and pretended it -- prohibited approach boundary. You have the voltage level. Those of you doing irrigation work with NRCS are probably going to fall within the two categories where the arrows are pointing to the voltage categories. The first one being 300 V or less. As long as the irrigation equipment that you are working on or near operates a 200. As long as the irrigation equipment that you are working on or near operates a 240 V, 300 V or less, that/protection boundary is 3 feet. The Limited approach boundary for expose conductors that are energized is 10 feet. If they enclosures are open and you can see energized conductors, you know the equipment is not turned off, you do not want to get closer than 10 feet. That assures your electrical safety. For an expose fix circuit part that Limited approach boundary is three-foot 6 inches. If everything looks fine cut the conductors are not cables or cords running over the ground, they are detected in conduit, then you can get within three-foot six-foot -- three-foot 6 inches of an equipment that operates at 240 V or last -- less even if his energized.

>> If I look at the next arrow, that is the category for over 300 V but not over 750 V which is where your 400 which is where your 480 V operating equipment fall. Notice the numbers there are the same numbers for the/protection, the limited approach boundary for both expose movable parts, and expose fix parts. Notice those restricted boundaries where you should probably not be going with at all, one foot then for over the 300 V. If it is not over 300 V, the 240 V equipment, it says avoid contact if it is over the 240 V you shouldn't get within 1 foot. Those are the things to think about. This is about how close you can be under certain visual conditions when you see certain types of equipment and certain voltages. That should give you your boundaries for different types of equipment you think about that will keep you safe and keep you within the OSHA and NFPA 70 E/arc boundaries. A lot of companies use the rule of thumb for that arc/protection boundary as long as you are below 600 volt systems. Stay at least 4 feet away from energized parts. In the previous table at the lowest level that was three-foot 6 inches. If I may safety professional I like marginal safety, 4 feet is an easy thing for employees to remember. So in practice you will hear a lot of safety policies. Just say 4 foot. That is more conservative actual calculations and safer and applies in all conditions. There's a good rule of thumb about how close you want to get to any energized irrigation equipment metal, 44 if it is energized. Wait until it is disconnected to get closer than that.

>> If you are working within and above 600 boat called medium voltage systems, those tables become important then to figure out that larger increased distance that you should be to that metal equipment before they deenergize it.

>> There are some other personal protective equipment that we want to talk about that you might consider as it NRCS employee. PPE Personal protective equipment protect us from electrical hazards. Proper foot protection on site becomes important. Not tennis shoes. Why not tennis shoes? Many

tennis shoes on the market today the souls are made from ground up steal tilted radial tires recycled and are conductive to some degree when they are worn and wet. Not all tennis shoes meet that requirement, but some do. You can buy electrical hazard rated insulated work boots that have shock protection ratings but those are not mandatory either. Typical weather boots or rubber boots are adequate. You might consider a hard hat that is insulated and not conductive. You are not a qualified employee that has to think about rubber insulating gloves, hoods, sleeves, like it's working on live equipment because you should not be doing those types of things. Clothing and personal protective equipment. Before leaving for a site consider the clothing and personal protective equipment needed. Primarily, the questions I would ask you, what is the weather like, what is the forecast today by the time you get to the site? There are probably bigger concerns about your clothing then electrical protection related to heat or cold. If it is hot , bring drinking water. Don't rely on drinking water from irrigation system -- systems. Typically, good cotton clothing is going to be the best clothing when you are out that will give you sufficient electrical protection. Cloth clothing -- cotton clothing is better than polyester clothing because polyester will melt from heat and cloth has a higher melting point.

>> Footwear, boots rubber or leather when appropriate to the environment you are headed for. Had protection a class I hardhat. Hearing protection, possibly earplugs or your mouse around fossil fuel systems. I protection -- if you have glasses are they ANSI C -- C rating. They will hold up if you are within the approach boundaries of the arc/--/.

>> Another important thing is eliminate problem clothing and jewelry accessories. Conductive articles of clothing cut jewelry things like that, watch bands, bracelets, rings, keychains, nettle -- necklaces, cloth with conductive thread, metal headgear, metal frame glasses should not be worn or present around an electrical contact hazard with exposed live parts. Eliminate and secure jewelry. Metal jury is electric holy conductive and tends to concentrate and electrical burn at the side of the metal. Longhair loose clothing. Tie that back with scarves. Longhair loose clothing can easily become caught in rotating parts in the hazard. Most HD owners and operators typically don't where had protection when working on or near irrigation of our machines. Falling objects are rarely ever encounter -- encountered however bumping your head on irrigation structures can be painful if you are concerned about basic had protection from physical and electrical contacts, a class I had protective the right -- protective device is adequate for working around low-voltage 600 volt equipment.

>> Foot protection. We talked about AG operations typically involve rough, uneven ground and partly muddy conditions. Comfortable foot wear appropriate for wet, muddy conditions in uneven terrain is required. Leather is nonconductive when dry. When wet, soaking wet, it can be conducted because of the water. We talked about tennis shoes. If I could stay dry, I leather boots. If I know I am going to get wet, rubber boots would be a better options to give us that back up to the backup to the backup that we have been talking about.

>> Those of the various topics that eyes electrical professional want you to remember in the back of your mind when you think about what it takes for you to be safe when you go out as it NRCS employee to irrigation system to do inspection of those systems. Safety communication is important. We get last on that. Safety can be a very complex issue with lots of competing interests. Sometimes the most important safety message gets lost in a large volume of information you are given by the owner, manager or operator at the site. This is important to put it all in context by looking at the graphic. Notice there is a lot of good factual safety information on that sign. It has a big caution to give us an

alert, it says this time -- the sign has sharp edges, it tells us how to be safe. In addition, was probably the most important information safety wise in the sign is the bridge is out ahead. It got lost in the other safety messages keeping you safe the closer you got to that sign, so you do not get caught -- cut. Some of the important things can get lost in all the details.

>> That brings us to the end of part 2 of our electric safety around irrigation system -- systems. These are the two thanks -- links. And NRCS irrigation safety PowerPoint that mirrors much of the information you received in this slide set. My contact information and email are there. I am always interested in hearing questions, concerns. My email is there. I will answer those. The NRCS folks are going to link a FAQ to these presentations at this point, I will quit talking and Jerry I'll turn it over to you.

>> Thank you, Greg. I had a couple. I notice of one of the warnings sticker -- stickers, enlisted that you had a arc flash hazard hundred and 80 inches that is 15 feet. For me it would take the very last slide of your presentation that sign about the sharp edges for me to be able to see I had to stay away 15 feet. I would not be able to read some of those stickers. I had an observation that some of those warning sign or stickers might need to be bigger if we are going to be aware of what they say. If I understood the details in the presentation 2 what it is talking about what NRCS is going to be doing and if we are just out there kicking around, as a result, I think we will recognize we should not touch some of this stuff if there is no reason for us to be around it. Correct me if I am wrong, it would appear if you can check the equipment out and get the visual information you need in state out of the 4 foot boundary for archive/-- arc flash with the producer there than we should be in good shape.

>> If we need to touch the equipment then we need to requests a qualified person, the land owner or operator to shut the energy off and use lockout/tag out procedures if we have to touch the equipment. One question I had cut one of the things that our focus will be involved in is checking a replacement sprinkler nozzle that have polyethylene tubing for the sprinkler at the bottom. Does that require the lockout tag out if you are or where you are staying away from the towers, the tower motors and are just looking at the nozzles at the end?

>> That is a interesting good question, Jerry. I would say based on my interpretation, as long as you can stay for feet away from the tower to inspect those nozzles that you are in good shape. The problem would be the violation of the OSHA rules cut without that machine lockout tag out you went to inspect the nozzle that which you closer the 4 foot away to that motor on those towers. That would be my answer. As long as you are more than 4 foot away, that machine doesn't have enough to arc to you. You are within the OSHA safe condition.

>> I know some of those nozzles are close to the towers could be within the 4 foot.

>> Depending on how many drops, you can have some that were oral and were not -- or were not expect I have worked at a number of sites with someone was electrocuted. A number of those resulted after a lightning strike. That was the result of the investigation. I have heard rumors early in my career from people who told me they had gotten a tingle just walking in a wet feel close to a center field that had been struck I lightning or had damage to the wires going to the pivot. I wondered if that was a true story? Back --

>> That could actually happen. We see that occasionally in lightning storms that get into underground wiring to center pivots or two pumps. That is probably the place we see that and have the exposure. It

is a very real issue. What happens is the lightning damages the insulation on the underground cable and we get a voltage away from the short-circuit of that underground cable. Details off fairly rapidly. If I have wet shoes, barefoot or conductive things on my feet like worn tennis shoes, I can feel a tingle when I step far enough to be exposed to a different voltage when I am taking steps. If you shuffle your feet in baby step -- steps cut typically you do not get shot there -- shocked their. You do not want to job and take long strides, the small baby steps prevent the higher voltages from accessing you as a circuit and help you get to the edge by not taking the bigger shock.

>> Thanks Greg. We are short of time and I surely appreciate you put on this training for us. I really appreciate that and I look forward to some follow-up conversations on the field evaluation sites..

>> Thank you, Greg for making a wonderful presentation today. Think you Jerry for coordinating the training sessions in making them available to our participants. Thanks to all our participants to join the webinar and I webinars in general. If you selected to earn CEU return to your browser wonder -- window this concludes our webinar presentation.