USDA FOREST SERVICE – SOUTHERN REGION

National Forests in Virginia

James River Ranger District

HIGH VOLTAGE ELECTRICAL INJURY

Facilitated Learning Analysis

Back Creek Fire

May 15, 2015

Burned cross beam at the top of power pole

Contents

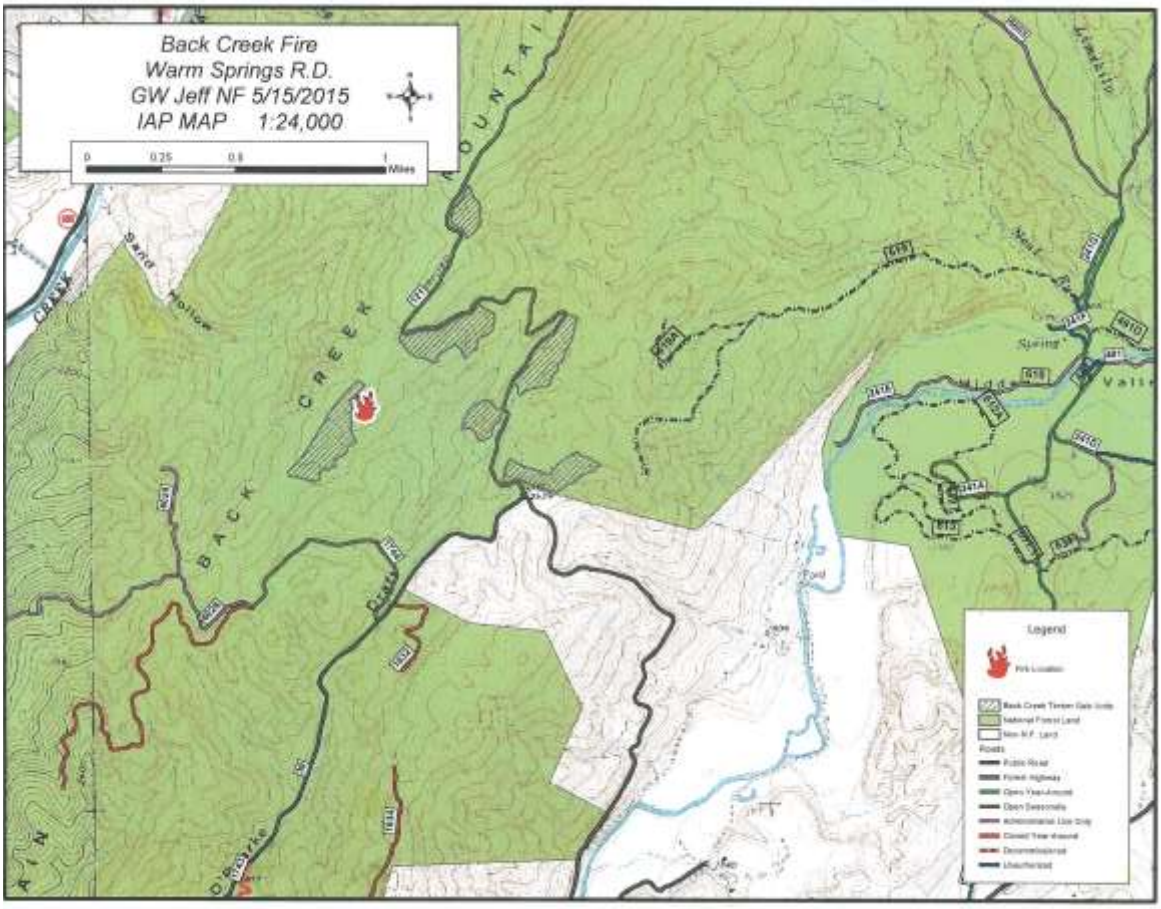
Executive Summary

On May 15, 2015 a firefighter received electrical injuries during mop-up operations while walking near a sagging and energized power line. His injuries were severe and life threatening, and included electrical burns of the shoulder, arm and both feet. Electricity arced through his body entering through his shoulder and exiting through both feet to the ground. The firefighter was treated on site by a fire line EMT. He was extracted from the fire on a backboard, transported to a community hospital by ambulance, and later life-flighted to a level one trauma and burn center.

A Facilitated Learning Analysis team was convened with a letter of delegation from the Forest Supervisor and assistance and support from the Regional Fire Risk Management Officer. The FLA team consisted of subject matter experts in fire line operations, safety, and Job Corps. They were asked to focus on "how PPE is viewed and used", the "post incident medical response", and "Risk Management Protocol".

Methods

FLA Team members conducted site visits and over 20 interviews. They gathered and analyzed photos, maps, dispatch logs, and incident documentation. Team members fact checked portions of the Narrative and Lessons Learned sections with key interviewees to clarify details. The Team also facilitated two dialog sessions to generate deeper learning from these events.



Narrative

Part 1 - Story - May 15th – Dead Bears, Electrical Burns, And Medical Treatment

> ***"Skin was coming off his arm in layers; feet appeared to have blown out, silver dollar size holes. The squad boss had carried him on his back to the dozer line from the power line."***

On the afternoon of May 15th, the 12-member Lonesome Pine Fire Crew was completing mop-up of the perimeter of a 14-acre fire in the George Washington-Jefferson National Forest. Three firefighters walked uphill, towards the interior of the fire to look at a dead bear that had been spotted earlier by a saw team. As they approached the bear, one firefighter knelt on the ground to take a photo while a second firefighter walked around the kneeling firefighter placing him within approximately 5 feet of a power line that was sagging and only 3-4 feet above the ground. An electrical flash or arc passed between the power line and the standing firefighter causing him to drop to the ground in pain. Immediately after the shock he experienced disorientation, felt his muscles tense tightly and felt like he stopped breathing. Then he heard one of the other firefighters telling him, "Don't stand up, stay on the ground and crawl backwards, away from the power line". The other firefighters also called for the Squad Boss who came running up the hill.

After checking on the consciousness level of the firefighter, they attempted to walk down the hill to meet the fire line EMT. After one step, the injured firefighter complained of extreme pain in his feet. His boots and socks were removed and deep burns in both feet were observed. The squad boss then picked up the injured firefighter and carried him down the hill to the dozer line where they met the fire line EMT. The EMT did a complete evaluation and took charge of the incident within an incident, directing personnel in how to assist with transporting the patient.

Left shoulder of the nomex shirt and entry point of electric arc

> ***Throughout this report the term District Dispatcher is used to indicate a person who works as a back-up dispatcher and/or radio relay person in the District Office. They are an important resource in emergency situations. Although most are not fully qualified as Initial Attack Dispatchers (IADP), they provide a key function relaying information to Central Dispatch when radio communication is compromised.***

While this was happening, crew overhead made contact with the District Dispatcher (communication with Central Dispatch was scratchy and intermittent that day), and an emergency call was made to 911 to send an ambulance to transport the firefighter to a hospital. The EMT had brought a backboard, spider straps, and a trauma bag to the fire line that day. The injured firefighter had his wounds dressed and was packaged on the backboard and transported to a vehicle to rendezvous with the

ambulance. Immediately following the injury, Central Dispatch called Dominion Power and was told that the power line in question was not one of theirs. Central Dispatch then called BARC Power Cooperative, the representative said they were not sure which company the power line belonged to, but dispatched a crew that arrived within 45 minutes and quickly repaired the power line.

While enroute to the local hospital (20 minutes transport time from fire to hospital) the FFMO, Dispatch Coordinator and EMT discussed the Forest Service standard protocol that all burn injuries must be treated at a burn center and also that all injured firefighters must have a "family liaison" assigned to them while in the hospital. The burn center protocol was communicated to the emergency room physician at the community hospital who then arranged for a life flight ambulance to transport the patient to a level 1 trauma and burn medical center in Richmond, VA. The patient was evaluated and stabilized and subsequently underwent several surgeries and skin grafts over the next two weeks. While the injured firefighter was being transported from the fire to the hospital, fire staff and Dispatch personnel identified a person to serve as family liaison and sent that individual, along with a Squad Boss from the Lonesome Pine Crew to be with the injured firefighter. Over the course of the next two weeks, USFS employees volunteered to serve as family liaison for the injured firefighter to ensure that he received outstanding medical treatment and had someone in the hospital advocating on his behalf.

Part 2 - The Rest of the Story – May 14th – The Day Leading up to the Accident

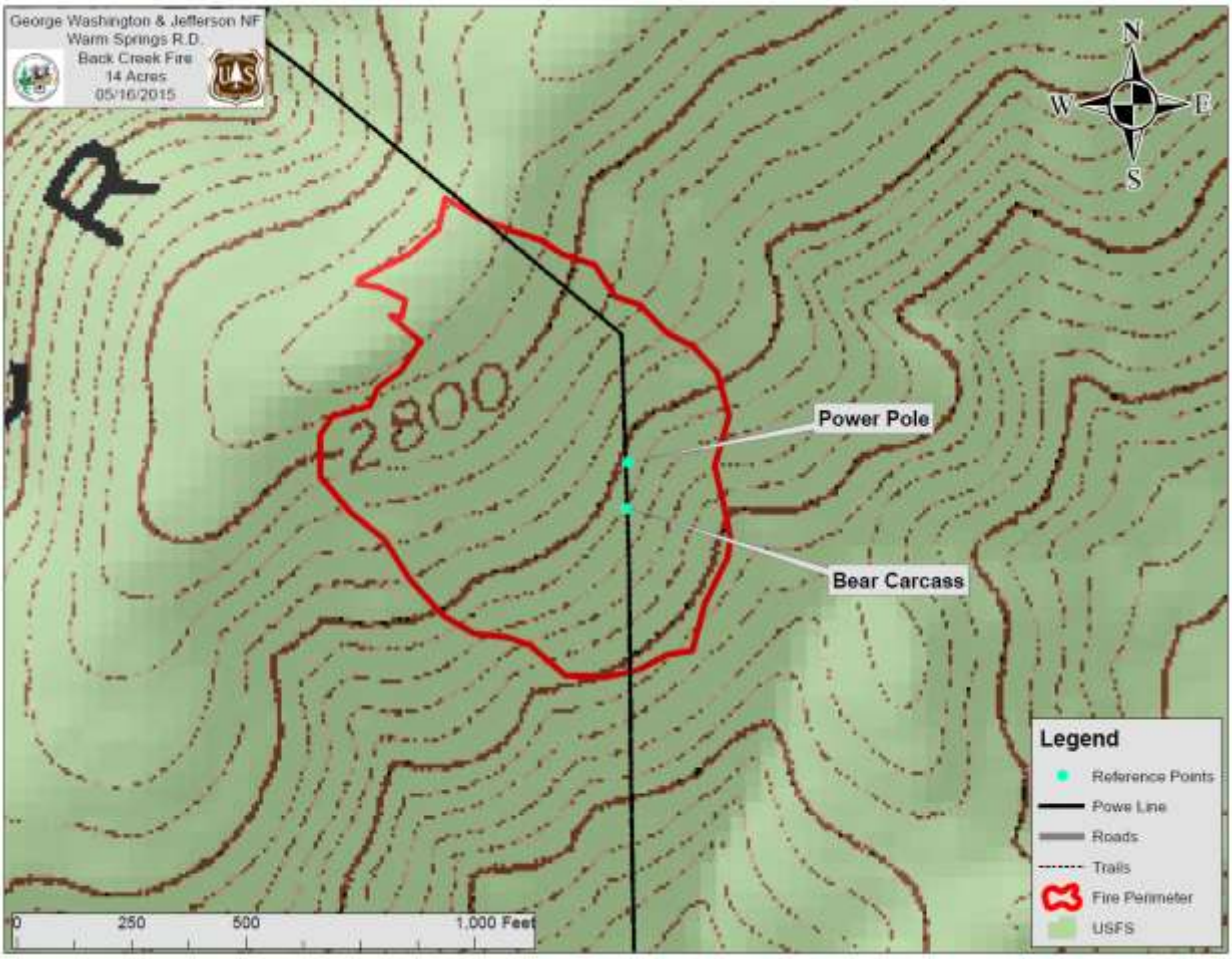
Thunderstorms had passed over the Central Fire Zone area on May 11th and several fires were spotted and staffed on May 14th. Later that day (May 14th), a recon flight spotted an additional smoke that was eventually named the Back Creek Fire and was described as "4-5 acres near a power line." An IC returning to station from one of the other fires heard the radio transmission about the new start and offered to check it out. The IC arrived on scene, walked the fire and provided Central Dispatch with a very complete size-up using the Initial Attack Organizer. He then tied in with the Zone FMO who had also arrived on scene to discuss the fire and plan of attack. The fire was described as 4-5 acres and backing down slope. The IC called for a dozer to line the fire and thought they could have it lined that afternoon.

The IC and the Zone FMO discussed the potential cause of the fire over the radio and the IC reported the power line as the suspected cause. The ZFMO asked if the line was broken and on the ground and the IC responded no. At this point both individuals discussed the need to call the power company and have the power turned off and the pole/cross beam repaired. The ZFMO called the Agency Administrator and briefed him on the events to that point. They (AA and ZFMO) discussed ownership of the power line and decided it was most likely Dominion.

Radio communications were spotty that day with resources on the fire having difficulty communicating directly with Central Dispatch. The IC communicated to a District Dispatcher that the cause of the fire was suspected to be the power line and at that point the AA said he would contact the power company. This information was then relayed from the District Dispatcher to Central Dispatch. At this time, only the IC had actually seen the sagging power line. Although the IC knew the power line to be 3-4 feet above the ground, the ZFMO had pictured in his mind that the "sagging power line" was still suspended 20-25 feet above the ground. At this time, no one had

"Radio communication was compromised that day on all three fires."

seen a dead bear near the power line (vegetation on the ground was blackened by the fire as was the dead bear). A US Forest Service and a Virginia Department of Forestry dozer with 5 Virginia Department of Forestry firefighters arrived at the fire and completed line construction and firing operations by the end of the shift. All resources were released for the evening. The fire was lined at approximately 14 acres.



Friday May 15th

The next day a briefing was held at the District Work Center for all three fires on the District. During the briefing, the Zone FMO and the Zone AFMO both discussed power line safety and the need to stay away from power lines. The Incident Action Plan did not discuss power line safety or the need to stay away from power lines in the fire. There had been a discussion with the Agency Administrator concerning risk management and power lines. The power line was identified as a hazard with a high potential consequence. The mitigation decided upon by the IC and the AA was avoidance. The plan for the day was to mop up 20-30 feet in from the perimeter. The sagging power line was in the interior of the fire, a distance of 180-200 feet from the fire perimeter. There should be no reason for firefighters to come in contact with the sagging power line. Attendees at this first briefing included the Back Creek Fire IC and the Crew Boss and two

"It's a grave yard out there, 4 different bear skulls, deer skeletons, dead buzzards decomposing."

Squad Bosses (FFT1's) from the Lonesome Pine Fire Crew.

The Lonesome Pine Fire Crew was assigned to the Back Creek Fire along with two sawyers and a line EMT for mop up operations. When they arrived at the Back Creek Fire the IC and Lonesome Pine CRWB held another briefing to talk about safety, the medical plan, and the plan for the day. The IC covered power line safety but did not emphasize it because the power line was located well interior of the mop up operation. The CRWB does not remember discussing power line safety during his tailgate safety session. Crew members remember hearing "don't work around downed power lines."

The crew split into two squads, starting at the head of the fire, worked in opposite directions until they reached the heel of the fire, mopping up 20-30 feet in from the perimeter. It had rained recently and the ground was wet and this made "dry mopping" easier even though they were working with heavy fuels along the perimeter.

One of the squad bosses described his attitude of always accomplishing more work than requested on fires. He tells his firefighters that hard work and high quality performance will impress the overhead and lead to future fire assignments. Because of this work ethic, the squads mopped up more than 30 feet into the fire.

Bones and remains of dead animals in the area of the sagging power line

Black bear under the sagging power lines

Around 1300, one of the saw crews came across a number of bones that appeared to be from various animals including bears, deer, and vultures. The saw crew then noticed a freshly killed adult bear lying on a log within 3-5 feet of the sagging power line. The sawyer relayed this information to other personnel on the fire and crew members became interested in the "dead bear" in the center of the fire. This was the first time that the dead bear, and the large number of bones and animal carcasses became known to personnel on the fire. Although some overhead and crew members speculated that the sagging power line might have caused the animals deaths, this was not communicated to all crew members. Most personnel still did not know the power line was 3-4 feet above the ground. Some firefighters requested permission to go see the dead bear and were at first told no. Later in the day around 1700 a firefighter requested permission to go see the dead bear and was told to go ahead but come back quickly. Three firefighters traveled uphill to see the dead bear where one of the firefighters was struck by an electrical arc or flash causing severe electrical injuries.

"When we found that bear, the whole thing changed. If we had not found that bear, students would have never come over there."

Sagging power lines in the center of Back Creek Fire

Participant Lessons Learned – What Went Right

The Forest recognizes that employees work in remote areas far from medical emergency services and encourages USFS employees to become trained and certified in emergency medical treatment. The injured firefighter on the Back Creek Fire received expert medical care in the field along with quick and efficient extrication and transport to a hospital thanks in part to a USFS employee assigned to the fire who is a qualified line EMT.

The Forest had recently practiced extrication of an injured patient including packaging of injured patient, use of a backboard with spider straps, carrying over uneven ground and coordinating with helicopter life flight crew for transport to a hospital.

As a part of basic fire school (S-130, S-190) the Forest had recently trained all new firefighters at the Flatwoods Job Corps CCC in the safe extrication, packaging and backboard transport of an injured patient over steep rough terrain.

First year firefighters who witnessed the electrocution of their fellow firefighter, kept calm, thought clearly and acted decisively when instructing the injured fire fighter to "remain on the ground and crawl backwards away from the power line." This very quick thinking likely helped save the firefighter's life and possibly saved others from being injured if they just rushed in to help.

USFS personnel including the FFMO, Dispatchers, and the line EMT all concluded that this was a serious burn injury and the patient needed to be transported to a hospital with expert burn and trauma care credentials. The burn injury in this incident was caused by high voltage electricity (46,000 volts), not your typical wildland fire burn injury. There were conflicting reports about the extent and severity of the firefighter's injuries (life threatening Vs. non-life threatening). The takeaway is that all high voltage electrical injuries are life threatening.

A family liaison was identified immediately and USFS personnel volunteered to serve in this capacity over the two weeks following this injury. This was critical to the patient's recovery and to ensure proper medical treatment in the hospital as well as an appropriate release date with adequate home care needs identified and covered.

Forest personnel commit time and energy to provide training above and beyond the requirements for the Lonesome Pine Fire Crew at Flatwoods Job Corps CCC.

A strong culture of safety and a positive attitude toward the use of Personal Protective Equipment (PPE) was exhibited by Forest personnel. This was especially true of Job Corps students who likened the use of firefighting PPE to the requirements they practice daily in their vocational training at Job Corps. To the students, PPE is just part of being safe on the job and accepted as normal.

Participant Lessons Learned – Areas for improvement

Through interactions with employees from the organizations involved in this accident The FLA team has identified a few areas below to discuss further. The intentions of sharing these comments below is to aide local leaders on this unit – but more importantly, share these comments to the great Forest Service and Job Corps communities of leaders for opportunities to learn. Many of the conditions found on this

event are not unique to this area but are conditions often found on any unit within the agencies.

Ensure safety concerns and risk management protocol are understood and effectively communicated to all fire fighters through the chain of command. Although it was clear to some overhead personnel that there was a hazardous and fully energized power line, sagging 3-4 feet above the ground in the interior of the fire, and that the mitigation of this hazard was avoidance; this was not effectively communicated to all crew overhead and not to individual firefighters.

Ensure all hazards are identified and mitigations are understood and implemented to provide for safety. Crew overhead and crew members remember hearing about staying away from a "down power line" during some of the briefings. Notification of down power lines in the fire arena should always compel a sense of urgency, stimulate additional questions to clarify the danger, and lead to the strict adherence to any mitigation measures put into practice. "Where is it located? Is it energized? Is it broken or sagging? How high off the ground? Is the area flagged?" Are some of the questions that should be asked.

Radio communication coverage needs improvement. Poor radio communication was a concern of every firefighter we interviewed. There were times when Central Dispatch could not hear any radio traffic. It is difficult for Duty Officers to maintain situational awareness of several ongoing fires, and prioritize resources when they cannot hear radio traffic for any of those fires. When firefighters resort to back up communications including district dispatch and in some cases cell phones, information is less widely shared and safety is compromised. On this incident, information about contacting the power company to turn off the power was relayed from the fire to the District to the Central Dispatch. Clarity in the communication was lost and the message was not correctly understood by all resulting in a delay before the power was turned off and the power line fixed.

Improve firefighter understanding of power line safety to include sagging power lines. Firefighters are taught to treat all power lines as being energized and dangerous. When a power line is broken and touching the ground or a tree, it may give off warning signals that include noise, sparks, flames, and movement. However when it is suspended 3-4 feet above the ground, it gives no warning but presents an even more dangerous situation. Particles in the atmosphere in the fire environment can become ionized creating a potential electrical pathway to the ground and this may increase the potential to arc through any human or animal that comes within 5-10 feet of that line (see appendix on power line safety). Perhaps because this is not widely understood or recognized, the exact nature of this sagging power line was not communicated and understood by all on the Back Creek Fire. Some individuals assumed that sagging power line was still suspended some 20-25 feet above the ground. Lessons learned included asking more clarifying questions, taking a walk to see the hazard first hand, and including the science and danger of sagging power lines in firefighter training.

How many people have encountered an energized power line that is sagging 3-4 feet above the ground?

Create an SOP for responding to reports of damaged power lines. This would identify the responsibility to advise all personnel of the danger, the responsibility to contact the power company, the responsibility to follow up to ensure power is off and/or power line is fixed, and the responsibility to

communicate to all firefighters when the hazard has been corrected.

Recognize the need to re-evaluate risk management and mitigation when the situation changes. In this case the changed situation was a human factor. Until 1300 on May 15th no one knew there were "bones everywhere" including the carcass of a freshly killed black bear. Once this was communicated by word of mouth from the saw team, it created a strong desire on the part of some firefighters to see the bear and the other animal bones and carcasses. The mitigation measure of avoidance and only mopping up 20-30 feet from the perimeter did not take into account the strong attraction of the dead bear. Everyone on the fire was not briefed on the bear or the potential hazard posed by the power line close to it.

Strongly consider the need for Critical Incident Stress Management (CISM) with all serious injuries. Although the potential need for CISM was discussed early on in this incident, there were differing opinions as to whether and how to implement it. Some personnel remembered positive experiences with CISM following serious accidents and/or death while some remembered mandatory CISM activities that did not go over well with employees. On this incident the decision was made to not activate CISM after asking key personnel whether they felt the need for a CISM team. Most people we talked to said they thought it would be best in the future to activate a CISM team in all cases of serious injury or death. Employees felt we should communicate to all involved employees that it is normal to have strong feelings after this sort of incident and that talking with your peers or a CISM team can be helpful. They suggested having the CISM team on site to allow anyone who wants an opportunity to easily access the team and discuss the incident. This is especially important since we heard from several employees that many people are hesitant to ask for help in these situations.

Ensure personnel assigned as Family Liaisons are provided clear direction so they can effectively provide services to the injured party and their family. Four individuals from the Forest and the Job Corps center served in the Family Liaison role over the course of the injured firefighter's two week hospital stay. They were sometimes unsure of their role and responsibilities and expressed the desire for the development of a "job description" for the Family Liaison that would include how best to interact with OWCP, ASC, DOL, the hospital administration, and how best to advocate for good patient care, and best practices. They were unaware of the extensive information available at the Forest Service Safety website that provides direction in these cases.

Keep a unit log of communication and activities at the hospital. There is so much going on and so many different care providers, that it can become very confusing quickly if you are not keeping a log of hospital interactions, including requirements and paperwork for OWCP and ASC. This is extremely important when the injured firefighter has no family with him at the hospital, and/or s/he is disoriented by the injury or pain medication.

Recognize that all high voltage electrical injuries are life threatening. At some point the firefighters injuries in this situation were described as "electrical burns, non-life threatening." Although the patient may only have visible entry and exit wounds, there can be severe internal damage including to the heart and other organs, and emergency medical treatment in a burn center/trauma care hospital imperative.

Recognize and anticipate difficulties involved with conversion from District Dispatch responsibility to

Forest-wide centralized dispatch. There will be a learning curve and bumps in the road. Making the switch requires a functioning radio system, agreement from all participants, and a back-up plan for when things don't go as expected. An SOP was developed pre-season with roles and responsibilities clearly spelled out but it is not yet fully implemented. Through innovative thinkers, leaders and employees on this event made it work; there is still an opportunity to improve.

When mitigating an electrical hazard on a wildfire incident, consider adding an additional operations level such as Task Force Leader (TFLD) or a Safety Officer. Another potential mitigation is to delay operations until the power company can assess the situation and provide guidance.

Ensure emergency SOPs are widely communicated and understood. Several Forest employees expressed different ideas on who to call for a medical emergency and suggested there should be an SOP. Some thought that for a medical emergency the order of emergency contact was Central Dispatch first, if no response then District Dispatch, and finally if no response, call 911. Other personnel thought the first call for any medical emergency on the Forest should be 911 since that would give emergency dispatchers a fixed location from a cell phone. There is an approved Field Medical Emergency Evacuation Plan that is available on the G-W Jeff intranet website; however it is not widely understood by employees.

Aggressively question anytime there is a power line down or arcing or suspected of causing a fire. "Tell me exactly what that looks like, or better yet, take me there and show me."

Lonesome Pine Fire Crew Lessons Learned

"Always assume the power line is energized. Always assume the gun is loaded."

"Constantly know what's around you. Take in your surroundings even the small things."

"Hope for the best and prepare for the worst. No matter how safe it is, anything can happen."

"Even if a snake's head is cut off, it can still bite you."

"Don't panic (panic kills)."

"We were out there to work, do your job and get out of there, don't be so curious."

"Don't make assumptions, and when it happens take care of business."

What would you like management to learn from this incident

Management should support and encourage employees to become EMT certified and make those skills available to Forest Service employees. We should have site specific medical evacuation plans that is widely known and practiced by employees.

There is outstanding commitment from Job Corp staff and the local Districts in regards to the Lonesome Pine Fire crew; however, a full time fire line leadership position devoted to Job Corps could make the crew more effective. This is something that employees would like for management to move forward with.

The radio system needs to be improved, it goes down all the time, and it has a lot of dead spots.

Personnel spent weeks documenting where dead spots were, the Forest added some repeaters, but still there are many problems; combining two separate radio systems, antiquated equipment, repeaters that are not working. Some of the radio traffic goes over VOIP and it has lower priority than data and sometimes calls get dropped.

We need to get Type 2 Job Corps crews out, and stop letting IMTs only order Type 2IA crews.

Aftercare for injured firefighters sometimes takes intervention by management to ensure OWCP and ASC provided the necessary continuing medical services. The injured firefighter has life threatening wounds and is at risk of infection, his home care and follow-up care are not ideal. Management worked to ensure continued Family Liaison services and appropriate aftercare.

Job Corps students with fire qualifications should be entered into the Incident Command Qualifications System. This will ensure better coordination, better tracking, documentation of experience, better oversight, and ensure that HSQ, IQCS, and pack test results are all complete and accurate.

Appendix - A

SEQUENCE OF EVENTS (extracted from dispatch logs and narratives)

May 11 Thunderstorms pass over the Central Zone of the GW-Jeff National Forest

May 14 Several fires reported in the Central Zone, two fires are staffed and recon flight ordered

1415 Central Dispatch radios are down will run dispatch through District Office until back up

1502 Recon flight spots a smoke that is eventually named the "Back Creek Fire"

1502 IC offers to check out the new start (back Creek Fire)

1601 IC arrives on scene

1624 IC gives rough size-up to Central Dispatch: "Backing fire, 5-10 acres, if we get a dozer on it, will be in good shape."

1641 Zone FMO on scene and walks to head of the fire with IC

1716 IC size up 5-8 acres, creeping, less than 2' FL, south aspect, upper 1/3 of slope, slope 10%, wind 1-3 mph, no structures or resources threatened. Dominion Power Pole #359 (AA will call power company) no need for investigation. Information relayed from District Dispatch to Central Dispatch.

1803 E-641 on scene. Will drop both blades and put quick line around fire
Virginia Division of Forestry firefighter arrive to help fire out lines

2037 Line around fire, all lines fired out, all resources off fire

2113 Line fired out. There are some heavies on the line so IC does not want it called contained

May 15

0959 Briefing completed at the work center (James River Office) for all three fires. Only overhead attended this briefing.

~1300 One saw crew discovers multiple bear skulls and animal bones and then a large fresh bear carcass.

1545 Zone FMO to Central Dispatch by phone: Fire may have been caused by a bear; carcass was found near fire, burnt. Speculate that bear climbed power pole, was electrocuted, and caused fire after fall.

1730 Firefighter receives burns from high voltage electrical arc

1737 Transporting an individual with 3rd degree burns from fire, the office is contacting an

ambulance and we will meet him on the highway

1750 Central Dispatch calls to confirm Ambulance enroute to meet FS vehicle w/ injured FF

1807 Central Dispatch documents that Warm Springs District is taking radio traffic from the Back Creek Fire and Incident-Within-an-Incident due to poor communication with Central Dispatch

1810 Patient transferred to Ambulance

1825 Per Forest FMO, called Emergency Room and requested patient be life-flighted to a burn center as per FS protocol

1854 Patient arrives at hospital, being evaluated; they feel he will be OK

1859 Helicopter has lifted, enroute to Bath County Community Hospital

1919 Ordered a Family Liaison for injured firefighter

1945 Helicopter getting ready to lift off with patient heading to burn center at MCV

2022 Family Liaison enroute to Warm Springs District to meet Squad Boss and then travel to burn center

May 16-26 Family Liaisons are assigned to work with the injured firefighter, health care providers, OWCP, ASC, and DOL personnel to ensure he gets the best medical care possible.

May 26 Injured firefighter is released from the hospital with home health care in place, return appointments made, prescriptions and supplies purchased.

Appendix – B

POWERLINE SAFETY

"We saw the line there, it was hanging pretty low, wasn't doing anything, no buzzing."
"Nobody touched it."

You don't have to come in direct contact with energized lines or electrical equipment to be injured. Depending on the voltage involved and a variety of conditions, electricity can travel through the ground, or arc through the air and cause severe injury or death.

"Stay Away From Down Powerlines"

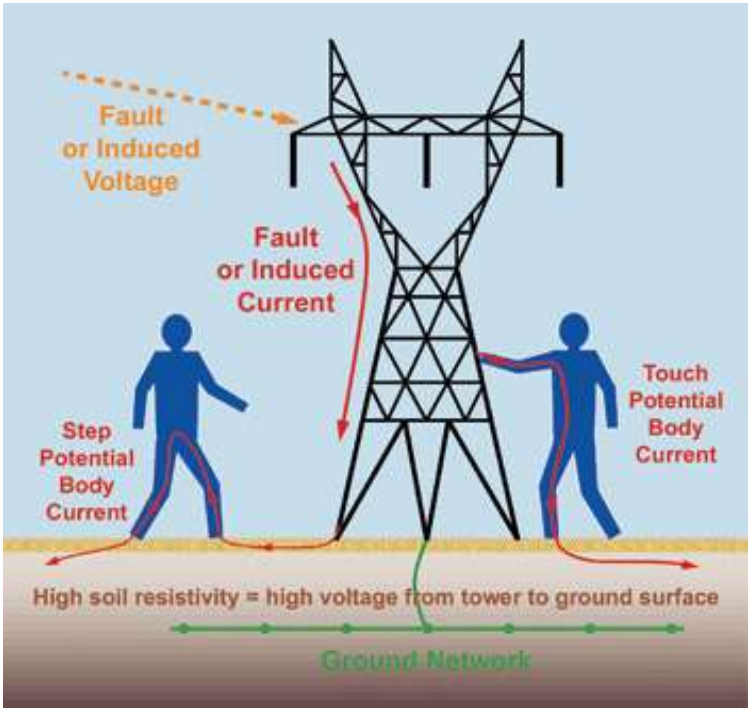
We see and hear this message a lot, it is prominently displayed in our Incident Response Pocket Guide and we often hear it on fires during the briefing. What does it really mean, and how far away should we be?

There are four situations of concern, downed or broken lines, sagging lines, and lines that are still up in the air but are hanging above the fire or in thick clouds of smoke, and there are the lines in the vicinity of the fire that may become one of the above. In addition to powerlines and wires, there is other electrical equipment such as sub-stations and transformers that firefighters may encounter. Any of this equipment can pose a serious hazard.

A powerline doesn't have to be "down" or touching the ground to be a hazard. Sagging or low hanging lines close to the ground are probably the worst case scenario. When a line actually touches the ground it may arc, pop, crack, and sizzle. The system will try to reset several times before it will likely shut down. When an energized line is in contact with the ground or some other object, electricity will flow to ground, and it can flow through the ground possibly completing a circuit through the body of anyone close by.

In the case of lines close enough to the ground to be touched the circuit will be completed to ground through anyone coming in contact with the line, or getting close enough to the line to cause an arc flash between the line and the person. Lines hanging close to the ground pose a high risk because they are hard to see particularly at night, in heavy smoke, or in low light conditions. These low hanging lines will likely carry electricity as usual, they won't make any noise, and they will be within reach of people or equipment.

Under the best of conditions electric transmission and distribution equipment can experience problems. A powerline within the fire boundary may have been the cause of the fire, or the line or other equipment may have been damaged by the fire. In either case, a ground fault could occur. Electricity always seeks a path to ground. In an equipment failure this path may include metal towers or poles, fences around sub-stations, or metal containment cabinets around transformers. Brush, a tree, or a snag in contact with a line could provide this path as well. Electricity can flow through the ground and a person close enough to this ground point could complete a circuit and allow current to pass thru their body. (See diagram, courtesy of Utility Products)



So, how close to this equipment is close enough? That all depends on the voltages involved and a variety of conditions but guidelines are established and tables are available if you know what you are dealing with. (See table below) As unqualified individuals, that is, people who aren't trained to work around this stuff for a living, our safety zone is called the "limited approach distance". In most cases firefighters and overhead on-scene aren't going to have enough information to make the determination of what the limited approach distance is. These tables also don't consider the effect of ionized air around the equipment caused by the fire and smoke. As with the fire, the condition of the lines or other equipment can change over time. Things can be working fine one minute and the line be compromised the next.

Table 130.4(D)(b) Approach Boundaries to Energized Electrical Conductors or Circuit Parts for Shock Protection, Direct-Current Voltage Systems

(1)	(2)	(3)	(4)
	Limited Approach Boundary		
Nominal Potential Difference	Exposed Movable Conductor*	Exposed Fixed Circuit Part	Restricted Approach Boundary; Includes Inadvertent Movement Adder
<100 V	Not specified	Not specified	Not specified
100 V–300 V	3.0 m (10 ft 0 in.)	1.0 m (3 ft 6 in.)	Avoid contact
301 V–1 kV	3.0 m (10 ft 0 in.)	1.0 m (3 ft 6 in.)	0.3 m (1 ft 0 in.)
1.1 kV–5 kV	3.0 m (10 ft 0 in.)	1.5 m (5 ft 0 in.)	0.5 m (1 ft 5 in.)
5 kV–15 kV	3.0 m (10 ft 0 in.)	1.5 m (5 ft 0 in.)	0.7 m (2 ft 2 in.)
15.1 kV–45 kV	3.0 m (10 ft 0 in.)	2.5 m (8 ft 0 in.)	0.8 m (2 ft 9 in.)
45.1 kV– 75 kV	3.0 m (10 ft 0 in.)	2.5 m (8 ft 0 in.)	1.0 m (3 ft 2 in.)
75.1 kV–150 kV	3.3 m (10 ft 8 in.)	3.0 m (10 ft 0 in.)	1.2 m (4 ft 0 in.)
150.1 kV–250 kV	3.6 m (11 ft 8 in.)	3.6 m (11 ft 8 in.)	1.6 m (5 ft 3 in.)
250.1 kV–500 kV	6.0 m (20 ft 0 in.)	6.0 m (20 ft 0 in.)	3.5 m (11 ft 6 in.)
500.1 kV–800 kV	8.0 m (26 ft 0 in.)	8.0 m (26 ft 0 in.)	5.0 m (16 ft 5 in.)

Note: All dimensions are distance from exposed energized electrical conductors or circuit parts to worker.
* *Exposed movable conductor* describes a condition in which the distance between the conductor and a person is not under the control of the person. The term is normally applied to overhead line conductors supported by poles.

Electricity can arc to wooden tool handles and even to insulated tool handles if they are cracked or in poor shape. A qualified person, one who is trained and experienced working with electric transmission and distribution equipment will be able to determine safe working distances and advise how close people can work to down or sagging lines.

If there are no qualified people on-site a good rule of thumb is to **stay back the length of a football field.**

"Call the Power Company"

Your best source of information and expertise will be a representative of the company who operates the powerline or other equipment. Always notify the power company when lines or other equipment is involved or threatened by an incident. It may be difficult to determine in the field what company the equipment belongs to, sometimes the company name will appear on a tag attached to a pole or there may be a sign on a sub-station fence. Look for identifying information well away from sections of line that are down or compromised.

"Assume all powerlines and associated equipment are energized"

- Delay firefighting operations until the hazards have been clearly identified, safe operating areas have been established, and hazard areas have been flagged and briefed.
- Determine the entire extent of the hazard by visually inspecting all lines. Track lines two poles either side of a downed wire.
- Flag the area around a downed or low hanging line, post guards and deny access.
- Clearly communicate to all resources the location of and the hazards associated with all powerlines and associated electrical equipment on the incident.
- Heavy smoke and flames can cause arcs to ground. Suspend direct attack within 100 feet of transmission lines.
- Water and electricity don't mix. Never use straight streams or foam, use a fog pattern around electrical equipment.
- Always be aware of where you are in relation to powerlines and associated equipment.
- Maintain at least 35 feet distance from transmission towers.
- Communicate locations of all transmission lines to air resources.
- Aerial drops onto powerlines will cause arcing to ground or arcing to towers or poles.
- Escape routes should not be under or near overhead powerlines.
- Safety zones, drop points, and staging areas should not be under or near overhead powerlines.

The following link provides an excellent training video on safety around power lines especially as it relates to firefighters. It is recommended and referenced on the USFS Missoula Technology Development Center website: https://m.youtube.com/watch?v=q5bvZIJlLXo

Appendix - C

CRITICAL INCIDENT STRESS MANAGEMENT

Critical Incident Stress Management (CISM) activities should always be considered whenever there is an incident or series of highly stressful situations that affect employees. Critical incidents can generate significant stress response that may overwhelm the usually effective coping skills of healthy employees. These sudden, stunning events are typically outside the range of common human experience. Because they are so unexpected and upsetting, they can manifest notable cognitive, physical, behavioral, and emotional outcomes, even in experienced, well-trained, and resilient people. The negative effects of traumatic stress may be acute, chronic, or cumulative in nature, and can adversely affect the performance and well-being of employees and the organization.

Following a traumatic event, a group debriefing is often provided. It is not mandatory that employees directly involved in a critical incident participate in a debriefing. Some employees may feel they do not need to attend, however, they should be urged to be there to support others involved which is what helps make the process work. Debriefings are intended to help facilitate “normal recovery, in normal people, who experience a normal reaction to an abnormal event”.

Timeliness is important; however, the debriefing process is generally most effective when performed a few days following the incident. This way, employees have the necessary time to recover from the initial shock, and are fit to engage in a formal group debriefing setting.

CISM services can be one-on-one or with groups of people involved in the incident. The CISM team can be available to meet with people after an administrative debriefing about the incident. Activities can be flexible and used to meet each situation.

The Employee Assistance Program (EAP) can refer a pre-designated Critical Incident Stress Debriefing provider. Agency CISD teams are also available to conduct debriefings, as well as provide pre and post incident stress management services and resources. Government employees/peers who assist in debriefings are formally trained to deliver CISM services and perform CISD within established guidelines. CISD teams work closely with a mental health professional that provides program management oversight and guidance to the team during debriefings. A qualified mental professional experienced with the agency should also be assigned to complex incidents and one-on-one needs/requests.

Appendix - D

FAMILY LIAISON POLICY

You got your injured coworker to the hospital. Your blood pressure and adrenalin were up getting your coworker to the right place for the right care. Now that you have accomplished that mission the rest is downhill right? Yes, the most important thing is taking care of the safety of our employee. But now you need to make the notifications that need to be done. There will be lots of individuals that will need certain information, so at times it can seem daunting. But the information is needed so that plans can be made to assist in the care and recovery of the injured firefighter. The information you give and who you give it to can be very critical in the overall care and recovery of the firefighter. At times like these it may be useful to designate a Family Liaison/Hospital Liaison.

The Liaison can help with flow of information from the hospital to the family to the Forest Service. They are there to try and facilitate the best care possible for the patient and keep everyone informed. This can reduce stress for everyone. Inform the Hospital staff that this is a Workers Compensation case and all bills will be sent to the Department of Labor (DOL). Remind them that the 9-digit OWCP claim number must be clearly annotated on each bill or document that is sent.

The paperwork and overall setting of a hospital can be daunting. Having someone there to assist with federal requirements and policy is helpful. Also having someone there who is able to establish trust and support for the family/injured employee is imperative. The Liaison will need to have good communication skills and the ability to keep key players informed, from the hospital staff, to the family, to updating the appropriate Forest Service Staff. The Liaison can insure that the ASC-HRM-Workers Compensation (WC) has been notified and serve as a point of contact between the Hospital and ASC-WC.

The role of the Liaison is a time consuming effort and can be emotionally taxing. If the hospital stay is projected to be long, consider rotating staff in to serve as a Liaison every 4 to 5 days.

Before accepting the role of the Family Liaison or asking someone to take on this role, carefully consider the following:

1. At times, Family Liaison duties are very emotional.
2. A long term commitment of time may be required, especially in the first few weeks.
3. This role may continue for a long time.
4. The role may be emotionally and/or physically demanding.
5. Consider your transition strategy from the Family Liaison role.
6. You must want to do this. The family will know if you are “just doing your job.”

For more information on policy and guidance for dealing with a serious injury or death go to the FS Handbook reference: http://www.fs.fed.us/cgi-bin/Directives/get_dirs/fsh?1309.19

Appendix - E

FLA TEAM MEMBERS

Stephen Lenzo—Assistant Director, USFS Job Corps National Office (Team Lead)

Rebeca Finzer—District Fire Management Officer, Ouachita National Forest, R8 (Fire Line Operations SME)

Lisa Blackmon—Support Services Specialist, Chattahoochee-Oconee National Forests, R8 (NFFE Union Representative)

Woody Lipps—Safety Officer (retired), George Washington-Jefferson National Forests, R8 (Fire Line Safety SME)

Fred Payne—Safety Officer, Centennial Job Corps Civilian Conservation Center, R4 (Job Corps Safety SME)