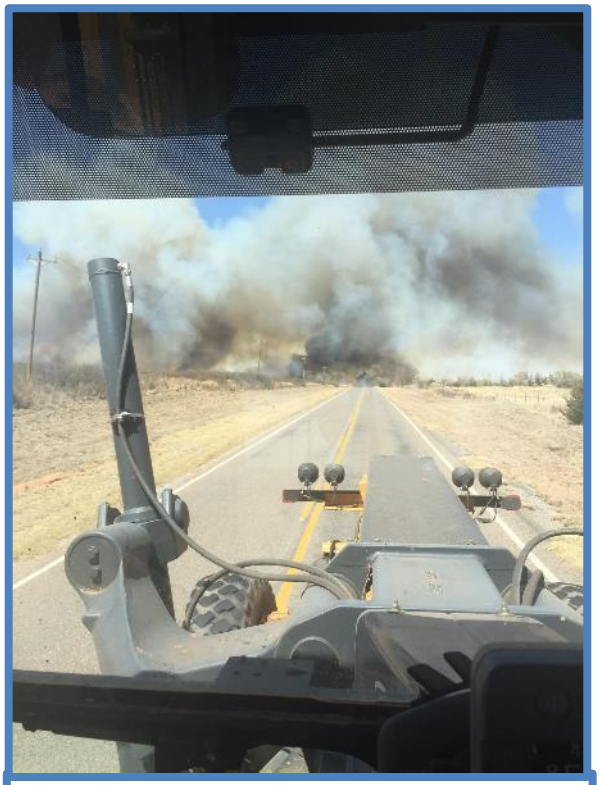
Incident Location April 15th, 2018,
Three Days after the Shaw Fire



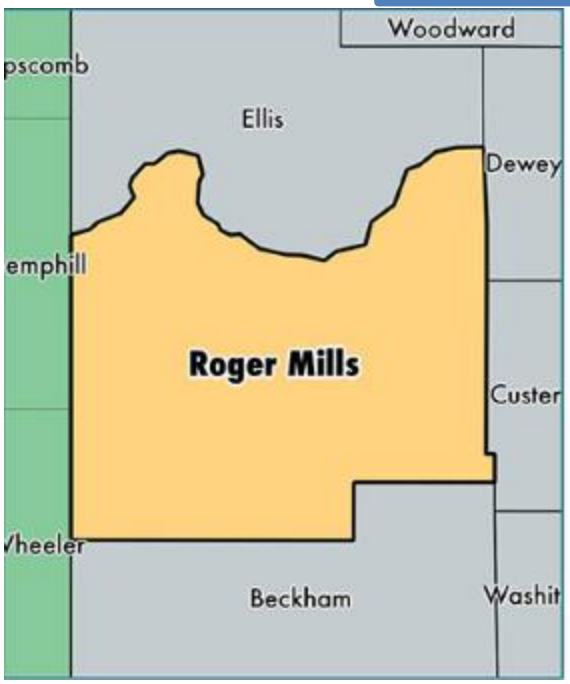
Motor Grader approaching the Shaw Fire

Shaw Fire

Facilitated Learning Analysis

Incident Date: April 12, 2018

Shaw Fire Vicinity



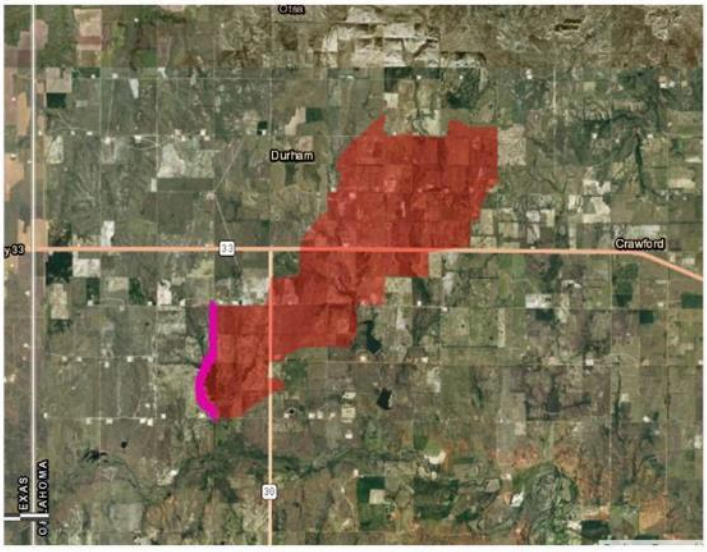
OKLAHOMA FORESTRY SERVICES
MANAGE • PROTECT

Shaw Fire
S. of Durham
Roger Mills County

13 April 2018
1600 Hours
Est 7250 Acres

Map not final.
Briefing Document Only.

N
W E
S



Shaw Fire Facilitated Learning Analysis
Brief Contents

1. Executive Summary

Except for Jack Osben, all names are pseudonyms

On April 12th, 2018, 61-year-old Jack Osben, a motor grader operator for Roger Mills County in Oklahoma and volunteer firefighter died as a result of thermal burns while providing initial attack to the Shaw Fire. The wildfire grew to approximately 3,500 acres in a mixture of grass and shrubs during a Red Flag Warning day. The employees of Roger Mills County were in a state of readiness due to a mixture of prolonged drought, extreme heat, and gusting winds that had created extremely dangerous wildfire conditions.

Jack was performing progressive line construction using a motor grader on the Shaw Fire. While he had been working as a grader operator for a few years, he had limited experience using the grader related to fire suppression activities. Between 1400-1430 hours Jack met up and began working with Alex, a fellow grader operator who had more than two decades of experience fighting fire.

Although they entered the field at different locations, they converged almost immediately. Alex instructed Jack to fall in line behind him to improve the initial grader line. After working together to establish line for about 4,000 feet, Alex lost sight of Jack's grader in the smoke and flames, which had grown significantly and shifted directions quickly.

Due to the fire's shift in direction, Alex was forced to abandon his grader. He began to walk toward a nearby road when he spotted Jack, who was also on foot emerging from the smoke. They spoke briefly when they met. Alex observed that Jack had visible burns to his arms and was possibly suffering from smoke inhalation. The reality was that Jack's injuries were much worse than they appeared. He died as a result of thermal burns either during transit in the ambulance or right after arriving at the hospital.

This accident took place in Western Oklahoma where the tactical use of motor graders for wildland fire line construction is common. Additionally, there is different emphasis on values at risk, namely that firefighters in Western Oklahoma commonly protect grass for cattle grazing. Other regions may rank grass as a low value-at-risk but it is absolutely a consideration for how people in this region fight fire and manage land[1].

This is the first Facilitated Learning Analysis (FLA) to emerge from the State of Oklahoma. In brief, the FLA process is meant to facilitate learning from unintended outcomes by interviewing people who were involved in the event, and sharing a collective story of their

[1] In Oklahoma, hay production provides between seven and 21 percent of the springtime agricultural income. There are 35 million acres of hay harvested in the state annually, for a total income of $491 million. In Roger Mills County, the acreage is 4,900 harvested for an income of $421.5 thousand. https://www.nass.usda.gov/Statistics_by_State/Oklahoma/Publications/Annual_Statistical_Bulletin/ok_bulletin_2017.pdf

experiences. We also offer lessons learned from those involved and with their help, generate recommendations that may be useful for people within and outside of the region.[2]

For many readers, this analysis will serve as an introduction to a different way of fighting fire with some of these methods appearing unconventional. But, in the words of one of the grader operators, ***"you make do with what you have."*** Even if the methods and context are different, this statement ties together the ethos of wildland firefighters everywhere. It is also important to note that the men and women of Roger Mills County are exceptional at what they do and have an impressive record of doing it safely.

Fuel loading common to this area.

2. The Accident Story

Predicted fire danger for 4/12/2018 was considered "historic."

Background

The Specialized Work of Motor Grader Operators in Western Oklahoma

The District 3 employees are a small, close-knit group working together every weekday. The motor grader operators have a portion of the District assigned to them for which they are responsible. Their neighbors depend on them to keep the roads open and in good shape. Their area of responsibility may be as large as 60 square miles per operator. There are other employees that are responsible for maintenance of the equipment, and others that drive service trucks and tanker trucks. Some of the employees are multi-talented, and some are

[2] The FLA team is listed in Appendix VII.

focused on one particular job. For example, one employee compared himself to the others by saying, ***"Those guys can do anything. I can turn a wrench but I'm not a mechanic. I can drive a truck, but I'm not a truck driver. But I am a grader operator."*** These operators take great pride in their work and provide a valuable service to their communities.

Initial Attack firefighting is part of their job because they are willing and able. They volunteer to fight wildfire because they care about their neighbors and community. The County Commissioner for District 3 is good at allowing the employees to participate in Initial Attack. One employee stated, ***"The commissioner "is good at sending equipment. We don't ask we just go."*** The operators may see smoke, and "self-dispatch," reporting to the Commissioner and Sheriff while in route to the fire. Other times, they may get the call thought the county "civil defense" radios. They work with vigor because, ***"Grass is important to the livelihood. Fire operations are a last ditch effort because we need the grass. We need to save the grass."***

Since motor graders are used as a tool for fire line construction, they utilize tactics similar to the way dozers or tractor plow units are used. Graders typically work in groups of two or more using the progressive method of line construction. The first grader places the toe of the blade down on the fire side of the grader and breaks the soil and discharges the spoil toward the fire. The first grader sets the correct distance from the fire edge and the desired path. The distance from the fire edge is determined based on fuel type, wind speed and direction, and flame length. While driving and controlling the grader, the operator is looking ahead for obstacles, ditches, ravines, and silage pits. The next grader starts at the edge of the cleared area left by the first machine. The blade on this grader is set to scalp the surface to mineral soil; this spoil is discharged to the side away from the fire. Each additional grader continues to scalp the soil and discharge the spoil away from the fire in a continuous process.

The Roger Mills County firefighters have varying amounts of training concerning progressive line construction and fire behavior. The most common training is from on-the-job experiences (OTJ). Some employees have attended formal training, but the majority receive only OTJ training. However, their volunteer efforts are not limited by training or experience. It is more of a function of their availability and proximity at the time of the fire. Generally, they try not to attack the wildfire alone. But this is not a firm rule, especially if the first one on the scene knows another grader is close behind. This was the case during the Shaw Fire. Alex, a grader operator and firefighter with over two decades of experience, began Initial Attack alone until Jack Osben arrived on-scene. (Jack had limited experience fighting fire using the motor grader.)

The operators remain in communication with each other and with their Commissioner by way of radio or cell phone. They are aware of the potential impact of their conversations on the local population that may be listening on scanners, so they may modify their communication method, or choose to talk direct by phone. They are careful to avoid causing panic. The graders and the fire department engines that fight alongside them frequently use CB radios to be able to avoid interference on the emergency management channel when they are trying to communicate with others nearby.

Communication methods for grader operators consist of CB radios, county network mobile radios, and cell phones. Cell coverage is good to very good over most of the operational area. CB's are used whenever individual units are in close proximity to each other, especially when performing progressive line construction. In the case of this incident, all communications were on the county civil defense channel, CB's, and/or cell phones. The county mobile radios contain frequencies for sheriff, fire, emergency management, and multiple mutual aid channels for surrounding county fire and transportation departments.

Topography, Fuels, and Weather

The area where the incident occurred was experiencing a high fire fuel load due to the wet spring of 2017. During that time, they had quite a bit of rain, which provided for heavier than normal grass loading. However, at the time of the fire, the area was experiencing extreme to exceptional drought. No significant rain or snow had fallen in almost seven months prior to the incident. The topography at the Shaw Fire can be characterized as very gently rolling hills and scattered canyons. The primary fuel in the fire area is tall grass with areas of brush and eastern redcedar. Current ERC's[3] were above the 97th percentile and fuel moistures were critically low. The Cheyenne (OK) Mesonet Station calculated the ERC to be 7 at the time of initial attack. A visit to the site following the incident confirmed that there was 100% fuel consumption. Green wheat fields in the area are usually considered to be suitable safety zones during times of cooler temps and higher RH's. However, they can become less reliable options as conditions become more extreme.

"It's a perfect storm. I've seen fires move faster and have higher flame lengths, but the radiant heat coming off of this is way hotter than any other fire."

-Devon, Grader Operator #3

[3] "The Energy Release Component (ERC) is a calculated output of the National Fire Danger Rating System (NFDRS). The ERC is a number related to the available energy (BTU) per unit area (square foot) within the flaming front at the head of a fire. The ERC is considered a composite fuel moisture index as it reflects the contribution of all live and dead fuels to potential fire intensity. As live fuels cure and dead fuels dry, the ERC will increase and can be described as a build-up index. The ERC has memory. Each daily calculation considers the past 7 days in calculating the new number. Daily variations of the ERC are relatively small as wind is not part of the calculation." For the mostly grass fuel type for the Shaw Fire an ERC of 7 is in the 97th percentile. Also see Appendix IV.
(https://ticc.tamu.edu/Documents/PredictiveServices/Fuels/ERC_fact_sheet.pdf)

A mixture of grass and shrubs in a field adjacent to the incident site.

These conditions, combined with critical fire weather caused explosive fire growth in the area. The weather in the Safety Briefing for the day of the incident read, *"**Ominous fire danger will be present both Thursday and Friday with subsequent fire danger remaining firmly in place through the weekend.**"* [4] Forecasted weather conditions led to the National Weather Service to issue a Red Flag Warning for Roger Mills County and all of Western Oklahoma on April 12th. [5]

The Roger Mills District 3 employees knew fire danger was extreme. They were aware of fires burning near the communities of Durham, Rayden, Cheyenne, and Hammon. One firefighter noted, ***"You can't put a blade on the ground"*** for fear of sparking a fire. Commenting on how quickly things could change, another firefighter mentioned, ***"A fire today will not be the fire you fought last week."***

Active fire behavior through these fields was observed during Initial Attack." [6] On April 12, 2018, the Cheyenne Mesonet Station was reporting fuel moisture in all categories in the single digits. One firefighter with roughly ten years of motor grader and firefighting experience reported there were ***"massive amounts of fuel and the windiest day I can remember."*** Another operator stated, ***"these areas haven't been grazed or hayed for 7-8 years, similar to lands in the CRP."***[7] These idle lands have been left alone and the fuel load has become extremely heavy.

Between 1400 and 1500 CDT, the Cheyenne Mesonet Station, the closest on-line weather station, reported that the wind speed was constant at 24-25 mph with gusts up to 50 mph. The temperature was 98ºF. The relative humidity was recorded at 5% and the probability of ignition was predicted to be 100%.[8] Those who were fighting fire that day reported 100º temperatures and at least 45 MPH winds.

[4] 180412 OFS Firefighter Safety Briefing, Appendix I
[5] 180412 OFS Fire Situation Report, Appendix II
[6] 180419 Rhea Fire Behavior Forecast, Appendix III
[7] The goal of the USDA's Farm Service Agency (FSA) Conservation Reserve Program is "to re-establish valuable land cover to help improve water quality, prevent soil erosion, and reduce loss of wildlife habitat." However, one unintended outcome of the program is that some acreage is left untouched for long amounts of time allowing fuels to build up and increas fire danger.
[8] 180412 Shaw Fire – Fire Wx and Fuels Information, Cheyenne Mesonet Station, Appendix IV

The firefighters on the Shaw Fire would later report flame lengths of four to six feet, and later in the afternoon, six to eight feet. It would not be surprising to find this an underestimate of actual flame lengths at the head of the fire, based on fire behavior witnessed on the Rhea Fire a few days later. The Oklahoma Forestry Services (OFS) Fire Safety Briefing predicted flame lengths in Short Grass/Pasture to be 11 feet, and the Tall Grass Prairie flame lengths to be 18-31 feet.

April 12th Tactics

On the morning of April 12th, Alex (grader operator #1) was tasked with hauling rock to put in a bar ditch. Alex is a 6'4" 285-pound man who has extensive experience as a grader operator and firefighter. He stood out as a leader among his peers. He was rarely seen without his iconic cowboy hat and blue jeans. Alex was working on the northeast corner of his 60-square mile territory in the approximately 360 square mile district. The morning went smoothly. He finished eating lunch and went to put his lunch box back in the 672G John Deere grader he was operating[9] when he saw a black plume of smoke northwest of where he was working. He thought to himself, ***"the smoke is so black it looks like someone is burning tires."*** He knew he needed to respond to the fire immediately.

Photo taken from Alex's grader during his Initial Attack efforts on the Shaw Fire.

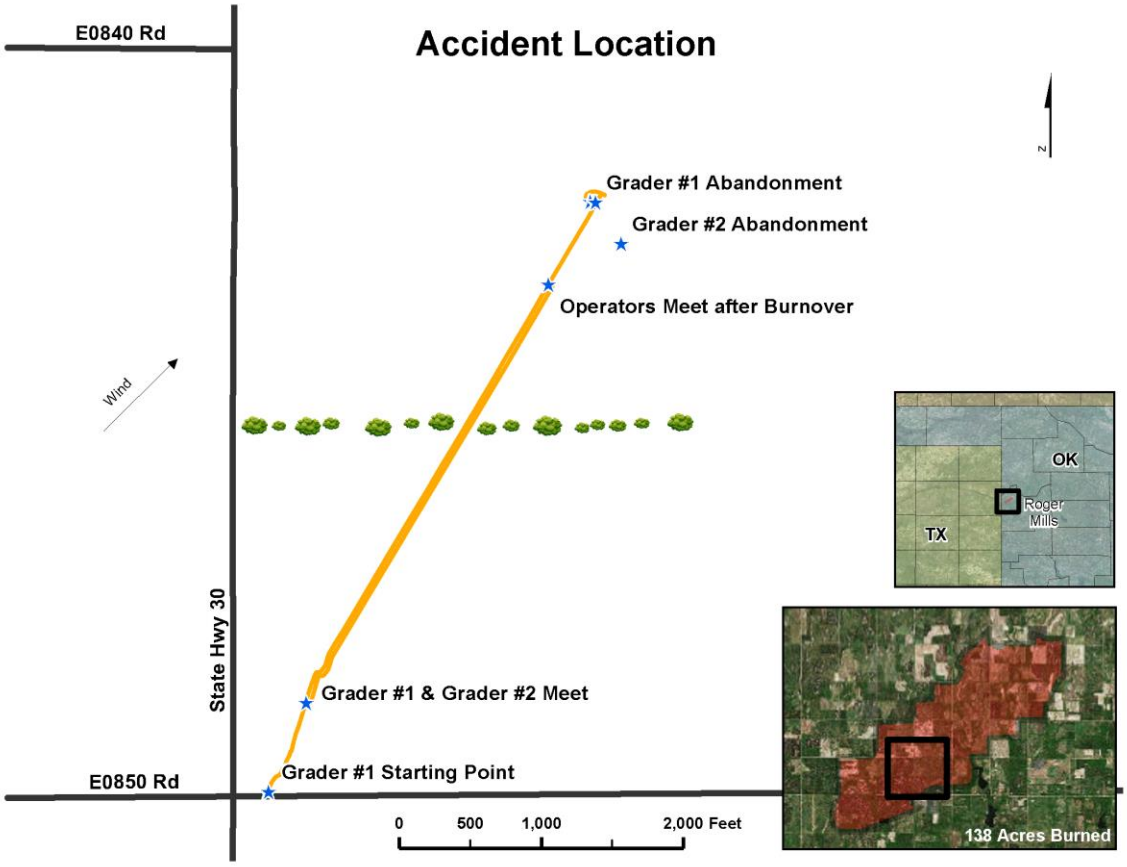
As he was heading toward the fire he picked up the phone to call the Sheriff's office. The deputy who answered the call said that dispatch had received a call about the fire and that the dispatch operator was currently on the phone working to mobilize resources to the fire.

As Alex was driving to where he believed the fire was located he heard pages go out from the Sheriff's office at approximately 1416 hours. While he was driving the grader as fast as possible, 28 mph max, he began thinking about what he would encounter. He started making a mental list of structures and obstacles: the area is an oilfield, directly south of it is an abandoned trailer house, there's a house on one end of the field . . .

[9] The HOBBS meter (used for measuring hours in use) for both Alex and Jack's graders were between 3,000-4,000 hours. They were roughly half-way between their maintenance cycles. At last maintenance, there were no issues with either grader, when the standard filter changing and fluid servicing was performed.

He turned off the highway onto the county road and drove east to the house on the property with the intent of dropping into the field where the fire was burning. However, he saw an area where the old barbed wire fence that lined the property was mostly broken down. He therefore decided to drive over the fallen fence to be able to cut fire line between the fire and the house (see "Accident Location" map *"Grader #1 Starting Point"*).

As he was cutting line with the grader, he spotted Jack (grader operator #2) driving toward him from the east, perpendicular to the line that Alex was cutting (see "Accident Location," *"Grader #1 and Grader #2 Meet"*), although it is unclear exactly where Jack entered the field or what he was doing directly before they met up. Jack had limited experience fighting fire on the grader, but willingly responded to the fire and began assisting Alex. As Jack approached Alex's grader, he pulled up next to Alex and began cutting line alongside him instead of falling in behind him to engage in progressive line construction, which is the typical method used. Alex called Jack on the CB, which is the common way that graders and other operators communicate on jobs in this county, and told him ***"get behind me and roll the berm."*** At that time, Jack fell in-line behind him.



Alex was monitoring the fire and watching for obstacles as he was cutting line, when after about 4,000 feet, he felt the heat in the cab of the grader get "a lot more intense." He looked in his rearview mirror and all he could see was flames. He didn't know if Jack was still

behind him or not. While working to contain the right flank, flames surrounded the grader (See "Accident Location" map, *"Grader #1 Abandonment"*).

At this point, Alex realized he could no longer continue cutting line. He quickly raised the blade out of the ground and tried to drive in a direction he thought was toward the green. Just as he did, the grader de-rated (aka going into crawl/limp mode)—which indicates the transmission or the engine overheated—and the vehicle immediately dropped RPMs. He made the decision to let the fire flash over him while he stayed in the grader's cab. He pulled the collar of his short-sleeved shirt up to cover his neck and ears, then pulled his cowboy hat down as far as possible, leaving only a small opening to be able to breath, right under the brim of his hat. He thought, ***"If my windows bust out, I'm going to jump out and take my chances."***

He could see the tachometer through the same small opening under the brim of his hat and could read that it was at 820, which meant the engine was at a normal idle. He hit the gas and saw that the motor was able to rev. He ***"slapped it into reverse"*** and without touching the extremely hot steering wheel, he drove backwards through the fire toward the black.

Alex's grader after the fire.

"My tires are on fire and the plastic on the top of this cab is rippling."

-Alex

As he pulled into the black and jumped down from his grader, he thought, ***"It's hot as hell and extremely windy."*** For the second time, he pulled his collar up and his hat down to protect as much exposed skin as possible. He realized that his arm had been burned. However, he didn't think it could have been that bad because he was never exposed to direct flames and it ***"felt just like a bad sunburn, at first."***[10]

He pulled the front of his shirt up to protect his burned arm from the intense heat and the blowing sand. The heat and smoke prevented him from looking up. He could only stare straight down. As he walked away from his grader, he noticed the berm he had been cutting and realized he was on his grader line. He decided to follow the grader tracks. After about 1,000 feet, he began to make out a tree and he saw Jack walking toward him (see "Accident Location" map on the previous page, *"Operators Meet after Burnover"*). Jack was out of breath, covered in soot and dust. Alex could see that Jack's sleeves were unbuttoned and that his wrists had been badly burned. It is important to note that the following conversation between Jack and Alex was brief and there wasn't a lot of information exchanged about what happened to Jack. As a result, we refrain from speculating about certain details such as what tactics Jack was carrying out, or where he sustained his injuries.

Alex's arm a few days after the incident.

[10]Although the pictures look pretty bad, fortunately Alex recovered from his burns. However, it is recommended that anyone who is burned visit a Burn Center/Burn Unit for evaluation as some internal injuries may not be visible at first or manifest at all for several days. (See for example, "Preacher Fire FLA," or other FLAs focused on burn care on the Wildland Fire Lessons Learned website.

When they first met up, Alex asked Jack if he was okay. Jack said yes. Alex then asked Jack if the grader had burned over. Jack said yes. At this point, 1453 hours, Alex called the District Commissioner to report that the graders had been burned over and to ask him to come pick them up.

As the operators began to walk out together, Jack fell to the ground. Alex was able to help Jack get up and keep walking after he fell several times. They walked toward the tree line but Alex said, ***"It's too hot; we can't walk back through that tree line."*** A big gust of wind came through the trees, and Alex reported that ***"The hot air felt like actual flames."***

At that time, Jack went down again and held out his forearm for Alex to pick him up. Alex reached out to pick him up but because Jack's arms were badly burned and the skin around his wrists was compromised, Alex had to reach farther up Jack's arms to be able to locate a sturdy place to pull him up. Alex was becoming weakened by the continued struggle and his own injuries. He felt like Jack was actually pulling him down more than he was able to pull Jack up. Alex thought to himself "***if we are both on the ground, the District Commissioner won't be able to see us. I have to stay on my feet."*** Alex told Jack to stay down below the hottest part of the wind, and at 1459 hours, he called the Commissioner back to say, ***"Where are you? Hurry!"***

Initially the Commissioner had trouble locating them. Once he arrived on the scene he spotted Alex, and at 1506 hours he called for the ambulance to meet them at a nearby road intersection.

When the Commissioner pulled up, Alex opened the back door of the Commissioner's truck and fell into the backseat. As he was getting into the vehicle Alex told the Commissioner he would need to pick Jack up off the ground and help him into the truck. Jack was badly injured, but still coherent when he got into the truck. The Commissioner then drove them to the ambulance, which was approximately 3-4 minutes away. As they were driving to the road intersection (1517 hours), Air Evac was dispatched. When they met with the ambulance, both operators were evaluated. Instead of waiting on the helicopter, Jack was immediately taken by ambulance to the nearest hospital. A very short distance after the ambulance pulled away from the site where they picked Jack up, they quickly pulled to the side of the road. It is unclear if Jack made it to the hospital or passed away in the ambulance while in route.

The Commissioner painted a large "X" on the highway to help the helicopter identify the correct location to land to pick up Alex. After a few minutes the helicopter arrived. The flight medics evaluated Alex who signed a release and opted not to take the flight to the hospital. The commissioner then drove Alex to the nearest hospital for further evaluation, where he was treated and released.

Jack's grader being gradually covered in blowing sand.
This photo was taken two days after the burnover.

Other Simultaneous Response Efforts

Devon (grader operator #3) had been monitoring the local weather reports and knew that there was high fire danger. He had more than ten years' experience as a grader operator and firefighter. Devon was in charge of much of the maintenance on the graders. At the time of the fire, he was doing maintenance at the shop, which was roughly six miles from the field where Alex and Jack were headed to begin their suppression efforts. At about 1422 hours he heard the call to respond to the Shaw Fire. He left the office, met up with Logan (grader operator #4) and two fire engines and made his way to the field.

When Devon got to the field, he was struck by the fact that this fire seemed different than any other fire he had fought. As if he was shaking off confusion, he explained to Logan, ***"It's a perfect storm. I've seen fires move faster and have higher flame lengths, but the radiant heat coming off of this is way hotter than any other fire."***

With that in mind, they began to cut line around private residences near the field. Although they started the process together, Logan peeled off to cut line around a house while Devon and the two engines proceeded down the road a little farther to do the same. While cutting line in a field near a home, Devon watched as the flame front he was monitoring change directions and run quickly. Experience told him he needed to drive though the flames into the black. He quickly realized he was okay but was shocked by the fact that he had to take such action because he had never had to do it before today. He knew that the engines were close by and that they might have seen the event. Not wanting them to worry, he picked up the radio to announce that he was safe. Because he knew about Alex and Jack getting injured earlier in the day, he immediately felt nervous that any other operator who might have heard his announcement over the radio would become alarmed. However, he knew

that it was important to be clear with the nearby engines and so he had to close that loop. One engine responded, ***"Okay, see you on the other side."***

Devon gathered himself and proceeded to the next house. As he finished cutting line around the house, the homeowner came out and was furiously yelling at him. He jumped down out of the grader to talk to the property owner. The property owner screamed at Devon to do more to protect his property. He noticed the engines and began to question why they weren't spraying water around his home. Devon told him the engines were out of water and that there was nothing else he could do at this time. The homeowner continued to yell at Devon. At this point, Devon grabbed the homeowner by the shoulders and said, ***"I can't do anything else to help you right now."*** He let go of the homeowner and began to walk away. Just as he took his first step in the opposite direction of the homeowner, Devon said, ***"That's the kind of thing that could get your teeth knocked in."*** Devon then got back in the grader and proceeded to the next house, just as he would continue to do all afternoon.

The crew knew they would be fighting this fire, or ones like it over the next few days until the weather eased up. What they didn't know while they were fighting fire that afternoon was that one of their own had been critically injured and later lost his life due to that fight.[11]

[11] A tactical sequence of events can be found in Appendix VI.

3. Lessons Learned

The Importance of Personal Protective Equipment (PPE) and Safety Equipment

> ***"I'm the world's worst. I've never gotten my equipment out. But after this event, I'm a firm believer and I tell the young guys they have to wear it. I'm never going to wear a short sleeve shirt while working again."*** **-Alex**

PPE can only be useful if the operator on a fire wears it. It only takes a minimal amount of time to put on PPE before responding to a fire and it will ensure the operator has some protection from heat and flames. Most of the grader operators on the Shaw Fire stated that they were furnished wildland fire PPE (brush jackets and pants with suspenders, and gloves), which meet National Fire Protection Association 1977 standards, but they had not used them in the past. They were also provided smoke masks. Specifically, Alex mentioned the importance of wearing PPE on every fire and even recounted how he saw a few young men responding to a fire after these events and felt compelled to pull to the side of the road where they were working and convince them to wear their PPE.

Sample of the Fire Dex Wildland Jacket issued to grader operators for Roger Mills County. The jacket has matching pants (not pictured).

Sample of the smoke mask typically furnished to the grader operators. It is stored in a bag in the cab of the grader.

At the time of this learning review, the operators had not been furnished fire shelters and have had no training on fire shelter deployment.[12] During this learning review the operators were shown a fire shelter and participated in a discussion about how they are used.[13] The interviewees raised questions about where shelters were worn or how they were carried. For the purposes of grader operators, harnesses (like the one *pictured on the left*) allow operators convenient access to the shelter without infringing on their ability to work. In the event of a burn over, fire shelters may also be used inside of graders to protect operators.

When the FLA Team members were in the field with Alex after the incident, they observed the melted items inside the cab and were surprised about what had burned and what didn't burn. This led to a conversation about safety equipment available to add to the graders themselves to

[12] Oklahoma Forestry Services, in partnership with Oklahoma State University Fire Service Training, provides NWCG wildland fire training to career and volunteer fire departments. Students that successfully complete training at the NWCG Firefighter, Type 2-level receive a set of wildland PPE (Nomex/Kevlar pants, Nomex fire shirt, hardhat, face and neck shroud, gloves, line pack, and fire shelter).

[13] A training video for how to use fire shelters can be found at https://www.nifc.gov/fireShelt/fshelt_main.html.

increase their ability to protect operators from radiant heat. For example, the fire curtains pictured below can be used in open or closed cab graders, dozers and tractors.[14]

Cup melted to the inside of Alex's grader cab by radiant heat.

In addition to PPE there are upgrades that can also be made to open or enclosed graders to decrease exposure to radiant heat.

Left: Fire curtain from the inside of the cab of a tractor. Right: Fire curtain from outside the cab.

Continuous assessment of skills and tailored training are important

Some of the grader operators reported receiving classroom training. Some had participated in hands-on learning through simulations. Others had received only on-the-job training. Some operators mentioned that the training they received was either way below their skill level or *"good in theory but not in practice"* because it was not tailored to the type of

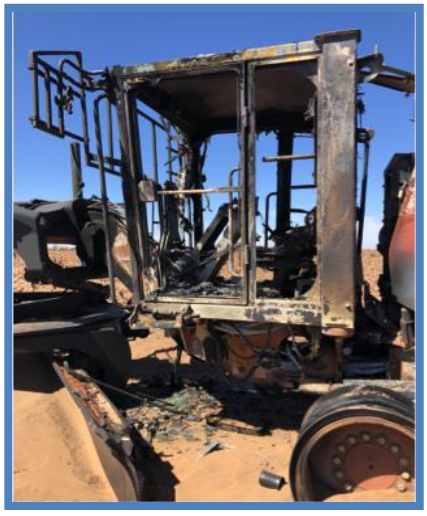
[14] Information about their use can be found at http://www.roscommonequipmentcenter.com/Project%2070_Fire%20Curtains%20for%20Crawler%20Tractor.pdf.

tactics used in this region. Most of the operators the FLA Team spoke with suggested that Jack was a good grader operator. But anytime an event like this occurs, it provides a chance to reflect on everyone's training, capabilities, and level of trust in each other's skills. It also provides a chance to ask questions like, "How do we determine if a grader operator is proficient?" "How do we know when a proficient grader operator is ready to fight fire?" One employee mentioned, ***"There is a young guy that wanted to go out on the incident. He was not ready. But you know, when you're that age, you're 10 feet high and bullet proof. But he needed more seat time. On a slow moving grass fire, with very little wind, he needs to fall in behind someone who is experienced and watch what we do."***

The interviewees mentioned the importance of developing a standardized training for the use of motor graders during wildland firefighting that is readily available and easy to access. Other topics that surfaced in the interviews included specific use of equipment, Incident Command, PPE, tactics, and communication that are specific to this type of work.

For example, although it is not entirely clear if it was the case in this incident, the tactic of driving through the flames to enter the black as a safety zone is likely counterintuitive and might not dawn on a firefighter if he or she has not received that type of tactical training. In short, these operators reported that they would value training that matched the work they were called to do, especially concerning safety.

Damaged but not destroyed grader that was driven through the flames into the black.



Destroyed grader. It is unclear if the grader entered the black before the burn over.

Our Communication Methods Could Improve

Communication traffic on the emergency management channel was overloaded during this incident. Cell phones and CB radios were used to overcome this obstacle. One grader operator suggested in the future splitting different flanks and portions of the fire onto

separate channels to decrease loading and permit clear communication between units. The District Commissioner suggested the first arriving supervisor assign channels to communicate during incidents. The interviewees mentioned the need to establish communication plans prior to an event to ensure that units will be able to communicate even more clearly and effectively in a timely manner. He recalled learning information about injuries from his wife via cell phone before he heard any messages from dispatch. Although he seemed glad to receive the information, he recognized the need for a more efficient system overall. All units responding should ensure that they check in with the on scene supervisor to establish operation channels and accountability.

A "Communications Field Day" was discussed as a way to bring individual agencies and departments together to establish communication protocols for fire and emergency response. During this exercise, all radios used on incidents could be tested to ensure units can communicate with each other and with local dispatch centers. A list of channels available for fire use can be established and distributed between all units. Dispatch and tactical frequencies can also be selected and all personnel made aware of their proper use.

Situational Awareness and Briefings

Much of the situational awareness that the employees develop daily is informal word of mouth communication. While daily situation reports and firefighter safety briefings may be broadcast across the internet, the information is not accessed and briefed to the employees. The employees have access to information on the web through their personal cell phones, and alerts to extreme conditions are spread to one another while they are gathering in the workshop each morning and across the radio throughout the day.

One lesson learned that emerged through discussions with interviewees was to set up Incident Command training for supervisors and employees and utilize an Incident Commander on incidents. The IC would have the ability to check accountability of all resources and provide basic briefing information to incoming resources on fire behavior, tactics, and safety.

Some interviewees mentioned that they sought out weather reports on their own but they recognized that not everyone did this. To make sure everyone receives this important information, they suggested that the District Commissioner check the Oklahoma Forestry Services website for information and pass it along to them. This information could contain information on both weather and fire behavior. One method would be for the local dispatch center to broadcast this information over the county radio system.

[A note on situational awareness for out-of the-region resources who may fight fire in communities similar to this one: Realize that community members often play a significant role in supporting the work of volunteer firefighters.]

Sometimes, fire operations run more smoothly if the general public steers clear of participating in helping with an incident all together. However, community members who are informed, and able to do so safely may play an important role in supporting firefighting efforts. For example, on the Shaw Fire the following event transpired:

Gary, (grader operator #4) was cutting line nearby on the same fire. He received a call from one of his neighbors who told him that fire was approaching his own home. Although he was concerned, he responded by saying ***"I can't do anything about it because I am currently on a different fire"*** and went back to his task. His neighbors then sprang into action. They opened the gates and let his cattle out. However, they did not just let them roam. They organized their effort and worked together to split the herd into multiple pastures to provide the cattle a safe place to graze because Gary had already lost all of his pasture. Later in the evening, Gary was relieved to find out that his herd was safe although he didn't quite know where all of them had been relocated. He was thankful and touched by his neighbors' sense of community.

"I didn't have to be here. Jack didn't have to be here. Nobody put a gun to our heads and said get in there. It was a personal decision to protect the community."

We should all know more about the resources available for the families of fallen firefighters.

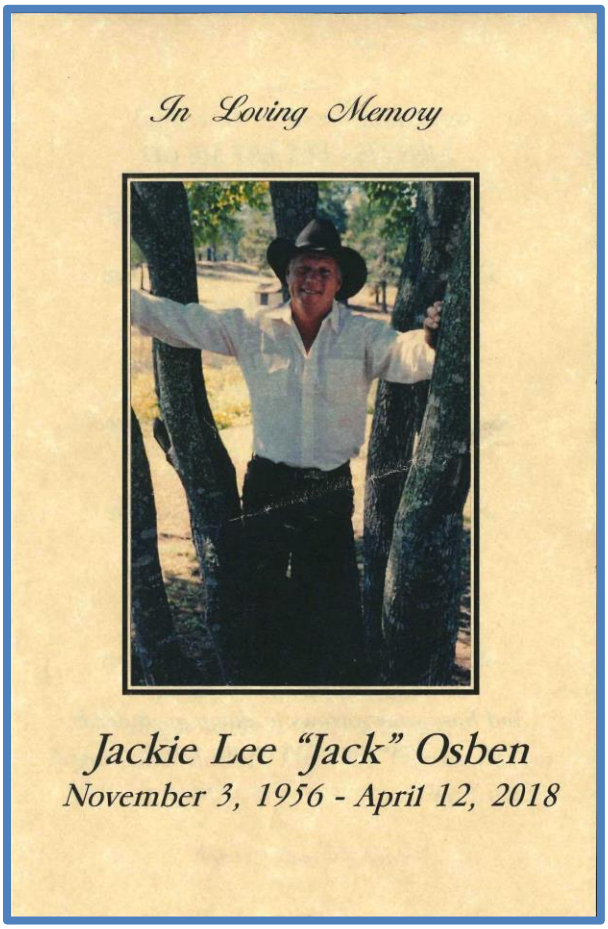
A Lessons Learned from the Learning Review Team

Immediately after an event like this occurs is not the time to begin the process of learning about what resources are available for the families. It is a difficult time for everyone involved, and there are lots of other things to organize and plan. However, families need to receive the right kinds of resources quickly to ensure things are processed properly. Knowing about these resources ahead of time will make it easier to help families and likely decrease the added stress of trying to find them right after an incident.

Although the resources available for fallen firefighters will vary by state and region, these or their equivalent in other states and regions are good places to start:

National Fallen Fighter Foundation
Public Safety Officer's Death Benefit
Wildland Firefighter Foundation
Oklahoma State Firefighters Foundation

4. Epilogue



Jackie Lee "Jack" Osben was born November 3, 1956 in Clovis, New Mexico. He passed away April 12, 2018 at Cheyenne, Oklahoma at the age of 61. Early in his life, Jack drove a tractor trailer as well as working as a ranch hand around the Clovis, New Mexico area where he developed his hard working style and love for animals and the ranching life.

In spite of the long hours that sometimes came with his work, Jack spent a great deal of time enjoying camping and fishing with this family. In 1988, Jack and his family moved to Butler, Oklahoma where he continued to work in farming and ranching. Some of Jack's favorite years were spent working for the Beutler Brothers Rodeo Company of Elk City.

His job with the Beutler Brothers allowed him to spend time riding horses and enjoying the outdoors. In the last few years, Jack had relocated to the Cheyenne community where he worked for the State of Oklahoma Highway Department and was most recently employed with Roger Mills County. When he wasn't working he enjoyed fishing and spending time with family.

[The text of this epilogue is a modified version of Jack's obituary.]

4. Appendices

Appendix I: OFS Firefighter Safety Briefing

Firefighter Safety Briefing for April 12 & 13, 2018

Ominous fire danger will be present both Thursday and Friday with subsequent fire danger remaining firmly in place through the weekend. The Fire Environment will support problematic and extreme fire behavior with potential for historic fire weather to occur over the most significantly drought influenced fuels. A dry line will push firmly into western Oklahoma with temperatures above 90°, single digit relative humidity and very strong southwest winds on Thursday. With minimal moisture recovery in the overnight hours and sustaining strong winds over extremely dry fuels, the burning period will last through Thursday night into Friday morning in the Panhandle, northwest and potentially far western Oklahoma. A cold front will push into northwest Oklahoma progressing through the state during the peak of the burning period.

A Red Flag Warning/Fire Weather Watch is currently in effect. Please refer to http://www.weather.gov/ for the latest updates to the fire weather forecast.

- ***Fire Behavior predictions indicate that attacking the head of any fire - frontal assault should be avoided.***
- ***Establish a Staging Area at the onset of a wildfire incident and designate additional fireline leadership personnel to facilitate span of control and resource accountability.***
- ***Consider predicted rates of fire spread and, if needed, plan evacuation notifications accordingly.***
- ***Forecast wind speeds and gust spread may***

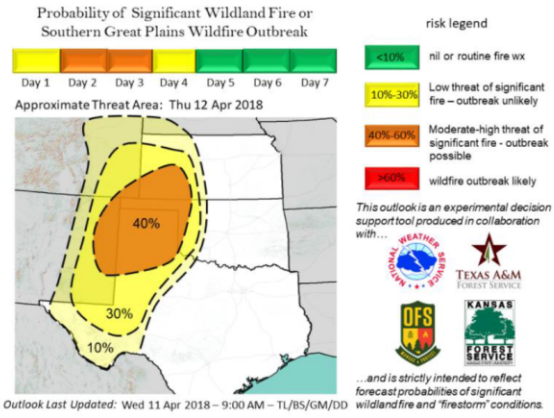
All firefighters are advised to take particular note of the 10 Standard Fire Orders with specific interest in the first three: (a complete list of the Standard Firefighting Orders below)

1. **Keep informed on fire weather conditions and forecasts.**
2. **Know what your fire is doing at all times.**
3. **Base all actions on current and expected behavior of the fire.**

Thursday:

Significant fire danger indices will exist across a broad area of the Southern Great Plains as a dry line pushes into Oklahoma. Temperatures into the mid-90°'s and relative humidity values in the single digits translate into fine-dead fuel moisture values of 2-5% and a probability of ignition approaching 100%. Southwest winds sustained 20-30+ mph will insure that any fire becoming established will likely exhibit extreme rates of fire spread and erratic fire behavior on Sunday. The burning period will last through the night and continue into Friday with poor overnight recovery.

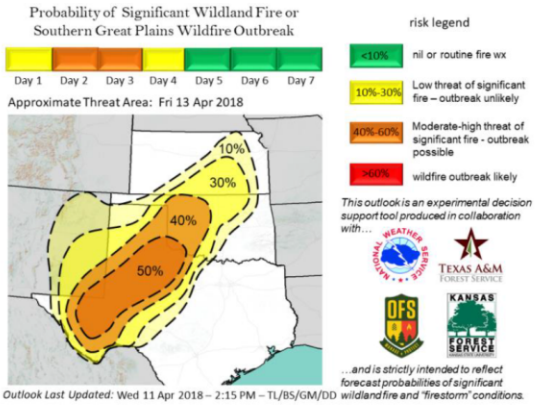
- *Short Grass / Pasture:* Maximum of 170-240 ft./min. (**2.7 mph**), head fire flame length 11 ft.
- *Tall Grass / Prairie:* Maximum of375-500 ft./min. (**5.7 mph**), head fire flame length 18-31 ft.
- *Grass/Shrub/Redcedar:* Maximum of120-190 ft./min, head fire flame length 10-20 ft. (Medium range spotting expected)



(continued)

Friday:

Ominous fire danger indices are expected across a much broader area on Friday in the pre-frontal fire environment. Green up has been delayed with drought impacts and further set back by hard freeze conditions. Very poor overnight moisture recovery will encourage an early burning period ahead of a cold front that will pass during the peak of the burning period and effectively push the fire threat eastward. Fuels will be very receptive given the depth of drying in previous days. Southwest winds sustained as high as 35+mph with gusts nearing 50 mph will shift clockwise to the northwest with the passage of a cold front. Extreme fire danger will progress into and east of the I-44 corridor ahead of the cold front. Again, problematic fire behavior and extreme rates of fire spread are expected along with a change in direction of fire spread.



- *Short Grass / Pasture:* Maximum of 190-270 ft./min. (**3.1 mph**), head fire flame length 10-12 ft.
- *Tall Grass / Prairie:* Maximum of375-600 ft./min. (**6.8 mph**), head fire flame length 18-35 ft.
- *Grass/Shrub/Redcedar:* Maximum of120-190 ft./min, head fire flame length 10-20 ft. (Medium range spotting expected)

Anchor the fire at advantageous point (road, creek, cold black) and flank the fire if utilizing direct firefighting tactics. Work the fire from the black if possible to provide for quick escape to a safety zone. Avoid placing yourselves in a situation where unburned fuel is between you and the fire. If protecting structures insure that ingress and egress are identified, escape routes and safety zones are identified and equipment is pointed in a direction to facilitate rapid escape. Establish trigger points for evaluating tactics and develop contingency plans should the primary plan not be successful.

All firefighters are advised to take particular note of the 10 Standard Fire Orders with specific interest in the first three: (a complete list of the Standard Firefighting Orders below)

4. **Keep informed on fire weather conditions and forecasts.**
5. **Know what your fire is doing at all times.**
6. **Base all actions on current and expected behavior of the fire.**

Resources:

- Oklahoma Forestry Services will have multiple Task Forces prepositioned in Western, Northwestern and along the I-35 corridor.
- USFS cooperating with OFS will have aviation resources available.
- National Guard will have aircraft available.
- County Wildland Task Force Resources should be prepared for mobilization.

To request assistance, call the Resource Hotline (800) 800-2481

Four common denominators of fire behavior on tragedy fires:

1. On relatively small fires or deceptively quiet areas of large fires.
2. In relatively light fuels, such as grass, herbs, and light brush.
3. When there is an unexpected shift in wind direction or wind speed.
4. When fire responds to topographic conditions and runs uphill. Alignment of topography and wind during the burning period should always be considered a trigger point to re-evaluate strategy and tactics.

Appendix II: OFS Fire Situation Report

Fire Situation Report – April 12, 2018

Oklahoma Department of Agriculture, Food and Forestry - Forestry Services

PROTECTION AREA STATISTICS* for Reporting Period 0800 04/11/18 thru 0800 04/12/18

NE Area – ***9 Fires Burned 325.25 Acres (5-Incendiary, 4-Escaped Debris)***
EC Area – ***2 Fires Burned 503 Acres (2-Incendiary)***
SE Area – ***1 Fire Burned 6 Acres (1-Incendiary)***

Large / Significant Fire Activity within the Protection Area:

- ***West Liberty Fire (Haskell County) – 418 Acres / 70% Contained***
- ***Pine Springs Ranch (Cherokee County – 200 (Est) / 50% Contained***

Fire Activity with OFS Response outside of the Protection Area:

- **5 Fires Burned 1,227 Acres**
- ***Brake Road Fire (Kay County) – 400 Acres (Est) / 50% Contained***
- ***Hwy 11 Fire (Kay County – 350 Acres (Est) / 75% Contained***

OFS Prescribed Fire Activity: ***No New activity***

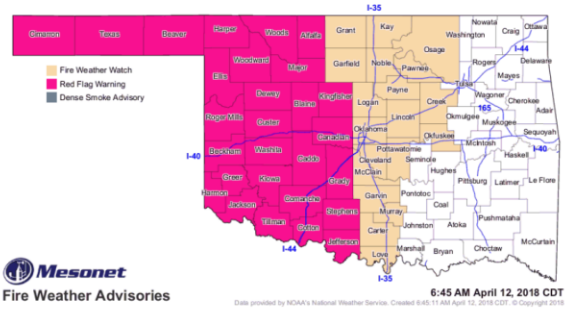
FIRE DEPARTMENT STATISTICS from www.firereporting.ok.gov recorded on 04/11/18 thru 04/12/18

- ***1 Fire Burned 12 Acres (1-Escaped Debris) Tecumseh FD Reporting***

Statewide Discussion:

Extreme fire danger today in the western one-third of Oklahoma with very-high fire danger indices well into the central core of the state are expected today. The burning period will likely extend through the night into Friday morning across the Panhandle, northwest and extreme western counties setting the stage for more widespread extreme fire danger on Friday in advance of a cold front. Conditions across western Oklahoma are expected to only moderate somewhat with frontal passage only to climb again through the weekend and into next week.

A Red Flag Warning is in effect for a large portion of the western half of Oklahoma – generally along and west of US 81 - with critical fire weather indices continuing well into the nighttime hours. Temperatures will soar into the 90°'s across much of the warned area nearing 100° in southwest Oklahoma along with relative humidity values 5% in the Panhandle, 6-10% along the western tier of counties and 20-30% along the I-35 corridor. Fine-dead fuel moisture values will range from 2-5% across the area with near 100% Probability of Ignition. Extreme rates of fire spread will be evident on any fire that becomes established in dormant fuels with what little green up that has developed in the drought stricken area serving as little to no benefit. Southwest winds will be sustained 20-30 mph with areas gusting around 50 mph at times driving rates of spread in dormant grass fuels in excess of 400 ft/min where fuels and topography are aligned with winds.



Very poor overnight moisture recovery, sustained strong winds and accelerated drying of fuels will facilitate a burning period that extends through the nighttime hours in the Panhandle, northwest and extreme western Oklahoma. A much broader area of concern will be present on Friday along with a cold front expected to impact the state during the peak burning period. Fire danger will be greatest tomorrow both in advance of the cold front in western Oklahoma and then driving east ahead of the frontal boundary supporting potential for extreme fire behavior east of I-35.

In the wake of the cold front we are expecting cooler temperatures and elevating relative humidity values, however respectable burning conditions will remain in place with several indications of escalating fire danger in successive days into early next week.

Resources: Resource Hotline (800) 800-2481

3 – OFS Task Forces (Woodward/Weatherford/Guthrie)
1 - OHP/OFS Aerial Observation Platform
1 – Air Attack Platform
2 - Type 1 Helicopters
2 – National Guard Helicopters
** **County Wildland Task Forces should be prepared for mobilization****

(continued)

Burn Ban Status:

RED = *Governor's Burn Ban*
YELLOW = *County Burn Ban*

For the most current information on Burn Bans click on the following link: http://www.forestry.ok.gov/burn-ban-info

Remember... *ONLY YOU can prevent wildfires! Enjoy Oklahoma's wildlands responsibly.*
Report any suspicious wildland fire activity on the
Arson Tip Line: 1-866-662-7766 (1-866-NO ARSON).
Prepared by: Drew Daily, Fire Staff Forester, Oklahoma Forestry Services – ODAFF

Appendix III: Fire Behavior Forecast, Rhea Fire

FIRE BEHAVIOR FORECAST

FORECAST NUMBER: 3	**TYPE OF FIRE:** Wildfire
FIRE NAME: Rhea	**OPERATIONAL PERIOD:** 04/18/2018 Day
DATE ISSUED: 04/17/2018	**TIME ISSUED: 1700**
UNIT: Oklahoma Forestry Service	**SIGNED:** /s/ *David L Greathouse* **Typed/printed:** David Greathouse - FBAN

WEATHER:

*****RED FLAG WARNING FROM 1100 – 2400 TODAY*****

See spot weather forecast for Details

Seiling Weather Station

Putnam Weather Station

Weather Watchout's – Temperatures greater than 70°, Relative Humidity less than 20%, Winds 20mph

FUELS:

The primary fuel in the fire area are tall grass with some brush intermixed on the flats and Juniper mixed with grass in the canyons The fuels in this area are very dry. Extreme to exceptional drought covers much of this area as it has been over 100 days since significant rain has fallen. Current ERC's are above the 97th percentile and fuel moistures are critically low. These conditions, can cause explosive fire growth when aligned with critical fire weather. Green Wheat fields may be suitable safety zones during times of cooler temps and higher RH's. However, they could be compromised as the day progress'. Active fire behavior through these fields have been observed during initial attack

Do not underestimate the potential of these fuels and do not get in front of the flaming front!

FIRE BEHAVIOR:

Another heads-up day for fire behavior!! Fires will establish themselves quickly in receptive fuels All easterly and southerly flanks will be exposed to the wind. Expect torching and crown fire runs in the Juniper. Downwind spotting up to ½ mile is probable. The probability of ignition is 75%.

Expect burning conditions to increase around mid-day, with peak burning conditions occurring late afternoon / early evening.

Todays Modeled Fire Potential (Head Fire)

	Rate of Spread	Flame Lengths
Short Grass	1-2 mph	5-7'
Tall Grass	2-4 mph	10-12'
Juniper	1-3 mph	10-12'

Rule of thumb: Flame lengths on the flanks are generally half of the head

Remember: Wind gusts and slope can dramatically increase rates of spread and flame lengths

AIR OPERATIONS:

Gusty winds and smoke could impede air operations today
Sunrise: 0657 Sunset:2010

SAFETY:

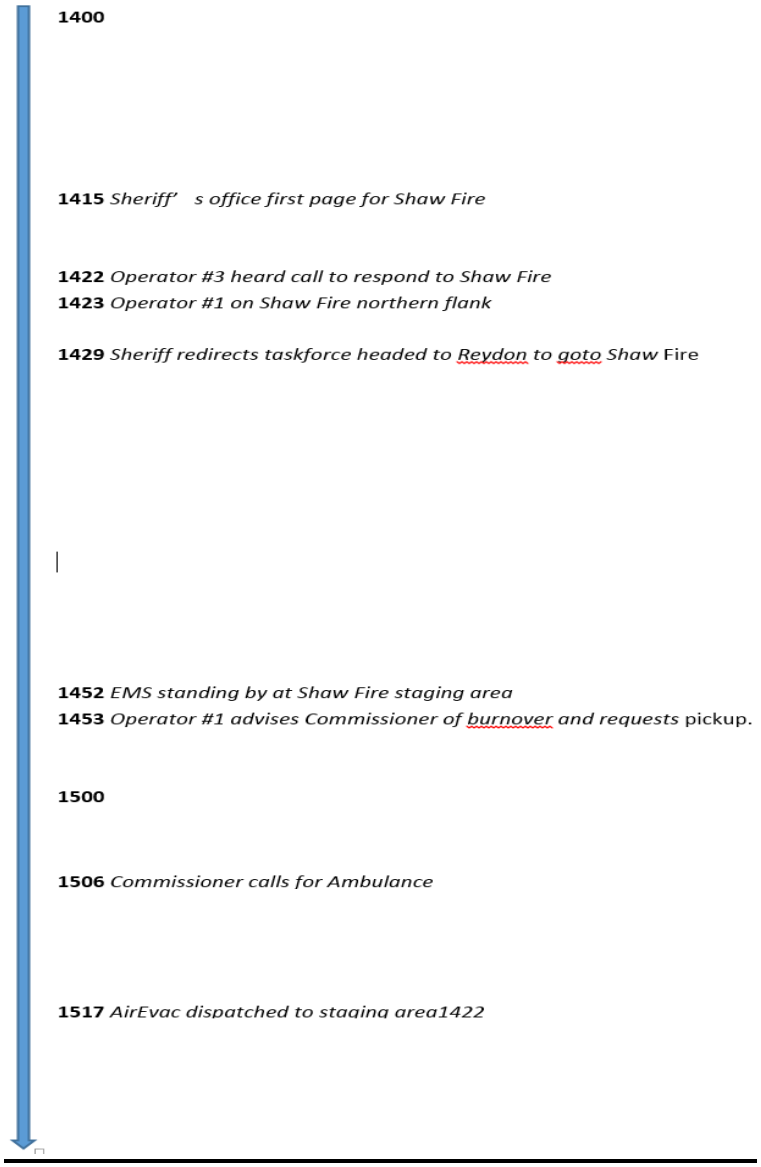
Know where your safety zones are at all times! Use good black as a safety zone when possible.

Appendix IV: Cheyenne Mesonet Station Report

Shaw Fire
Fire Weather and Fuels Information - Cheyenne Mesonet Station
12 April 2018

DATE / TIME	TAIR (°F)	RELH (%)	WSPD (mph)	RAIN_ 24H (in)	BI	SC	ERC	IC (%)	1-HR (%)	10-HR (%)	100-HR (%)	1000-HR (%)	HERB (%)	WOODY (%)	SOIL MOISTURE (%)	KBDI
Thu Apr 12, 2018 11:00 pm CDT	83	12	15	0	79	190	6	81	3	4	8	7	16	77	14	353
Thu Apr 12, 2018 10:00 pm CDT	87	10	17	0	84	208	7	85	2	4	8	7	16	77	14	353
Thu Apr 12, 2018 9:00 pm CDT	88	9	20	0	90	229	7	90	2	4	8	7	16	77	14	353
Thu Apr 12, 2018 8:00 pm CDT	91	7	17	0	96	256	7	95	2	4	8	7	16	77	14	353
Thu Apr 12, 2018 7:00 pm CDT	96	5	20	0	101	278	8	100	2	4	8	7	16	77	14	353
Thu Apr 12, 2018 6:00 pm CDT	98	4	22	0	101	274	8	100	2	5	8	7	16	77	14	353
Thu Apr 12, 2018 5:00 pm CDT	98	5	22	0	98	262	7	98	2	5	8	7	16	77	14	353
Thu Apr 12, 2018 4:00 pm CDT	98	5	25	0	92	237	7	94	2	5	8	7	16	77	14	343
Thu Apr 12, 2018 3:00 pm CDT	98	5	25	0	81	197	7	86	3	5	8	7	16	77	14	343
Thu Apr 12, 2018 2:00 pm CDT	97	7	24	0	67	151	6	68	3	6	8	7	16	77	14	343
Thu Apr 12, 2018 1:00 pm CDT	90	17	20	0	57	123	5	52	4	6	9	7	16	77	14	343
Thu Apr 12, 2018 12:00 pm CDT	83	24	20	0	51	109	4	41	5	7	9	7	16	77	14	343
Thu Apr 12, 2018 11:00 am CDT	77	34	23	0	45	98	4	32	6	8	9	7	16	77	14	343
Thu Apr 12, 2018 10:00 am CDT	71	43	23	0	39	91	3	24	8	8	9	7	16	77	14	343
Thu Apr 12, 2018 9:00 am CDT	66	51	23	0	35	84	2	19	8	9	10	7	16	77	14	343
Thu Apr 12, 2018 8:00 am CDT	62	54	21	0	34	82	2	18	9	9	10	7	16	77	14	343
Thu Apr 12, 2018 7:00 am CDT	62	55	23	0	36	86	3	20	8	8	10	7	16	77	14	343
Thu Apr 12, 2018 6:00 am CDT	64	49	23	0	39	90	3	23	8	8	10	7	16	77	14	343
Thu Apr 12, 2018 5:00 am CDT	65	46	21	0	41	93	3	26	7	8	10	7	16	77	14	343
Thu Apr 12, 2018 4:00 am CDT	68	43	20	0	43	96	3	28	7	7	10	7	16	77	14	343
Thu Apr 12, 2018 3:00 am CDT	68	41	20	0	44	97	3	29	7	7	10	7	16	77	14	343
Thu Apr 12, 2018 2:00 am CDT	68	40	21	0	45	99	4	31	6	7	10	7	16	77	14	343
Thu Apr 12, 2018 1:00 am CDT	70	37	21	0	46	101	4	33	6	7	10	7	16	77	14	343
Thu Apr 12, 2018 12:00 am CDT	71	36	21	0	48	103	4	35	6	7	10	7	16	77	14	343

Appendix V: Incident Timeline



Appendix VI: Tactical Sequence of Events

On April 12, a private citizen reported a wildfire. At approximately 1415, county dispatch alerted local fire departments and county transportations crews (grader operators). These operators were each working in their assigned areas, and immediately began driving to the fire.

Grader operator #1 reached the area first, saw that the fire had just crossed Oklahoma Highway 30 and was spreading rapidly to the northeast. He intercepted the fire on the east side of the highway, near the intersection with E0850 Road. The operator found an accessible place to breach the barbed wire fence just west of a residence on the E0850 Road. Operator #1 anchored into the E0850 Road (point A on map) and began plowing initial grader line to the northeast on the right flank of the fire, approximately 50' away from the flames. Operator #1 reported that the grader was operating at approximately 28 mph as he began line construction. After progressing approximately .10 miles, Operator # 1 saw Operator #2 approaching from the east. Operator #2 initially began constructing line parallel to the line established by the initial grader. Operator #1 contacted Operator #2 via CB radio with instructions to get behind him and roll the berm created with his initial line, improving it with progressive line construction. Both Operators continued northeast along the right flank, passing through a tree line and into the grass field to the north.

After paralleling the flank for approximately .75 miles in tandem with Operator #2, Operator #1 realized that the heat inside of the grader cab had intensified and that the fire had crossed the grader line to his rear, and was between his position and Operator #2. Operator #1 lifted his moldboard and continued northeast until his grader derated (limp mode), and felt flames flashover his grader. After sheltering in the cab during the initial wave of flames, Operator #1 noted that the grader was still running and shifted into reverse without touching the steering wheel due to the extreme heat. The grader reversed through the flaming front in a counter-clockwise arc, coming to rest with the rear ripping points near the berm of the initial grader line.

Operator #1 exited his grader and began walking away from the fire, and realized he was on the initial grader line.

Specific actions taken by Operator #2 are unknown, but at some point his grader initiated a right turn and was overcome by the flaming front. The grader came to rest facing southeast, approximately .13 miles southeast from where Operator #1 exited his grader.

Operator #2 exited the grader and began walking west, where he encountered Operator #1 (point B on map). Operator #1 assisted Operator #2, and contacted his supervisor via cell phone, and both operators were picked up by the County Commissioner and driven to meet with an ambulance nearby.

Appendix VII: FLA Team

The FLA Team for the Shaw Fire consisted of four members:

J. R. "Red" Anderson (Team Lead)
Staff Officer, Fire, Lands & Planning
United States Department of Agriculture
Forest Service
Francis Marion & Sumter National Forests

Darryl Jones (Subject Matter Expert)
Forest Protection Chief
South Carolina Forestry Commission

Steven Counts (Subject Matter Expert)
Assistant Fire Chief-OPS
Virginia Department of Forestry

Rebekah L. Fox, PhD (Writer/Editor)
Associate Professor of Communication Studies
Texas State University
San Marcos, Texas

5. Acknowledgements

Our FLA Team would like to acknowledge the transportation workers and shop crew for their willingness to participate in this process and for their warm reception of this team. We would like to recognize the Black Kettle National Grassland Forest Service for generously providing us with working space in their Ranger Station, local knowledge, and other resources. We also would like to express appreciation to all the employees of the Oklahoma Forestry Services for their support in developing this FLA.