



Davis 5 Prescribed Fire Escaped Fire Review

Helena National Forest
August 25, 2010



Lincoln Ranger District
Lincoln, Montana

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EXECUTIVE SUMMARY

On Wednesday August 25, 2010, the Davis 5 Prescribed Fire was ignited southeast of the town of Lincoln, MT. Several spot fires occurred outside of the burn unit that afternoon. One of the spot fires made a run of about 20 acres before lying down. The next morning crews were in the process of controlling the largest spot fire and gridding for additional spots. At about 1300 hours a spot fire that had not been staffed started torching trees and rapidly became established beyond the capacity for control by ground forces resulting in an escape and a subsequent conversion to wildfire.

The Northern Region Regional Forester convened a review team to review key factors leading to the escape and subsequent wildfire declaration. The Review Team interviewed personnel associated with the implementation of the burn, and reviewed and examined the written record of events and actions leading up to the escape.



Figure 1. Davis Fire Vicinity Map.

The Review Team found six factors contributing to the escape of the prescribed fire and the conversion to wildfire. These six are:

- **Awareness of potential prescribed fire complexity-** As a group there may not have been recognition of a low probability, high consequence event for this prescribed fire.
- **Fuel type differences inside and outside the planned burn unit** -The Davis 5 Prescribed Fire Plan does not address the abundance of subalpine fir inside and outside of the unit and does not include a discussion of the associated spotting potential and probability of ignition.
- **Spot Forecasts** - The winds predicted in the Spot Weather Forecast changed between the forecast received the afternoon on August 24th and immediately prior to ignitions on August 25th. The prescribed fire personnel stated they did not note any differences between the two forecasts.
- **Weather/ Fuels Conditions** - Weather conditions crossed a critical threshold for the torching of subalpine fir and as the winds shifted from upslope to a westerly direction a number of embers spotted outside of the unit.
- **Other environmental conditions** - The saddle in the southern part of the unit, the proximity of the fuels to the boundary, and the slash in the last mixed timber stand to burn in the burn unit contributed to the escape of the prescribed fire.
- **Compressed timeframe to complete the project** - Given the fire weather watch that escalated into a red flag warning, there was little opportunity for error or course correction when spots occurred.

Recommendations from the Review Team include:

- Consider different ignition tools and patterns,
- More thorough discussion on the variables and effects of spot weather forecasts should occur,
- Improve specificity and clarity of the burn plans,
- Ensure delegations of authorities are in place,
- Ensure documentation is thorough and complete pre, during, and post prescribed fires,
- Consider using principles and practices associated with High Reliability Organizations,

- Improve the public outreach to include the media, cooperators, partners, etc...,
- Improve training and qualifications for Line Officers.
- Explore additional research/modeling into fire spread in subalpine fir crowns and “red and dead” lodgepole.

Acronyms and terms used in this report are defined in the glossary at the end of the document.

INTRODUCTION

The Helena National Forest straddles the continental divide in central Montana. The Forest includes three Ranger Districts. The Lincoln Ranger District is the northern most Ranger District on the Forest. The District Office is located in the town of Lincoln in the approximate geographic center of the Ranger District. The District is essentially the Blackfoot River drainage, bisected by Montana Highway 200.

Throughout the Lincoln Ranger District forest vegetation has increased in coverage with tree encroachment into meadows and increases in density, i.e., the number of trees per acre. In addition there are a number of insect and disease outbreaks active in the area. In some locations lodgepole pine stands are dominated by red-needled trees recently killed by the mountain pine beetle. In other locations Douglas fir stands are dominated by red-needled recently killed trees. In both situations the stands often include an abundance of trees dead for several years that have lost all of their needles. There is a growing need to implement fuel reduction, and forest health measures that will decrease the risk of high intensity stand-replacement wildland fire occurrence, limit potential for spread of wildland fire onto private property, and decrease firefighter exposure and risk to public safety during wildland fire situations and establish younger more insect and disease resistant forest stands.

In response to this situation, the Lincoln Ranger District has been implementing fuels reduction projects including prescribed burning for several years, with even more projects entering the planning phase.

These actions are not inconsistent with goals and objectives outlined in the Helena National Forest, Forest Plan (Helena NF 1986). The actions planned have been analyzed and the environmental effects of these actions documented in the appropriate environmental analysis document. Each specific analysis typically identifies very specific goals and objectives for the project area.



Photo 1. Picture of the “red and dead” on the Helena National Forest.

BACKGROUND and OBJECTIVES

Background

The Davis 5 Prescribed Fire Plan was developed by the Lincoln Ranger District to increase the quality and quantity of grasses, preserve white bark pine, and to minimize the risk, severity and extent of wildfires within the Poorman Project area (Figure 3). The Poorman planning area encompasses approximately 31,000 acres of National Forest System lands, including lands adjacent to private property. The project area encompasses all of the Poorman Creek drainage, all of the Humbug Creek drainage, a portion of the Bear Creek and Gould Creek drainages east of Granite Butte, and a portion of the Willow Creek drainage adjacent to Fields Gulch of Poorman Creek.

The Davis Prescribed Fire unit is located in T13 N, R7 W, Sections 16, 21, and 22, approximately 11 miles southeast of the town of Lincoln. The prescribed fire area includes a Research Natural Area and spans the Continental Divide National Scenic Trail. The Davis 5 Prescribed Fire is in the MT Fish, Wildlife and Parks Hunting Unit 293.

Prescribed Fire Objectives

The Davis 5 Prescribed Fire, a unit under the scope of the Poorman Project, is consistent with and designed to accomplish objectives stated in the National Fire Plan (USDA/USDI 2000), the Helena National Forest Plan (Helena NF 1986), and the Poorman Project Environmental Impact Statement (Helena NF 1997-98).

Objectives of the National Fire Plan include:

- Reduce the total number of acres at risk to severe wildfire.
- Expand and improve integration of the hazardous fuels management program to reduce severe wildfires to protect communities and the environment.

The Helena Forest Plan provides direction that states, "Provide a fire protection and use program which is responsive to land and resource management goals and objectives." The Plan contains the following direction relating to the proposed project:

- Use prescribed fire to maintain healthy and dynamically stable ecosystems that are inherently fire dependent.
- Manipulate vegetation for the benefit of timber, wildlife, and range management.
- Reduce the potential for damaging wildfire.
- Encourage prescribed fire burning to reduce conifer encroachment.
- Perpetuate the natural diversity of plant communities.

For the Poorman Project, the Lincoln Ranger District proposed to conduct pre-commercial thinning, regeneration thinning and harvest, commercial thinning, and prescribed burning in pre-identified areas. The Poorman Project Environmental Impact Statement includes direction related to the proposed burn including reducing the risk of large fires and improving the health of forested stands and sustaining desired ecosystems.

Actions taken in the Davis 5 Prescribed Fire were intended to increase the vigor, palatability and availability of grasses and abundance of white-bark pine in the continental divide system, reduce encroachment of conifers into white-bark pine stands, minimize the risk and severity of wildfires, and

to open existing meadows around white-bark stands. The following objectives were identified for the Davis 5 Prescribed Fire Plan:

- Increase the amount of native grasses and shrubs desirable for wildlife.
- Reduce conifer encroachment in the existing meadow.
- Remove most of small diameter latter fuels in areas where mature conifers are not currently present.
- Reduce the density of the dominate tree canopy.

Additional information is available in the Davis 5 Prescribed Fire Plan (Helena NF 2009).

REVIEW PROCESS

Requirements

Forest Service Manual 5140.42 (Forest Service 2008) states that Forest Supervisors are responsible for, "conducting reviews of all prescribed fires that are converted to wildfire status," and for "reporting the review results to the Regional Forester within 60 days after the prescribed fire was declared a wildfire". The goal of this requirement is to guide future program actions by minimizing future resource damage and/or preventing future escapes from occurring by gathering knowledge and insight for incorporation into resource management and prescribed fire planning.

Consistent with this requirement, the Northern Region Regional Forester convened a team of five people to conduct a review of the Davis 5 Prescribed Fire. The number of individuals assigned to the team and their functional expertise were commensurate with the scope and focus of the review. The Review Team consisted of:

Allen Rowley	Team Leader	Forest Supervisor Fishlake National Forest Richfield, Utah
Gary Brown	Team Member	Forest Fire Staff Officer Payette National Forest McCall, Idaho
Jennifer Martynuik	Team Member	Missoula Smokejumper Region 1 Missoula, Montana
Bruce Suenram	Team Member	Deputy Chief – Fire & Aviation Management Montana Department of Natural Resources and Conservation Missoula, Montana
Ken Schmid	Team Member	Assistant State Fire Management Officer Montana/Dakota's Bureau of Land Management Billings, Montana
Ashley Snellman	Forest Liaison	Acting Executive Assistant Helena National Forest Helena, MT

The Review Team spent September 1-5, 2010, interviewing key personnel, examining planning, decision-making processes, and reviewing materials relevant to the implementation of the Davis 5 Prescribed Fire. The Review Team interviewed personnel associated with the implementation of the

burn, and reviewed written documentation of events and actions leading up to the declaration of the prescribed fire as a wildfire.

The level and scope of the review were consistent with agency policy as stated in FSM 5140.42 (Forest Service 2008) and the Interagency Prescribed Fire Planning and Implementation Procedures Guide (NWCG 2008).

Review Objectives

The objectives of this review were developed from: guidance in the Regional Forester Delegation of Authority to the Review Team Leader; FSM 5100, Chapter 5140 (Forest Service 2008); the Interagency Standards for Fire and Fire Aviation Operations (USDI/USDA 2010); and the Interagency Prescribed Fire Planning and Implementation Procedures Guide (NWCG 2008). These objectives were to:

- Review the seasonal severity, weather events, and on-site conditions leading up to the wildfire declaration.
- Determine if the Prescribed Fire Plan was adequate for the project and complied with policy and guidance related to prescribe fire planning and implementation.
- Determine if the prescribed fire prescription set forth in the Prescribed Fire Plan was adequate.
- Determine if the prescription, actions, and procedures set forth in the Prescribed Fire Plan were followed.
- Determine if the approving line officer's qualifications, experience, and involvement met required standards.
- Determine if the qualifications and experience of key personnel involved met required standards.
- Determine the level of awareness and the understanding of the personnel involved, in regard to procedures and guidance.
- Identify and document factors that contributed to the escape.

Synopsis of Events Leading up to Wildfire Declaration for the Davis Prescribed Fire

Preparation for burning the Davis 5 Unit began in 2008 when some small diameter trees were cut and slashed to reduce ladder fuels in the unit. In April of 2010 some of the piles from the slashing and some of the grass along the eastern boundary of the unit were burned where snow was not present. Because of snow in the area, the rest of the unit was not burned in April.

On August 18, the District FMO and District AFMO began discussions about burning the Davis 5 Unit in the future, possibly in the next week or two. It was decided they needed to check the fuel moistures in the unit and fire crews could clear out any previously constructed control lines. The initial thoughts were that because of the amount of rain received in the area during the month of August the unit may be too wet and still too green to burn. It should be noted that during the month of August the District did not have a single wildfire.

On Monday, August 23, the District FMO began discussions with the District Ranger on the possibility of burning the unit should the fuel moistures and weather be within the prescriptions as written in the burn plan. Initial contacts were made with neighboring resources to check on availability during the week to assist with the burn and as contingency resources should the decision to burn the unit be made. The District FMO discussed with the Forest AFMO the possibility of burning the unit. The Forest

AFMO let the District FMO know he would speak with the regional fuels specialist to see if there were any issues with conducting the burn should the unit be in prescription. Dead fuel moistures taken from the unit on Monday, August 23rd were within the burn plan parameters.

On Tuesday, August 24th, spot weather forecast for the unit indicated favorable conditions to achieve objectives may be present on Wednesday, August 25th. The same forecast also called for strong winds, low relative humidity, and warm temperatures on Thursday, which would exceed the parameters in the burn plan. A fire weather watch was issued for Thursday afternoon through Thursday evening followed by a cold front bringing cooler temperatures, strong winds, and a potential for rain. The District FMO contacted the National Weather Service and discussed with a meteorologist the conditions for the next several days. Communications with the NWS verified increased chances of rain, especially for Saturday and Sunday. Although it was August, resources were available both within and outside of the forest because of little fire activity. The District FMO discussed with the acting Forest FMO the burn unit, the burn plan, the availability of resources, weather window for Wednesday, fuel moistures, and cooler temperatures and precipitation forecasted following Thursday.

In order to mitigate concerns with the eastern edge of the unit, the burn boundary was moved from timber to a two-track road on the ridge above the eastern edge of the unit. This would create a buffer of grass and the two-track road between the planned ignition and the timber outside of the burn unit. Given the size of the unit, roads on the boundaries, the weather window, availability of resources, and fuel moistures both FMO's agreed the unit could be burned on Wednesday. The District FMO met with the District Ranger to go over resources, weather, and the plan to burn the unit. A decision was made to proceed with the burn for Wednesday. Resources were notified of the plan to burn the unit on Wednesday. The Forest FMO and District FMO agreed the District had the ability to complete the prescribed fire before the fire weather watch on Thursday. Both individuals expected minimal problems with containment of any undesired fire and subsequently commenced with planning operations.

On Wednesday August 25, all personnel were briefed by 0800 at the Lincoln Ranger District. An overall objective for the day was to complete the prescribed fire on Wednesday well before forecasted fire weather watch conditions developed for Thursday August 26. To mitigate any potential holding issues, additional personnel were included in the prescribed fire operations. In total, two type 4 engines, four type 6 engines, and a total of 33 people were involved in executing the prescribed fire. A spot weather forecast was obtained prior to ignition of the test fire. The spot forecast called for conditions, which could approach or possibly exceed the burn prescription parameters. As part of standard procedures for any prescribed fire, on site weather observations were taken hourly and broadcast by hand-held radio to all personnel. The monitoring on-site conditions allowed for comparison to spot weather forecasts, a routine activity performed on prescribed fires.

The ignition plan was to burn the grass along the eastern edge of the unit creating a buffer before igniting the mixed subalpine fir and lodgepole timber, which was further away from the eastern boundary. Hand ignition with drip torches was used to create a backing fire by igniters. A test fire was ignited at 1045 in the middle of the unit. The test burn only carried in grass that had not burned during the spring prescribed fire. The test fire burned with a slow rate of spread, low flame heights, and presented no difficult holding issues.

The decision was made by on-site personnel to continue with hand firing the unit, with one burn team



Photo 2. Initial test fire burn on the eastern boundary in the middle of the unit.

heading south and one burn team heading north. Because the grass did not present any holding problems, the burn team heading to the south proceeded into the timber to assess if the pine litter would carry any fire. The burn team heading north continued mainly in the grass. From 1045 hours until 1330 hours it was noted prescribed fire objectives were not being achieved as it was difficult to get fire to carry in the grass or in the timber litter. Prescribed fire personnel observed, at 1330 hours, the grass and timber began to burn slightly better than previously observed. As the burn team heading south reached a small bench near a saddle on the southern portion of the burn unit, they continued their ignition pattern in a small stand of mixed conifer which contained some slash litter from previous thinning activities.

Around 1400 hours, the burn team heading south noted that the wind switched from light winds blowing uphill to a stronger wind from a westerly direction. This wind shift increased fire activity into the canopy of the mixed conifers the burn crew was igniting, sending embers ahead of the crew. The burn team ceased firing and moved out of the way of the fire now moving into the canopy. The smoke column, which had been rising straight up, was now leaning over the saddle. The holding crew started picking up spot fires in the grass near the unit boundary and in front of the igniters. The small stand of mixed conifers in the burn unit was now actively burning in the crowns. Ignition was stopped by the Firing Boss and the ignition crew began to assist in containing spots as the falling embers landed near the boundary of the unit. A spot fire outside of the boundary in heavy mixed conifer moved into the canopy and actively torched in the trees making a small run downhill away from the burn unit. The Review Team refers to this spot as Spot #1. As the fire moved downhill away from the unit, it made a turn to the south and moved uphill. Numerous other small spots were observed outside of the unit. Suppression actions were initiated to respond to all of the known spot fires. All resources began suppression actions on the spot fires outside of the unit except one engine which remained in the northern part of the unit to maintain holding. Two additional contingency engines were ordered to assist in suppression efforts. No additional ignitions occurred in the prescribed fire unit on Wednesday after Spot #1 was established.

By 1600 hours, the most active spot fire, Spot #1, which had burned an estimated 20 acres calmed down. Efforts were made to contain this and other spots outside of the unit. Before fire suppression resources departed for the night, saw line and a hose lay were completed around all but approximately 400 feet of the perimeter. The fire activity was diminishing for the day, no fire runs were occurring, and the most active area of burning was now only smoldering in dead and down woody materials concentrations, it was believed that additional spot fires may surface the next day. Additional resources were requested for the following day. Because of the potential for unmitigated hazard trees falling over during the night, the decision was made for firefighter safety concerns that no resources would remain on the spot fires overnight. By 2200 hours all resources left the area and the plan was to return in the morning.



Photo 3. Spot #2 as it moved into the canopy resulting in the declaration of a wildfire. Spot #1 can be seen in the background.

On August 26th a briefing was held at 0700 in Lincoln with resources assigned to the unit and spot fires. The plan was to split the resources into two divisions to concentrate on Spot #1 and locate and suppress any additional spots. No additional ignition was planned or occurred on August 26th in the prescribed fire unit. Additional resources ordered for the day included one type 3 helicopter with crew, 3 engines, 3 water tenders, and miscellaneous overhead. A total of approximately 70 people were on scene at the unit and spot fires, staffing 9 engines, 3 water tenders, 1 helicopter, a 30 person crew, and overhead. By 0800 hours resources were

arriving on scene and suppression efforts focused on completing saw line and hose lays around Spot #1 and gridding for new spots. By 1200 hours the suppression resources had hose line and saw line around Spot #1 and crews were gridding and suppressing additional spots as they occurred without any significant flare-ups or problems.

Around 1300 hours a holdover from August 25th, referred to as Spot #2, quickly developed before resources could engage in suppression. Spot #2 quickly transitioned into a crown fire and continued to move northeast into unburned fuels. Suppression resources briefly disengaged to reassess the emerging situation and for safety considerations. The situation was reported to the Helena District Ranger. At 1313 hours Helena Dispatch was notified that the prescribed fire was being declared a wildfire. An Incident Commander was assigned from the suppression resources and assumed oversight of the incident. On site resources continued with suppression efforts. Air tankers, helicopters, and additional resources were ordered through dispatch. At 1427 hours, a Type 2 Incident Management Team was ordered for the escaped fire. By nightfall the fire was estimated at over 1,600 acres on federal land and 450 acres on private lands involving multiple landowners. Approximately 22 structures were evacuated on the afternoon and evening of August 26th.



Photo 4. Photo of Spot #1 and wildfire from Spot #2.

FINDINGS

Information presented in this section may not necessarily identify all areas in prescribed fire planning and implementation where improvements are possible. The Review Team was tasked with addressing specific elements for the review of a prescribed fire which was declared a wildfire. (*Forest Service Manual 5100 Fire Management, Chapter 5142*). The timeframe involved with this review ends once the prescribed burn was considered an escape and declared a wildfire and transitioned to the Type 2 Incident Management Team (IMT); none of the actions implemented during suppression of the fire by the IMT are addressed in this report.

The following eight elements are discussed in this section:

- Seasonal severity, weather events, and on-site conditions leading up to the wildfire declaration.
- Adequacy of the Prescribed Fire Plan for the project and compliance with policy and guidance related to prescribed fire planning and implementation.
- Adequacy of the prescribed fire prescription.
- Compliance and consistency with the prescription, actions, and procedures set forth in the Prescribed Fire Plan.
- Line officer's qualifications, experience, and involvement.
- Qualifications and experience of key personnel involved in the prescribed fire.
- Level of awareness and understanding of prescribed fire planning and implementation procedures and guidance of the personnel involved.
- Factors that contributed to the escape.

The information under each element of the review is organized by leading with a finding, followed by supporting discussion, and background information. Recommendations are summarized in a separate section that follows the element reviews.

Seasonal Severity, Weather, and On-Site Conditions Leading Up to the Wildfire

Seasonal Severity

The 2010 fire season has been unusual in many respects. The winter of 2009/2010 was dominated by an El Nino event in the Pacific Ocean which resulted in a warmer and dryer winter than normal. The Helena NF received significantly less snow fall and the snow pack started to melt earlier than normal. By the end of February, fire officials were concerned that this could be a significantly dry fire season. In mid spring the oceanic condition switched to a La Nina condition which generally produces above average moisture conditions for the northwest. Starting in mid March significant rainfall started to occur and lasted throughout the summer in amounts enough to reduce the threat of a significant fire season in the Northern Rockies Region.

Weather

The Davis 5 Prescribed Fire is located within Fire Weather Zone MTZ116 which is forecasted from the Great Falls, Montana Office of the National Weather Service. The Helena NF utilizes the Lincoln Remote Automated Weather Station (RAWS) to track fire danger and potential fire severity for the northern portion of the forest. The weather station is located in the town of Lincoln behind the Lincoln Ranger Station. During the month of August prior to the prescribed fire, the Lincoln RAWS station reported 1.96 inches of rain. On site weather observations were taken using the Forest Service issued Belt Weather Kits.

The weather in the week leading up to the burn day was dominated by a strong high pressure system that covered the entire Pacific Northwest. Temperatures gradually increased over the period starting from just below seasonal norms to above seasonal norms on the burn day. Winds during this period were generally light and followed the daily diurnal patterns. The approaching cold front that occurred on August 26th began to appear in the forecasts on August 23rd as the result of an unusually good weather model agreement in the extended forecast. As the high pressure started to track east in advance of the cold front the general air flow started drawing warm dry air from the south which resulted in an increase in temperatures and decrease in relative humidity that occurs during these frontal passages.

Weather Forecasts

The Great Falls National Weather Service Office issued four spot weather forecasts for the Davis 5 Prescribed Fire.

- 1446 MDT Tuesday 24 for Wednesday – Fire weather watch in effect for Thursday, August 25, in the afternoon through Thursday evening, August 25, for gusty Southwest winds, low relative humidity and very warm temperatures. For Wednesday, temperatures 69- 74 degrees, minimum relative humidity 15% -20%, winds upslope 3 to 6 mph, ridge top winds southwest 5 to 10 mph with gusts to 15 mph.
- 1043 MDT Wednesday for today – Fire weather watch in effect for Thursday, August 25, in the afternoon through Thursday evening, August 25, for gusty winds and low humidity. For today, temperatures 69-74 degrees, minimum relative humidity 18%-23%, southwest winds 10 to 15 mph with gusts to 25 mph, ridge top winds 15 to 20 mph.

- 2024 MDT Wednesday for Thursday – Red Flag warning in effect from noon Thursday, August 25, to midnight Thursday, August 25, night for gusty winds, low relative humidity and very warm afternoon temperatures. For Thursday, temperatures 79-84 degrees, minimum relative humidity 9%-14%, southwest winds 5 to 10 mph increasing to 10 to 15 mph with gusts to 30 mph.
- 1836 MDT Thursday for Friday – Red Flag warning in effect through midnight tonight for gusty southwest winds and very low relative humidity. For tonight, temperatures 43-48 degrees, maximum relative humidity 50%-60%, southwest winds 15 to 25 mph gusts up to 35 mph. For Friday, temperatures 53-53 degrees, minimum relative humidity 30%-35%, west winds 15 to 25 mph gusts to 35, ridge top winds west 20 to 30 mph gusts to 40 mph.

Weather observations at various weather stations around the area indicated that the spot weather forecasts were considered accurate. The Northern Rockies Predictive Services Center reported that on both August 25th and August 26th the atmospheric conditions destabilized between 1300 and 1400 MDT. When this occurred free air winds were able to mix down to the surface and relative humidity levels dropped upwards of 5%.

Table 1. On-Site Weather Observations: taken at approximately 7,100 feet in the Burn unit.

Time, August 25	Temperature (°F)	Relative Humidity (%)	Wind Speed (mph)	Wind Direction
1000	64	48	3 to 5 gusts 10	Southwest
1100	66	32	7 to 8 gusts 10	Southwest
1200	70	27	7 to 9 gusts 11	Southwest
1300	70	35	3 to 5	Southwest
1330	72	31	3 to 5	Southwest
1400	74	31	3 to 5	Southwest
1545	74	29	5 to 7	Southwest
1630	75	25	5 to 7 gusts 10	Southwest

Time, August 26	Temperature (°F)	Relative Humidity (%)	Wind Speed (mph)	Wind Direction
1000	69	25	6 to 8 gusts 11	South/southeast
1100	72	22	5 to 6 gusts 11	South/southeast
1200	75	20	5 to 7 gusts 11	South
1300	80	19	7 to 9 gusts 15	South/southwest

On-site weather observations taken prior to and during the ignition of the Davis 5 Prescribed Fire were within the prescription element ranges identified within the prescribed fire burn plan. Although not documented by the weather observer, around 1400 the ignition crews experienced stronger winds from a westerly direction.

Fuel Moisture Analysis

On site fuel moisture readings taken at the unit, with the use of a hand held fuel moisture probe, produced the following results. Readings were taken on Monday August 23rd.

Sheltered Fuels:

- 10 hour timelag fuels (¼" to 1"): Range 8% - 11%, average 9%
- 100 hour timelag fuels (1" to 3"): Range 9% - 23%, average 15%
- 1,000 hour timelag fuels (3"+): Range 20% - 28%, average 24%

Exposed Fuels:

- 10 hour timelag fuels (¼" to 1"): Range 6% - 9%, average 8%
- 100 hour timelag fuels (1" to 3"): Range 9% - 12%, average 11%

- 1,000 hour timelag fuels (3"+): Range 12% - 20%, average 16%

Fuels moisture samples taken at the unit were within the prescription range identified in the prescribed fire burn plan on Monday when the samples were taken. From Monday to Wednesday with the warm and dry conditions that were occurring, the fuels moistures, particularly the 10 hour timelag fuels, would have had the opportunity to continue drying. Since the 10 hour timelag fuel moistures were at the lower limits of the prescription (8-12%) on Monday it is conceivable that the 10 hour timelag fuel moisture may have been below the prescription limit at the time of ignition on Wednesday.

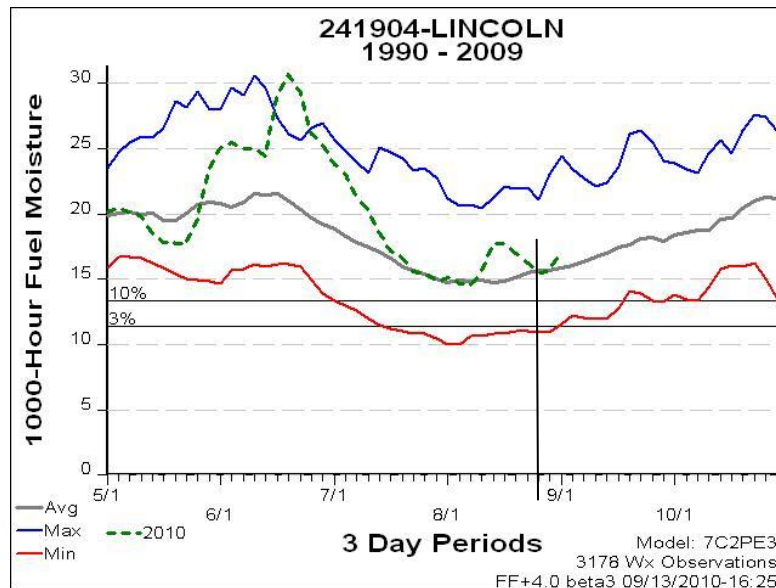
The 1 hour timelag fuel moisture is calculated using a combination of several factors including temperature, relative humidity and exposure to sunlight. The Review Team calculated 1 hour timelag fuel moistures for August 25th ranges from 5% to 11%, and on August 26th ranges from 3% to 9%. This prescription element average is within the range identified during the period that the ignition crew was actively igniting the prescribed fire.

Seasonal Weather Conditions and Trends

The moisture content of woody debris greater than three inches in diameter (1,000 hour timelag fuels) is used as an indicator of drought severity and resistance to fire control. The following graph depicts the calculated 1,000 hour time lag fuel moisture from the weather observed at the Lincoln RAWS site.

The dashed green line represents the 2010 observations and shows that the fuel moisture remained relatively high during the season the direct result of the above normal moisture received this year. Fuel moistures bottomed out in early August just to a point near average over the past twenty years.

Lincoln Weather Station
1,000 Hour Time Lag Fuel Moisture

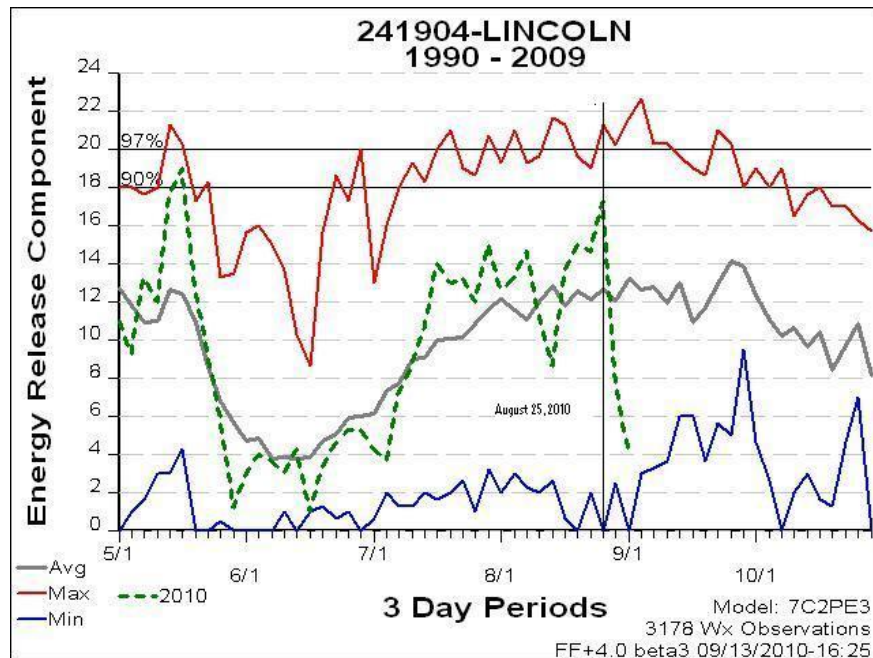


Energy Release Component

The National Fire Danger Rating System (NFDRS) index used to track the combined effects of fuel dryness on fire potential is called the Energy Release Component (ERC). The following table displays current ERC's and compares them to historic readings.

The 2010 ERC for the Lincoln Weather Station (represented as the green dashed line) indicates that conditions in early summer did reach a critical level; however, June rains significantly reduced the summer's threat of an active fire season. ERC levels at the time of the burn were near 15, which is below historic highs for that date and would indicate that a seasonal drought was not a factor in the prescribed fire escape.

Lincoln Weather Station
Energy Release Component



Spotting Distance and Probability of Ignition

Spotting Distance and Probability of Ignition are fire behavior calculations that estimate the maximum distance a floating fire brand will travel and the likelihood that a fire brand will ignite into a spot fire. Spotting distance utilizes topographic inputs along with tree stand information and wind speeds. Probability of Ignition is based on 1 hour time lag fuel moisture, temperature, and amount of shading.

Utilizing environmental and physical conditions at 1400 hours on August 25 produced an estimated spotting distance of 1/10 to 2/10 of a mile and a probability of ignition that ranged from 34% to 52%. In simple terms, when the group of trees torched in the unit near the saddle, the ensuing embers would have spotted an estimated 1,000 feet which is approximate 600 feet outside of the line. Of those embers, anywhere from a third to a half could have had the potential to start spot fires given that they landed on a suitable fuel bed.

Upon review of the available weather forecasts and observed weather and fuel conditions, the following conclusions can be drawn. It appears that on Wednesday August 25th, spots created from a

group of torching trees just west of the saddle in the southern portion of the unit were able to become established and started burning at the same time that the atmosphere destabilized. Observations from the Northern Rockies Predictive Service noted that there was a drop in RH of 5% and mixing down of free air winds causing an increase in gusty winds. These changes in atmospheric conditions allowed the fire to transition from the surface fuels to the canopy in a stand of sub-alpine and lodgepole pine. The tree canopy in this stand was continuous enough to allow the fire to actively spread from tree to tree through the stand. On Thursday August 26th, burning conditions created an opportunity for significant fire growth once spot fires became active enough to burn into the surrounding tree canopy.

Adequacy of the Prescribed Fire Plan for the Project and Compliance with Policy and Guidance Related to Prescribed Fire Planning and Implementation

The Burn Plan has some good written elements. However, other elements lack depth required under the 2008 *Interagency Prescribed Fire Planning and Implementation Procedures Guide*. The prescribed fire plan emphasizes fire weather and fuel conditions for a spring prescribed burn. The burn plan package is for the most part complete but lacks documentation on pre and post burn fuels monitoring. Even though element 11 (organization and equipment) is brief, the organization for the burn on the actual burn day was well organized, clear, and staffed above what was called for in the burn plan. Table 1 shows specific findings and potential contribution to the escape for prescribed fire plan elements.

Table 2. Prescribed fire plan elements, findings, and potential contributions.

PRESCRIBED FIRE PLAN ELEMENTS:	COMMENTS/FINDINGS	DID THIS PLAY A ROLE IN ESCAPED FIRE?
<p>1. Signature page</p>	<p>The technical review and approval are dated the same day though it is not clear if this review identified any needed changes to the prescribed fire plan. The technical review sheet in the Appendix of the plan was not completed during the actual technical review.</p> <p>There is conflicting guidance from Agency Policy: the Forest Service Manual 5140.42 states the Forest Supervisor is responsible for approval of prescribed fire plans. There is no delegation letter from Helena Forest Supervisor to District Rangers on the Forest.</p> <p>Conflicting direction is stated in the <i>Interagency Prescribed Fire Planning and Implementation Procedures Guide</i>. Under the "Responsibilities for Agency Administrator" section (p.11) the "Agency Administrator" is defined as "the Line Officer (or designee) of the agency or jurisdiction that has responsibility for the prescribed fire. These usually include the NPS Park Superintendent ...USFS Forest Supervisor/District Ranger..." As stated the <i>Guide</i> gives direction that a USFS District Ranger can approve prescribed fire plans.</p>	<p>NO</p>
<p>2. GO/NO-GO Checklists</p>	<p>Agency Administrator Pre-Ignition Approval Checklist was completed in July 2009. No date is located on the "Approval Expires" line so the duration of project viability and the need for a review process is open to conjecture.</p> <p>The Prescribed Fire Go/No-Go Checklist was completed but the spot weather forecast winds predicted were not</p>	<p>Potential Factor in regard to Prescribed Fire Go/No Go Checklist</p>

favorable for keeping crown fire embers within the unit. For further explanation please see the "Factors Contributing to the Escape and the Wildfire Declaration" section of this review.

3. Complexity Analysis Summary	<p>In general the Complexity Analysis underestimates potential fire behavior within the prescribed fire unit. The effects and consequences of an escape fire due to spotting or a sloop-over were predicted to be easily contained. Any differences in implementation between a spring versus fall prescribed fire are not documented. The fire behavior characteristics of subalpine fir are not discussed.</p> <p>However, on-site implementation of prescribed fire plan was adjusted to address potential fire behavior differences for summer/fall conditions. The District FMO ordered additional engines as on-site holding resources above the prescribed fire plan requirements.</p>	Potential Factor
4. Description of the Prescribed Fire Area	<p>The original description of fuels conditions outlined in the prescribed fire plan has changed since the February 2009 final review & signatures and the August 2010 implementation. An increased component of "red/dead" lodgepole pine located within and outside of the unit was not captured in the prescribed fire plan.</p> <p>There is no discussion of subalpine fir as part of the fuel component both inside and outside the burn unit and the potential as a primary driver in short to medium range spotting.</p> <p>There are no references to maps or project boundary within the plan.</p>	Potential Factor
5. Goals and Objectives	<p>The objectives of the burn are stated in clear and measurable terms.</p>	NO
6. Funding	<p>There are no estimates of cost included in the plan.</p>	NO
7. Prescription	<p>The prescribed fire plan only used fuel model 8 to describe fuels adjacent to the burn unit. The use of fuel model 10 with a subalpine fir component would better represent adjacent fuels. There is no discussion of spotting distances and an under-prediction of spread potential in the adjacent fuels.</p> <p>The prescription did not consider crown fire modeling to address the aerial fuel component in both inside and outside of the unit.</p> <p>Live Fuel Moisture of 80-120% is listed for fuels both inside and outside of the unit. There is no indication what specific species these fuel moistures are addressing. Additionally, the District was not monitoring on-site live fuel moistures prior to the burn day.</p>	Potential Factor
8. Scheduling	<p>There are not separate discussions on the implementation differences in a spring versus a summer/fall prescribed fire.</p>	NO

9. Pre-burn Considerations	<p>Public notification did not include any media contacts.</p> <p>Individuals in current positions listed in "Inter/Intra-agency Coordination" Table have changed since 2009.</p> <p>The prescribed fire plan does not facilitate documentation of work done pre, during, and post prescribed fire.</p>	NO
10. Briefing	<p>Briefing elements outlined are adequate. Interviews with personnel indicated a thorough briefing was provided on the burn day.</p>	NO
11. Organization and Equipment	<p>Brief. Nothing is outlined beyond Burn Boss, Ignition, and Holding positions, however, the organization on-site was well organized and staffed in a reasonable way for the burn day.</p> <p>The minimum qualifications for personnel to fill specific assigned positions in the prescribed fire plan are not listed.</p>	NO
12. Communications	<p>The Communications Plan is adequate for the project.</p>	NO
13. Public, Personnel Safety and Medical Procedures	<p>The safety plan covers fire fighter safety, but there is no mention of public safety; for example, the need for trail or road closures in the proximity of the prescribed fire unit.</p> <p>The JHA is not specific to the burn site – <i>Interagency Prescribed Fire Planning and Implementation Procedures Guide</i> states: "identify and analyze the safety hazards <i>unique</i> to the individual prescribed fire project and specify personnel safety and emergency procedures." A generic JHA is included in the plan.</p>	NO
14. Test Fire	<p><i>Interagency Prescribed Fire Planning and Implementation Procedures Guide</i> states: "provisions for a test fire are required and results must be recorded." The test fire was completed but no documentation of the results is noted in the documentation provided to the Review Team.</p>	NO
15. Ignition Plan	<p>The Ignition Plan was adequate but brief.</p> <p>Mop-up procedures placement in this section is unnecessary, typically part of the holding plan element.</p>	NO
16. Holding Plan	<p>The Holding Plan was adequate but brief.</p> <p>Interagency Qualification and Certification System (IQCS) the qualifications required for the Holding Boss are not identified in the plan.</p> <p>The expected fire behavior outside the unit was under-represented in the prescribed fire plan, especially in comparison to the observed fire behavior on August 25th.</p>	NO
17. Contingency Plan	<p>The Contingency Plan is adequate but brief. A list of additional resource availability on the burn day could have been more thoroughly documented.</p>	NO

18. Wildfire Conversion	The policy statement is out-dated. Agency terminology changes were implemented in 2009 and should have been updated for 2010.	NO
19. Smoke Management and Air Quality	This section does not contain the minimum standards outlined in the <i>Interagency Prescribed Fire Planning and Implementation Procedures Guide</i> . There is no mention of meeting air quality regulations or of there being any smoke sensitive receptors in the project area.	NO
20. Monitoring	The statement for monitoring meets standards outlined in the <i>Interagency Prescribed Fire Planning and Implementation Procedures Guide</i> . There is no documentation of Spring 2010 prescribed fire results.	NO
21. Post-burn Activities	Meets standards outlined in the <i>Interagency Prescribed Fire Planning and Implementation Procedures Guide</i> .	NO

Adequacy of the Prescribed Fire Prescription

Review of the prescription elements indicates that they are clear and easy to understand. However, the prescribed fire plan does not discuss any changes in expected fire behavior and operational considerations between a spring versus summer/fall burn conditions. The prescription elements and fire behavior calculations do not include a discussion of spotting potential and crown fire potential. A discussion of spotting, crown fire potential, or a summer/fall burn may have led to different prescription elements.

Compliance and Consistency with the Prescription, Actions, and Procedures Set Forth in the Prescribed Fire Plan

A live fuel moisture element is also included in the prescription. There is no evidence of on-site or other monitoring of live fuel moisture, nor were any plant species of concern mentioned in relation to live fuel moisture.

The August 25th 10:43 am spot weather forecasted ridge top winds of 15 to 20 miles per hour and the prescription parameters outlined in the prescribed fire plan called for mid-flame winds up to 15 miles per hour. On-site observations were within the prescription parameters.

Interviews with Prescribed Burn personnel indicated they were monitoring weather and fire behavior closely. The behavior was well below the top end of the prescription until approximately 14:00 on August 25th. At that time ignition stopped due to numerous spots reported by the holding crew. The Burn Boss chose to use holding resources well above the minimums amounts outlined in the Prescribed Fire Plan to address the possible high-end fire behavior and forecasted weather conditions.

Line Officers Qualifications, Experience, and Involvement

The Agency Administrator has responsibility to ensure that all prescribed fires are conducted in accordance with the approved implementation plan and established standards and guidelines. Four Agency Administrators from the Helena National Forest had various roles in the planning and implementation of the Davis 5 Prescribed Fire.

During the planning and preparation of the prescribed fire the Forest Supervisor was out of the office for personal reasons and had limited participation. The Deputy Forest Supervisor was out of the office on the days leading up to the prescribed fire ignition, returning on Thursday August 26th to assume leadership of the escaped Davis Prescribed Fire. The Helena District Ranger served as the Acting Forest Supervisor during the absence of the Forest Supervisor and Deputy Forest Supervisor and provided advice and counsel to the Lincoln District Ranger who was serving as the project's Agency Administrator.

The District Ranger of the Lincoln Ranger District served as the primary Agency Administrator for the project, approving the prescribed fire burn plan and complexity analysis. During the planning and preparation of the burn the District coordinated with the Burn Boss. The District Ranger had completed National Fire Management for Line Officers on May 22, 2003 and S-580 Advanced Fire Use Application or local equivalent on May 12, 2003. The Lincoln District Ranger met the qualifications and experience required, although there is no official delegation of authority to approve the burn plan from the Forest Supervisor.

The Helena District Ranger, who served as the Acting Forest Supervisor, had completed Fire Management for Line Officers class on April 22, 2002. In addition the Helena District Ranger is currently qualified as a Type 2 Safety Officer and has expired qualifications of Division Group Supervisor (DIVS) and Type III Incident Commander (ICT3).

The Regional Forester had not approved the qualifications for the Deputy Forest Supervisor for 2010.

The Forest Supervisor completed the Fire Management for Line Officers on March 20, 2007.

The Forest Supervisor, the Deputy Forest Supervisor, and the Lincoln District Ranger have completed National Fire Management Leadership and Fire Use Applications (or local equivalent) and meet the qualifications and experience required.

Fire Management Officer Qualification, Expectations and Involvement

The Forest Fire Management Officer, the Acting Assistant Forest Fire Management Officer, and the District FMO each provided guidance and advice to the Lincoln District Ranger and the Prescribed Fire Burn Boss and crew.

The Forest Fire Management Officer completed Fire Program Management (M-581) on March 6, 2006. In addition the individual meets Forest Service – Fire Program Management requirements that will be enacted on October 1, 2010, thus meeting the requirements of the Forest Fire Management Officer position. In addition the Forest Fire Management Officer is currently qualified as a FBAN, ICT2, LTAN, OSC2, RXB1 and SOPL.

The Acting Assistant Forest Fire Management Officer completed Fire Program Management (M-581) on January 30, 2006. In addition the individual meets Forest Service – Fire Program Management requirements that will be enacted on October 1, 2010, thus meeting the requirements of the Assistant Forest Fire Management Officer position. In addition the Acting Assistant Forest Fire Management Officer is currently qualified as a DIVS, ICT3, and RXB2.

The Lincoln District Fire Management Officer (DFMO) meets the Forest Service – Fire Program Management requirements that will be enacted on October 1, 2010. The DFMO completed Fire Program Management (M-581) on March 10, 2006. In addition, the DFMO is currently qualified as a DIVS, ICT3, RXB1, RXB2, and FIRB. The Lincoln DFMO also served as the Prescribed Fire Burn Boss Type 2 during the implementation of the Davis 5 Prescribed Fire.

Qualifications and Experience of Key Personnel Involved in the Prescribed Fire

Key positions on the prescribed fire and their qualifications are listed in Table 3.

Table 3. Qualifications of key personnel involved in the Dave 5 Prescribed Fire.

Position	Qualification Date	Meets Requirements	Other Qualifications
Burn Boss, Type 2	March 1, 2000	Yes	RXB1, ICT3, DIV, FIRB
Firing Boss (north)	June 9, 2006	Yes	RXB2, ICT4, TFLD
Firing Boss (south)	July 10, 2003	Yes	RXB2, ICT3, DIVS
Holding Specialist	September 3, 2003*	Yes	RXB2, ICT4, TFLD, FIRB

*The burn plan did not specifically identify the qualifications required for the holding boss position; however, based on the number and diversity of the fire suppression resources the Incident Command System would indicate that a Task Force Leader is the appropriate qualification for the Holding Specialist position on this project.

Level of Awareness and Understanding of Prescribed Fire Planning and Implementation Procedures and Guidance of the Personnel Involved

All staff within the fire organization both at the Forest and District levels demonstrated verbally, in writing, and in actions a high level of knowledge and awareness of policy, planning, and implementation procedures. There is strong evidence of leadership and support for building the program, developing expertise, confidence and high expectations for performance, and demonstrated success leading to employee pride in program accomplishments. In describing the culture of the Lincoln Ranger District prescribed burn program, employees spoke of “hard work and pride” in completing fuels projects that make a difference on the landscape. There is an ethic of work accomplishment in an open, trusting and transparent environment.

The program is centered on fuels treatment for ecosystem benefits. The prescribed fire projects are a mix of small scale, and often, older NEPA decisions as well newer landscape scale treatments. There is an emphasis on increasing skills and qualifications throughout the organization. It is clear the District has placed a focus on expanding relationships in support of forest restoration treatments.

Positive actions to meet policy and procedural directions were evident at each level of the organization, including:

- Consistent engagement and communication by the Lincoln District Ranger with the Burn Boss during implementation of the project.
- Having an approved burn plan and well thought out operations for August 25th.
- Availability of incident qualification records.
- Field level briefings with prescribed burn personnel were completed and thorough.

Factors Contributing to the Escape and the Wildfire Declaration:

Factor	Description	Contributed To:
<p>Level of Awareness of potential prescribed fire complexity</p>	<p>As a group there may not have been recognition of a low probability, high consequence event for this prescribed fire.</p>	<p>Escape of prescribed fire:</p> <ul style="list-style-type: none"> • A robust complexity analysis for this burn day was not completed; therefore, the potential for and consequences of torching and crown fire in the subalpine fir may not have been recognized.
<p>Fuel Type differences inside and outside the planned burn unit</p>	<p>The Davis 5 Prescribed Fire Plan did not address the abundance of subalpine fir inside and outside of the unit. The Prescribed Fire Plan does not include a discussion of the associated spotting potential and probability of ignition.</p> <p>The fuel type differences outside the unit that were receptive to spots and fire growth in areas dominated by subalpine fir and the “red and dead” lodgepole pine.</p>	<p>Escape of prescribed fire & Wildfire declaration:</p> <ul style="list-style-type: none"> • The fuel type outside of the burn unit, in some locations, is dense, uniform, and continuous with stands of subalpine fir and “red and dead” lodgepole pine. Given the continuous nature of this forest type the torching of a single tree can grow into an active crown fire. This type of crown fire is easily steered by any wind.
<p>Awareness of changes to spot weather forecasts</p>	<p>The winds predicted in the Spot Weather Forecast changed between the forecast received the afternoon on August 24th and immediately prior to ignitions on August 25th. The prescribed fire personnel stated they did not note any differences between the two forecasts.</p>	<p>Escape of prescribed fire:</p> <ul style="list-style-type: none"> • A more detailed discussion on projected forecasts could have raised awareness about the 20-foot and ridge top winds, which were forecasted to approach the high end of the burn plan prescription. This forecasted change in conditions might have served as a signal for the on-site increase wind intensity and direction.
<p>Weather and Fuel Conditions</p>	<p>Weather conditions crossed a critical threshold for the torching of subalpine fir. On the morning of August 25th the igniting crew had not been successful in starting sustaining fire even in subalpine fir. In the afternoon one patch of subalpine fir torched. Concurrent with the torching trees the wind shifted from</p>	<p>Escape of prescribed fire:</p> <ul style="list-style-type: none"> • De-stabilization of the atmosphere facilitated a shift to a west wind that pushed the column to the ground and across slope toward the saddle on the southeast corner of the burn unit.

	<p>southwest wind directly up slope to a west wind cross slope carrying a number of spots through a saddle on the continental divide outside the unit.</p> <p>ERC Charts indicate the 1,000 hours fuel conditions were at the driest point during the summer of 2010 and approaching the 90th percentile.</p>	<ul style="list-style-type: none"> Personnel may have underestimated the receptiveness of fuels outside the unit to spotting and potential fire behavior once spots became established.
Other environmental conditions	<p>The saddle in southern part of the unit, the proximity of the fuels to the boundary, and the slash in the last mixed timber stand in the burn unit contributed to escape of the prescribed fire.</p>	<p>Escape of prescribed fire:</p> <ul style="list-style-type: none"> The initial spots occurred when a pocket of mixed timber with scattered slash near the boundary torched and the resulting column carried embers over a saddle and out of the boundary of the burn unit.
Compressed timeframe to complete project	<p>Given the fire weather watch, that escalated into a red flag warning, there was little opportunity for error or course correction if something did go wrong.</p>	<p>Wildfire declaration:</p> <ul style="list-style-type: none"> The compressed time frame did not provide on-site personnel the opportunity to suppress spots outside the unit prior to the fire weather watch.

RECOMMENDATIONS (In alphabetical order)

- Awareness of Spot Forecasts** - The most current spot weather forecast predictions and the potential impacts need to be thoroughly discussed before actual on-the-ground implementation occurs. With consideration to cold fronts with strong winds, which are common during the late summer and early fall along the continental divide in the Northern Rockies, specific attention needs to be given to the distance embers may travel and the likelihood those embers may become spot fires. Recommended to obtain forecast by phone (land-line, cell, or satellite) prior to ignitions, if possible.
- Burn Plan Development** - Improve specificity and clarity of the burn plans.

 - Discuss spotting potential and probability of ignition.
 - Discuss spread potential of fuels outside the units.
 - Consider different ignition tools and ignition patterns to successfully implement prescribed fire when fuels outside the unit are less flammable.
 - More factors should be considered in the development of the complexity analysis, including a spring burn vs. a fall burn and the potential consequences.

- Consider developing a prescribed fire organizer as method of documenting work accomplished on a prescribed fire project.
 - Burn Boss should consider having the Firing Boss and Holding Specialist sign the Go/No Go Checklist as a means to raise a level of awareness and document concurrence between on-site personnel.
 - Ensure the JHA is specific to the individual prescribed fire project.
 - Ensure prescribed fire plans utilize up to date terminology.
- **Delegation of Authority** – FSM 5140 requires the Forest Supervisor to delegate approval authority for prescribed fire plans to District Rangers.
 - The Forest Supervisor should specifically delegate authority to District Rangers prescribed fire plans.
- **Documentation** - Consider efforts to ensure documentation is thorough and complete pre, during, and post prescribed fires. Such documentation facilitates process improvement in a prescribed fire program.
- **High Reliability Organization Principles** – Consider using the principles and practices associated with High Reliability Organizations (HRO's). Specific to prescribe fires, consider conducting thorough discussions of the consequences during the planning and implementation phases of prescribed fire projects with all those involved in the project. In these discussions allow individuals an opportunity to discuss what they believe could go wrong with the project and then discuss ways to mitigate those measures.
 - The principles and practice of a HRO may have lead to better identification of the risks associated with the compressed time frame the Davis Fire was planned for.
- **Public and Political Interest** – Improve the public outreach to include the media, cooperators, partners, etc.
 - Consider development of a pre-season book that describes all current year planned prescribed burn projects including photos, objectives, locations, etc. Distribute this book to media, Fire Chiefs, Agency Administrators, Congressional Delegation, etc. Project specific press releases, can refer to the project and page number in the book.
 - Consider utilizing the “targeted notification system” from the Lewis & Clark County Sheriff’s Office to notify nearby homeowners during prescribed burns.
- **Qualifications/Certifications** – Consider utilizing the Interagency Qualification and Certification System (IQCS) to track completed training and positions performed in fire for Line Officers. In addition, a written delegation of authority, specific to prescribed fire, should be completed by the Forest Supervisor to the Line Officers on the Helena National Forest.
- **Research** – Explore additional research/modeling into fire spread in subalpine fir crowns and “red and dead” lodgepole.

COMMENDATIONS

General – The Review Team could not have completed our assigned task without significant support from the Helena NF and the Lincoln and Helena Ranger District and MT DNRC personnel. The Team wishes to thank all individuals who assisted us for their significant help to the Review Team.

Professionalism –

- Lincoln Ranger District personnel demonstrated competence and dedication in planning and executing a prescribed fire program on the District.
- All personnel and agencies involved in the Davis 5 Prescribed Fire demonstrated a willingness to participate in the review process in an open and honest manner.
- On the night of the August 26th a public meeting was held at Canyon Creek Community Center to apprise residents of the wildfire situation where the Lincoln District Ranger took responsibility for the wildfire and supported the efforts of the firefighting resources.

Decision Making and Leadership – The Burn Boss immediately recognized the need to convert to a wildfire when Spot # 2 blew up. The individual immediately transitioned to a local Type 3 IC who had considerable wildfire experience. The entire organization went into a full suppression response and placed appropriate orders for additional resources, local fire agencies and Sheriff's Office response.

REFERENCES

Forest Service. 2007. *Forest Service Handbook, FSH 5109.17, Training & Qualifications Standards*. U.S. Forest Service, Washington, D.C.

Forest Service 2009. *Forest Service Manual 5100 Fire Management . Chapter 5140 – Fire Use. R1 Supplement No. 5100-2009-1*. U.S. Forest Service, Northern Region. Missoula, MT

Helena NF. 2009. *Davis 5 Prescribed Fire Burn Plan*. U.S. Forest Service. Helena National Forest. Helena, MT.

Helena NF. 1986. *Helena NF Land and Resource Management Plan*. U.S. Forest Service. Helena National Forest. Helena, MT.

Helena NF. 2010. *Helena NF Fire Management Plan*. U.S. Forest Service. Helena National Forest. Helena, MT.

Helena NF. 1997-1998. *Poorman DEIS & Poorman FEIS*. U.S. Forest Service. Helena National Forest. Helena, MT.

USDI/USDA. 2010. *Interagency Standards for Fire and Fire Aviation Operations (Red Book)*. US Department of the Interior/US Department of Agriculture. National Interagency Fire Center, Boise, ID. <http://www.nifc.gov/policies/guides.htm>

NWCG . 2008. *Interagency Prescribed Fire Planning and Implementation Procedures Guide*. National Wildfire Coordinating Group. National Interagency Fire Center, Boise, ID. <http://www.fs.fed.us/fire/fireuse/rxfire/rxfireguide.pdf>

GLOSSARY OF ACRONYMS AND TERMS

Agency Administrator – The Line Officer (or designee) of the agency or jurisdiction that has responsibility for the prescribed fire. For the U.S. Forest Service, the Forest Supervisor/District Ranger.

Assistant Fire Management Officer (AFMO) – An assistant to the Fire Management Officer.

Command - The act of directing, and/or controlling resources by virtue of explicit legal, agency, or delegated authority.

CRWB (Crew Boss) - A person in supervisory charge of usually 16 to 21 firefighters and responsible for their performance, safety, and welfare.

Escaped Prescribed Fire – A prescribed fire that has exceeded or is expected to exceed prescription parameters or otherwise meets the criteria for conversion to wildfire. Criteria is specified in “Interagency Prescribed Fire – Planning and Implementation Procedures Reference Guide”.

ENGB (Engine Boss) – A person in supervisory charge of usually 2-6 firefighters and responsible for their performance, safety, and welfare.

Division – Divisions are used to divide an incident into geographic areas of operation.

DIVS (Division Supervisor) – The person in charge of a number of resources located in a geographic area around the perimeter of a fire.

FBAN (Fire Behavior Analyst) – The Fire Behavior Analyst is responsible for collecting weather data, developing strategic and tactical fire behavior information, predicting fire growth, and interpreting fire characteristics.

FIRB (Firing Boss) – The Firing Boss reports to the Prescribed Fire Burn Boss and is responsible for supervising and directing ground and/or aerial ignition operations according to established standards in the Prescribed Fire Plan.

Fire Management Officer (FMO) – The person responsible and accountable for providing leadership for fire and fire aviation management programs at a local level.

FOBS (Field Observer) – This position is responsible for collecting and reporting situation information for an incident.

Helispot – A natural or improved takeoff and landing area intended for temporary or occasional helicopter use.

Holding Specialist – The supervisory position in charge of the holding forces on a prescribed burn.

Incident - An occurrence either human-caused or natural phenomenon, that requires action or support by emergency service personnel to prevent or minimize loss of life or damage to property and/or natural resources.

ICT1/ICT2/ICT3/ICT4/ICT5 (Incident Commander) - The Incident Commander position is responsible for overall management of the incident. The Incident Commander reports to the Agency Administrator for the agency having incident jurisdiction.

LTAN (Long Term Fire Analyst)—Technical specialist who uses a variety of fire behavior tools to analyze the long term fire behavior associated with a wildfire.

Mop Up – Extinguishing or removing burning material near control lines, felling snags, and trenching logs to prevent rolling after an area has burned, to make a fire safe, or to reduce residual smoke.

OSC2 (Operations Section Chief Type 2) – The person responsible for the management of all tactical operations directly applicable to the primary mission.

Prescribed Fire — A wildland fire originating from a planned ignition to meet specific objectives identified in a written, approved, prescribed fire plan for which NEPA requirements (where applicable) have been met prior to ignition (see planned ignition).

RXB1 (Prescribed Fire Burn Boss – Type 1) – Person responsible for supervising a prescribed fire from ignition through mopup. See definition for “Type” below.

RXB2 (Prescribed Fire Burn Boss – Type 2) - Person responsible for supervising a prescribed fire from ignition through mopup. See definition for “Type” below.

RXB3 (Prescribed Fire Burn Boss – Type 3) – Person responsible for supervising a prescribed fire from ignition through mop up. See definition for “Type” below.

SOPL (Strategic Operational Planner) - Primary task of this position is to coordinate the development of the course of action for a wildfire (unplanned ignition).

Safety Officer Type 2 – Person responsible for monitoring and assessing hazardous and unsafe situations and developing measures for assuring personnel safety.

Spot Fire – Fire ignited outside the perimeter of the main fire by a firebrand.

Spotting – Behavior of a fire producing sparks or embers that are carried by the wind and which start new fires beyond the zone of direct ignition by the main fire.

Strip Firing – Setting fire to more than one strip of fuel and providing for the strips to burn together.

Task Force - Any combination of single resources assembled for a particular tactical need, with common communications and a leader. A Task Force may be pre-established and sent to an incident, or formed at an incident.

Test Fire – A prescribed fire set to evaluate such things as fire behavior, detection performance, and control measures.

TFLD (Task Force Leader) - The Incident Command position responsible for supervising a task force. This position reports to the Holding Boss.

Type (1/2/3) - Refers to resource capability. Resource typing provides managers with additional information in selecting the best resource for the task.

Wildland Fire – A fire occurring on wildland that is not meeting management objectives and thus requires a suppression response.