

Coal Canyon Fire

August 11, 2011

Serious Accident Investigation Report-- Expanded Narrative

Hell Canyon Ranger District
Black Hills National Forest
South Dakota

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Further Learning

The link below accesses a Google Earth presentation, which gives a brief overview of the Coal Canyon Fire incident. This presentation can aid in learning and sharing and is suitable for self-study and discussion. Download and open the zip file, which contains the Google Earth file and a facilitator's how-to guide. Once Google Earth is installed, double-click on the CoalCanyonFire.kmz file to begin.

[Coal Canyon Fire Depiction Using Google Earth](#)

<http://wildfirelessons.net/documents/CoalCanyon.zip>

To view the file: download it, load it into Google Earth, and follow the prompts. The user must have Google Earth installed; this software may be downloaded free of charge from

<http://www.google.com/earth/download/ge/>

In addition to learning from the tragedy at Coal Canyon, wildland fire-management organizations must strive to learn from how they study and present such accidents to the fire community. Help us continuously improve by providing your feedback regarding the Coal Canyon Serious Accident Investigation and associated learning tools. Please follow the link below and fill out the brief questionnaire. Your responses are anonymous, and they will help us improve this process and better serve the fire community.

[Coal Canyon SAI Feedback Questionnaire \(for use by federal employees only\)](#)

Executive Summary

On August 11, 2011, at approximately 1330, U.S. Forest Service, South Dakota State, and Volunteer Fire Department personnel responded to a fire in Coal Canyon on the Black Hills National Forest.

During initial attack, the Incident Commander(IC) formulated a plan: use hose lay and hand line to work up from the heel on the right flank, use the helicopter to make bucket drops along the left flank. As additional resources arrived, the IC, perceiving the increasing complexity, requested a type 3 organization through dispatch. Shortly after, as fire behavior increased and compromised an egress route, fire entrapped and overran firefighters attempting escape.

One firefighter died, two received serious burns, and two received minor burns. Two firefighters were entrapped in the engine; one remained entrapped and died; the other escaped and was transported to the Rapid City Regional Hospital. The third firefighter, who was overrun by fire while on foot, was transported to a Greeley, Colorado Burn Center. Two other firefighters received minor burns during rescue efforts; they were treated at local hospitals and released.

A national Serious Accident Investigation (SAI) Team conducted a review of events surrounding this accident. The team consisted of employees from the Forest Service, State of South Dakota, and State of Colorado. They worked to identify conditions and events leading to the entrapment, in an effort to help the greater wildland fire community learn from this incident and help prevent accidents of this kind in the future. Team members visited the site, listened to recorded dispatch audio, interviewed individuals associated with the incident, reviewed fire weather and behavior, and examined available written records and physical evidence.

Introduction

Purpose of the Expanded Narrative

The purpose of the Expanded Narrative is to give readers of the SAI a more detailed story of events surrounding the accident on the Coal Canyon Fire on August 11, 2011. The story is told from the perspective of those involved with the information available to them at the time. The intent is to give the reader a sense of the situation as it unfolded for the firefighters on scene, and how they came to their perceptions, decisions, judgments and actions.

Genuine learning from accidents requires multi-level trust and open communication. Current research recommends investigations avoid the "blame and shame" approach, which undermines trust, obscures the story, and impedes meaningful learning. Therefore, this SAI process seeks to build mutual trust as a step toward improving individual and organizational learning.

The Team invites you to use this information and associated learning tools to develop an understanding of this accident and to spur inquiry and dialog with others in your organization. Following are useful questions to keep in mind as you read.

- Can you see how their decisions and actions made sense to firefighters based on their perspectives at the time?
- How did risk-management tradeoffs and risk acceptance appear to decision-makers at the time?
- Which risks and hazards do we accept as a normal part of the job?

Background

This incident involved fire resources assigned to the Coal Canyon Fire on the Hell Canyon Ranger District, part of the South Zone of the Black Hills National Forest (BKF).

Interagency Wildland Fire Response

Fire management within the South Zone of the Black Hills is coordinated among the Black Hills National Forest (BKF), Nebraska National Forest (NBF), South Dakota State Division of Wildland Fire Suppression (SDS), Bureau of Land Management, National Park Service, and career and volunteer fire departments (fig. 1). The South Zone includes the communities of Custer, Hot Springs, Edgemont, Argyle, Pringle, Minnekahta, and Cascade along with Newcastle, WY. The Northern Great Plains Interagency Dispatch Center (GPC) processes Federal and State resource requests. Local fire departments are dispatched through the appropriate county 911-dispatch center with mutual aid assistance from surrounding counties as requested.

These fire resources form part of the interagency wildland fire community in southwestern South Dakota. Area wildland fire management exemplifies robust interagency cooperation, which has developed over the past decade as a result of deep commitment and sustained efforts of leaders from the various agencies.

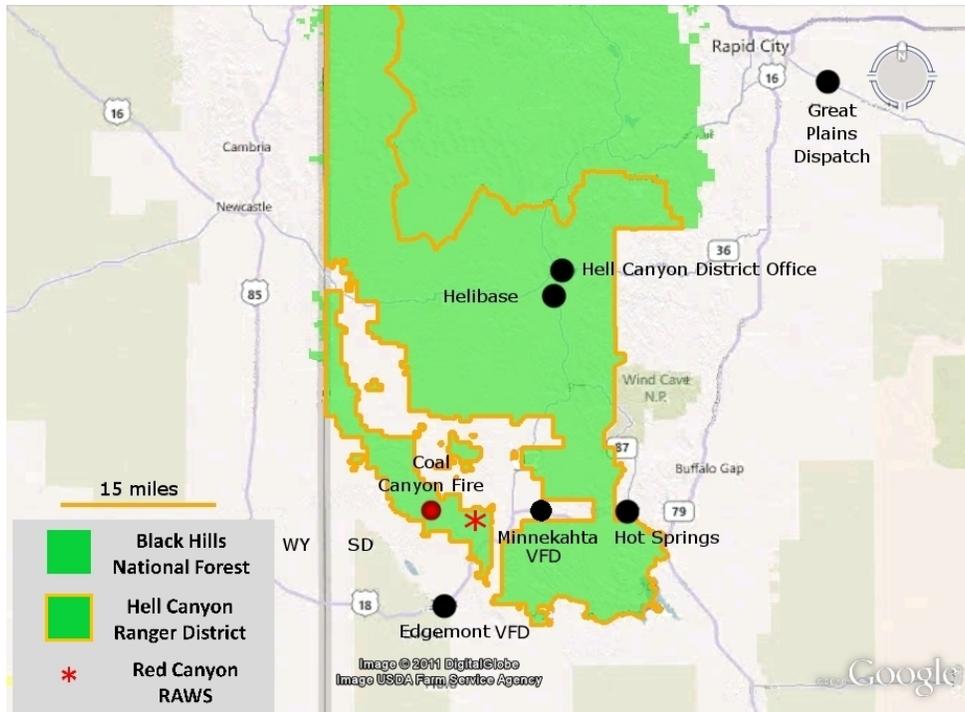


Figure 1. Map showing locations of wildland fire resources serving the South Zone of the Black Hills National Forest.

Interagency training contributes to successful interagency outcomes and relationships. Numerous live fire exercises and classroom training courses are offered each year. Live fire training opportunities are primarily provided by South Dakota Wildland Fire Suppression and occur across the State. The Forest Service conducts tabletop tactical decision games and numerous 200 and 300 level courses. All agencies are welcomed and encouraged to attend, with participants from not only South Dakota but also surrounding states.

Training managers conduct live fire training schools to simulate actual incident conditions. They use all functions of the Incident Command System, and provide trainees with opportunities to achieve training goals and complete task books. Notably, *live fire exercises in recent years have included scenarios of an incident within an incident (IWI) using actual life flight capability.* This training builds mutual respect among firefighters from cooperating agencies, and sets the stage for working together and communicating effectively within the Incident Command structure while on incidents.

The preplanned interagency dispatch response level is a three-tiered response based on the area’s Fire Danger indices. The Hell Canyon Ranger District fire organization has a standing daily morning briefing to discuss pertinent issues, such as staffing, resources available, weather forecasts, lightning activity, and Six minutes for Safety. Great Plains dispatch reads morning fire weather, response levels, National Fire Danger Rating observations, and daily staffing. These briefings are broadcast via radio, which provides an opportunity for Federal, State, and local career and rural volunteer fire resources to monitor the briefing each day.

Origin of the Coal Canyon Fire

A lightning storm swept through the South Zone on Monday, July 27, 2011. One lightning strike ignited a tree in Coal Canyon, about 100 feet below Road 318, on the lower quarter of the slope. The fire smoldered and remained undetected until August 11, 2011.

Several intersecting gullies form a network in the bottom of the Coal Canyon drainage. The canyon runs generally east to west, and Road 318 traverses the canyon mid-slope, about one-third up from the canyon bottom on the north aspect. Slopes range from 30 to 40 percent, but the terrain is rugged, with tight rocky canyons.

Ponderosa pine makes up the primary tree species in the immediate fire area and is the dominate tree species for the BKF. Density varies from moderate in the larger trees to high in the saplings. Rocky Mountain junipers grow in the drainage bottoms. On the slopes outside of the gullies, there is a uniform duff layer of ponderosa pine needle-cast. The gullies have heavy live and dead fuel concentrations in the bottom, with light to no fuel loadings on the open, rocky south aspect and pockets of dense regeneration on the north aspects. The site has a light grass component, and at the time of the entrapment, most of this grass on the north aspect was still green.



Figure 2. Lightning-strike tree.

The Black Hills received a significantly above average snowpack during the winter of 2010–2011. Above average precipitation in the form of rain persisted through the spring. These conditions created a higher than normal soil moisture and delayed green-up by several weeks. The summer drying–curing process had begun, but was later than normal.

The Black Hills mountain range is fire prone terrain. Numerous large fires have occurred since Pre-European times. Fuels, weather, and topography all contribute to large and fast moving fires started by frequent lightning storms generated by the orographic lifting effect of a mountain range situated on a large open prairie.

The vegetative biology of the ranges evolved with frequent low intensity fires burning through the understory of ponderosa pine and open grassland areas, maintaining characteristic open park-like stands of pine. As fire suppression became effective in the last century, fuel loading started to increase both in terms of accumulated dead fuels on the ground and in terms of increased stocking levels of tree regeneration. Today, fires burn with mixed severity, including both lethal and non-lethal (stand replacing some stands while under burning others), and are more difficult to control.

There is no record of any significant fires in the Coal Canyon vicinity during the past 100 years and no timber harvests or fuels treatment on the site. As a result, the north aspect slopes in the area have high stand density and low-to-moderate down-dead woody fuel loading. Across the drainages, on the south aspects, tree density decreases and there are more open areas with higher grass loading.

Because of patented mining claims dating back to the Gold Rush days of the mid 1800s, private property is scattered throughout the entire BKF. These lands now host private residences and small communities. Using the various county Community Wildfire Protection Plans (CWPPs), the Forest demarcated a 3-mile Wildland Urban Interface (WUI) buffer for communities throughout the national forest. When mapped, the WUI layer covers virtually the entire forest, creating a situation where most fires lie within a WUI area.

Note to Reader: This story is told in present tense to place readers in the firefighters' boots, with the information available to them at the time. Fictitious, gender-neutral names are used. Some quotes have been adapted to fit the narrative, while still preserving the original meaning.

Day of the Accident – August 11, 2011

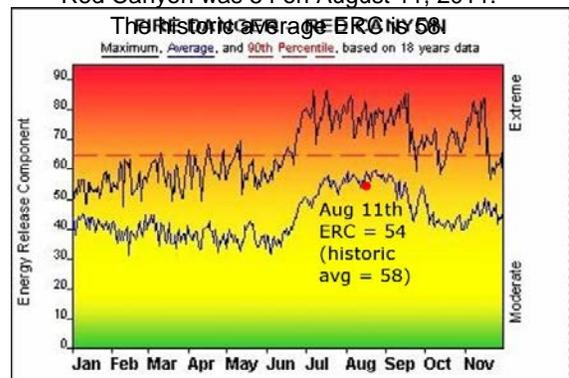
The South Zone morning briefing on August 11, 2011 lasts about 30 minutes, twice as long as usual. The discussion covers the normal topics: staffing; local, regional, and national fire situation; and lightning maps for the past 72 hours. Also discussed is a Red Flag Warning for nearby eastern Wyoming, "LOW RELATIVE HUMIDITIES AND GUSTY WINDS." South Zone crews prepare for potential Red Flag conditions, even though the Red Flag Warning does not extend into their area.

The local forecast calls for a maximum temperature of 77 to 87°F with winds from the south at 5 to 10 mph shifting to the west at 5 to 15 mph in the afternoon. (For a more detailed discussion of the Red Flag warning, forecasted weather, and actual weather during the fire, see Fire Behavior Analysis in the SAI Report). Based on predicted ERCs, the response level for the day is 2, which calls for an initial response of two engines, a helicopter, and an ICT4.

Red Flag Warning and ERC: Looking Back

Red Flag conditions forecast for eastern Wyoming did not materialize in the Coal Canyon area.

The calculated energy release component (ERC) for Red Canyon was 54 on August 11, 2011.



Initial Dispatch (1300–1330)

A resident reports a fire to Fall River County 911 Dispatch, who dispatches E1. Fall River County Dispatch notifies Great Plains Dispatch (GPC) of the reported smoke, and GPC dispatches E2, E3 and Helo1. E2 is already patrolling the area, searching for a possible smoke they saw earlier. They hear E1's dispatch, and—after being dispatched by GPC—they proceed into the fire. From the BKF Custer office, Duty Officer Prescott and District (b) Terry monitor communications.

Initial Action on the Fire (1330–1422)

Helo1 arrives first. While orbiting the fire, they report an initial size of one-quarter to one-half acre fire. The (b) (6) (b) (6) considers going indirect and trying to catch the fire at the ridges, and asks dispatch about the availability of the local Single Engine Air Tanker (which was on a day off); and orders two more engines. One crewmember notes that the smoke is "just sitting there, like a white mushroom."

Helo1 drops off crewmembers Alex and Morgan south of the fire. As they hike in, Helo1 flies circles above the fire, helps direct E2 into the area on Road 318, and then sets down to reconfigure for bucket drops. E1, E2, and the two Helo1 crewmembers arrive at about the same time and meet on the road above the western edge of the fire. Alex assumes command as IC(b) and the group develops a basic escape plan (use the road as their escape route) and tactical plan (use resources on scene to reinforce the anchor point and western edge until an IC(b) arrives). They report the fire to be 1 to 2 acres, burning with 0- to 3-foot flames in a draw bottom about 100 feet below a mid-slope road. Winds are light and variable. The fire is most active in non-continuous grass and timber on the left flank, which is on a south aspect. On the right flank, below the road on the north aspect, less active fire burns in heavy, brushy fuels. Areas of thick fuels restrict visibility around most of the fire.

Although the road is not a dead-end, incoming resources treat it as such due to its overgrown condition and the potential for washouts farther down. E1 and E2 turn around, so the vehicles face the way they came in, and then continue hose lay along the right flank.

After hearing the initial size up, E7 Captain (Blake), one of the few IC(b) on duty in the South Zone, begins heading toward the fire. GPC soon dispatches additional resources, including E7.

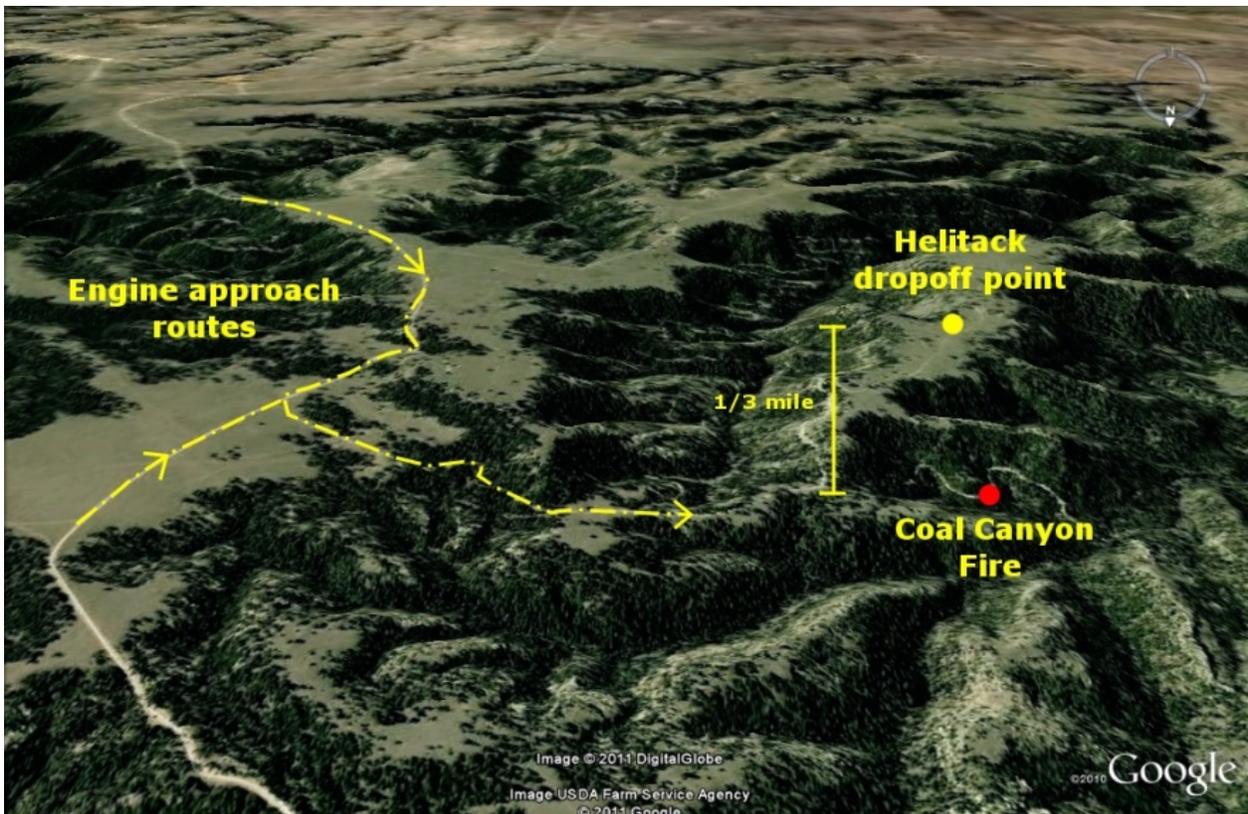


Figure 3. Google Earth screen capture showing topography, point of origin, and engine approach routes.

Vehicle Bottleneck (1419–1433)

As E3 drives into the fire along Road 318, they reach a tight turn where the road goes through a narrow draw (the narrative will call this area "the draw"). Here, they cut a few small trees to widen a turnaround spot. E3 Captain Kendall (IC(b) qualified) hikes down the road toward the western edge of the fire. He meets face-to-face with Alex and personnel from E1 and E2. In their meeting, Alex hands off command to Kendall (IC(b)), briefs him on the fire, and gives him his incident organizer card. They see this as a "normal south zone anchor-and-flank fire." They re-evaluate and continue with the escape plan and tactics already in place: extend hose lay and hand line along the right flank and begin bucket drops along the left flank, using the road as the escape route on the right flank.

Meanwhile, four more engines (E4, E5, E6, E7, in order of entry) have turned onto Road 318 and are driving into the fire.

They begin to create a bottleneck at the turnaround spot in the draw, and become uncomfortable with the idea of spreading out and parking their engines here. One operator sums up his unease as, "Mid-slope, one way in, tight, and fire below." Although not feeling immediately threatened by fire behavior, they feel there are too many engines on a narrow mid-slope road with uncertain egress below and with smoke in the draw. They opt instead to turn their engines around in the draw, park in a meadow above the fire, reconfigure their personnel into a hand crew, and hike in.

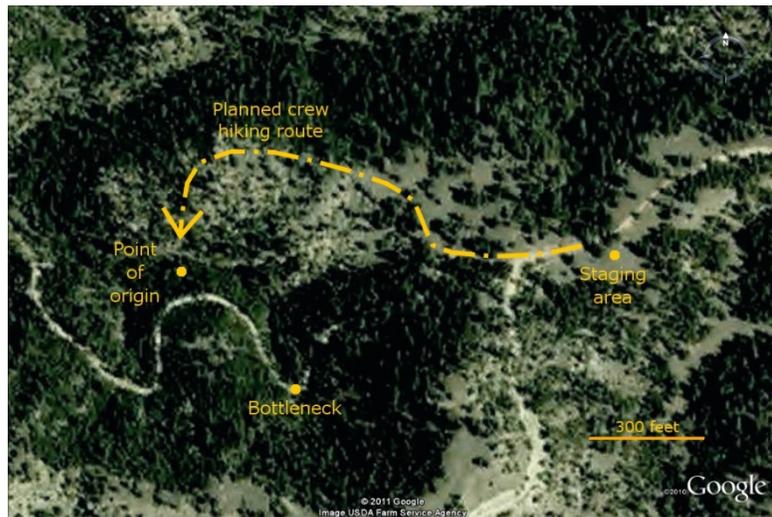


Figure 4. Google Earth screen capture showing point of origin, staging and bottleneck areas, and planned crew hiking route.

Command transitions from IC(b) Kendall (from E3) to IC(b) Blake (from E7), with Kendall staying on as (b) (6)(b) (6). Blake and Kendall exchange information about resources on the incident, decide to continue for now with the existing tactical plan and escape route as the road, the same way they came in. Blake asks E5 Captain Reese to handle (b) (6) on the right flank of the fire, calling the role (b) (6)(b) (6) or (b) (6) (Note: Assigning an (b) (6) on a Type 4 incident is an option that is uncommon, but not unheard of in this area. Note also that Reese will function more as a (b) on the right flank than an (b) for the fire).

As the engines get turned around and head back to the meadow, (b) (6) Kendall and IC(b) Blake walk down the road toward the western edge of the fire. Reese (E5 Captain) goes up to the meadow with the engines, where he assigns a firefighter to configure the engine personnel into a hand crew; the plan is for the hand crew to hike in to the heel and cut line from there. Reese then starts walking down the road to size up the fire and get a better sense of operations.

As they hike down the road, IC (b) Blake and (b) (6) Kendall review actions planned and taken, resources on scene and en route, and radio frequencies. Near the western edge of the fire, they meet the E1 crew and talk for a few minutes, then hike down toward the anchor point, pushing through dog-hair stands of sapling-sized ponderosa pine. Near the anchor point, they meet Alex (Helo1 crewmember, previously IC (b)), who is improving hand line with his chainsaw, while fellow Helo1 crewmember Morgan is on the left flank directing bucket drops.

IC (b) Blake feels good about having a face-to-face meeting with Alex, the fire's previous commander: this is an opportunity to ensure that everyone is on the same page. They review actions taken and resources on scene. From here, Blake and Kendall see E2 crewmembers working the hose lay above them but did not talk with them.

Blake and Kendall then continue along the cool western edge, hiking up the left flank to a flat rock near

the ridgeline. The left flank lies mostly on this south-facing slope. Here, fuels are lighter and thinner than on the right flank, and are exposed to direct sunlight at this time of day. From their vantage point at the flat rock, the only active fire they see is crawling upslope on the left flank, with flame lengths of less than two feet. There's still nothing noteworthy about the wind; it's maybe 5 mph, and variable in direction. They see the greatest potential for spread here on the left flank, and they consider contingency plans in case the fire makes it over this ridge and into the messy network of canyons behind it. Blake radios that his initial control objectives are to hold the fire at the ridge on the left flank, and keep it below the road on the right flank.

After a few minutes together at the flat rock, Blake and Kendal split up; Blake continues hiking up along the left flank. He's trying to get a sense of whether this ridge will hold, and he's thinking about contingencies and additional resources in case it gets over the ridge. He's looking out over the fire; through the trees he can make out E2 along the road above the western edge (see fig. 5). He's confident in (b) (6) leadership of the fire, thinking to himself, "He's running it. I'm confident he could get signed off [as IC (b) on this fire]." Kendall moves downhill, heading toward the anchor point then toward the road, to tie in with resources along the way. He meets E2 crewmembers working their hose lay and mentions this to Blake over the radio. Blake now knows that either he or (b) (6) has met face-to-face with everyone on the fire.

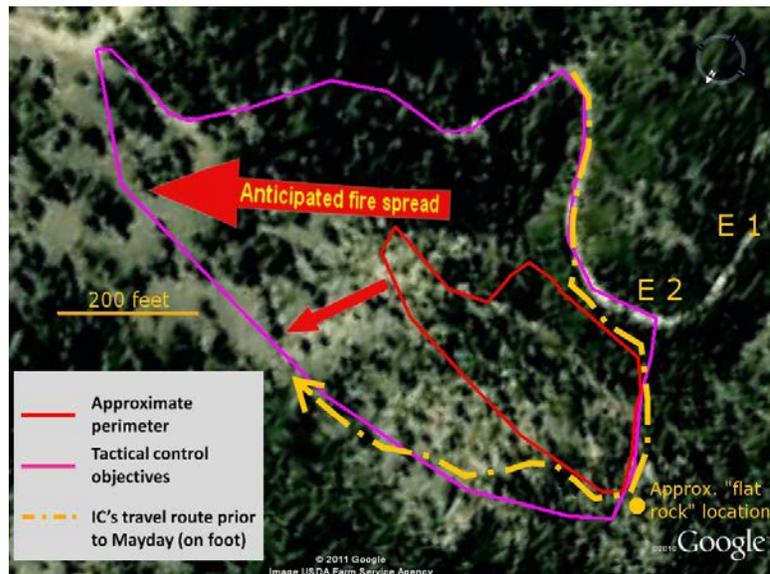


Figure 5. Google Earth screen capture showing control objectives, approximate fire perimeter as of 1430, E1 and E2 locations, and IC's foot travel path before mayday call.

While IC (b) Blake and (b) (6) Kendall were moving up along the left flank, Reese (E5 Captain, (b) left the staging area and began walking down the road to look at conditions on the right flank. Just before the draw, Reese feels a pulse of heat through the dense foliage below. He hears crackling down there, but sees nothing through the dog-hair timber thicket. He continues to the western edge and is surprised to find E2 and E1 (he knew they were on the fire, but wasn't sure where).

Independently, both Reese and (b) (6) Kendall consider burning off the road; but given the topography, fuels, and resources on scene, they don't think this would be successful: If they start a burn and the fuels *don't* burn well, they'd just "make a mess" below the road. On the other hand, if it burns cleanly, it would be difficult if not impossible to keep fire below the road. The fire is still small, and the line along the right flank is holding without issue, even the preliminary scratch line E1 put in ahead of E2's hose lay. If this fire is going to get away from them, firefighters expect it to happen on the left flank.

Discussion Points

With what you've read so far, where on the fire would you anticipate the potential for problems? Hindsight can make the answers seem obvious, but try instead to put yourself in the shoes of firefighters on scene.

What are the relative risks and potential benefits of direct attack vs. burning off vs. delaying engagement altogether?

Immediately Before Entrapment (1440–1502)

After walking down to the western edge of the fire and getting a general sense of the situation on the right flank, Reese walks back up the road. Meanwhile, E2 crewmembers continue working their hose lay, as E1 crewmembers put in scratch line ahead of them and Alex follows behind with his chainsaw. In the meadow, the five engines are parked and personnel have started walking down the road as a hand crew. Some firefighters notice the smoke lift a bit and a few more trees torching, but the wind doesn't increase.

Hiking up the road, Reese passes the draw and finds the fire has spotted across the road. It's too hot for him to go any further. He radios (b) (6) Kendall about the spot fire. IC (b) Blake asks whether he thinks they'll still be able to hold the road. Reese responds, "We are past that point now." The hand crew radios that they cannot continue in because of a spot fire near the road ahead of them.



Figure 6. Locations of hose lay, hand line, and E2 when Reese saw the first spot fire above the hand line.

Reese turns around and walks back down toward E2, and sees a spot fire over the road, above and slightly ahead of the hand line (fig. 6). Reese has E2 pull forward to cool the spot with water, and an E1 crewmember begins scratching line around it. They're still not far from the black or the cool western edge.

There is some torching below the road, and firefighters there are starting to feel more heat. Yet, the hand line along the right flank is still holding without issue, and about 50 feet from them, the western edge is still cool.

As they work the spot, Reese heads back up the road to check fire activity. IC (b) Blake hears the radio traffic, and orders a dozer. With the spots over the road and the hand crew unable to get in, Blake thinks it's time to order an IC (b) . He radios the Duty Officer to update him and discuss options; then he calls GPC Dispatch to order the standing Hell Canyon District Type 3 organization. He also ends

Discussion Points

For IC (b) Blake, the triggers for ordering an IC (b) were: the hand crew's access was blocked, and firefighters were starting to get spots over the road. While the situation still appeared under control, he ordered an IC (b) and ended Kendall's (b) (6) assignment.

As a leader, what triggers and tools do you use to evaluate whether your situation calls for a decision-maker with higher qualifications? What if there isn't one available?

When do you make that call?

In a mentorship role, how do you judge when it's time to step in and end a (b) (6) assignment? In your experience, what can make this difficult to do?

Kendall's (b) (6) assignment and reassumes full control of the fire. He notes the time as 1503. (b) (6) (b) (6) (b) Terry prepares to leave the BKF Custer office for the fire.

Meanwhile, Reese reaches the draw and turns around. As he heads back down toward the engines, he sees two more spots above the road and thinks, *"This canyon's going to go."* He radios for everyone on the right flank to back their engines down the road. He yells at E2 to back up, and yells it again as he walks past them. E2 crewmember Kyle, who is standing at the pump behind the truck, says, *"It's too hot!"* Reese shouts, *"It's hotter up there. Back Up!"* Reese continues down the road another 40 to 50 feet to re-check the western edge. E1 backs about 150 feet down the road.

Kendall is near the anchor point, hiking toward the road. He feels a sudden urgency he can't explain--he doesn't see threatening fire activity, and can't think of anything specific he heard on the radio to justify this feeling that there might be a problem on the road and he needs to get up there. He starts sprinting.

Right behind E2, a large tree is torching just below the road. The E2 crew leader, Drew, hurries down from the spot fire he has been working. He jumps into the passenger seat. Inside the cab, he and the driver, Rory, see only smoke and flame behind them. They've lost visual contact with everyone else, including Kyle (E2 crewmember), who is behind the engine with the hose. Trying to get to safety and away from the increasing fire intensity behind them, they drive forward.

Entrapments (1503–1508)

Reese is shocked to see the engine pull away, he looks down at his watch; it's 1503. A moment earlier, E1 crewmember Pat saw E2's reverse lights flash briefly, was sure they were about to back up, and thought, *"I'd better get out of their way."*

Kyle is standing behind the engine, between a torching tree below the road and the spot fire above when the engine drives away. Looking for what to do, he runs a small circle then drops facedown onto the road (fig. 7), with his fire pack next to him. Immediately, a rush of heat, fire, and smoke curl over the road, hiding him from view.

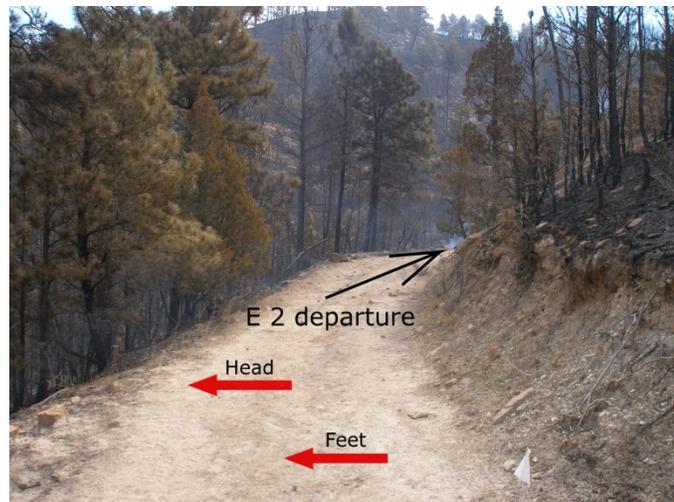


Figure 7. Entrapment Site 1. Red arrows indicate location and orientation of entrapped firefighter.

Kendall bursts up onto the road from below. Reese tells him E2 drove away, toward the draw. The smoke lifts for a moment and they see Kyle lying in the road. Reese yells for him to get up and run, but Kyle doesn't do anything. Reese dashes forward, lifts Kyle to his feet, and sends him racing down the road. Kendall walks him toward E1.

As they drive, E2 soon finds they are surrounded by active fire, heavy smoke, and intense heat. Inside the cab, Drew pulls out his fire shelter and gets ready to deploy it. They drive past the draw and find a wall of flame across the road. E2 backs into the turnaround area in the draw. They're trying to get turned around so they can drive back down the road. But the vehicle halts against the embankment, and soon, the vehicle's engine stalls. Rory struggles to get his shelter out of his pack, so Drew drapes his shelter over both of them. They expect they'll have to stay here and ride it out until the heat passes. Flames quickly engulf the engine, and it begins to burn. The crewmembers make two Mayday calls and request bucket drops from Helo1. It's getting hotter and harder to breathe.

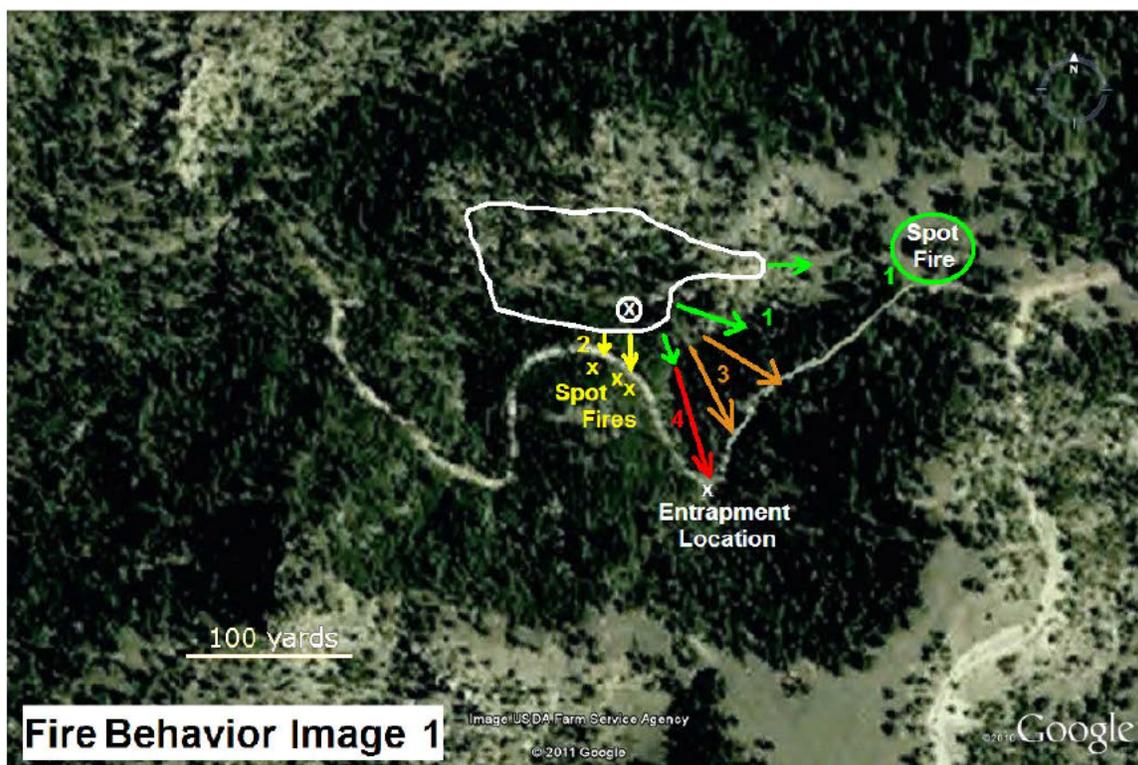


Figure 8. Fire progression on the right flank (from Fire Behavior Analysis, Appendix B): The spotting at (1) blocks (b) progress up the road. Then, at (2), he finds spots above the road near the western edge of the fire. E2 works these spots and later drives forward from here. Their escape is cut off by fire over the road (3), so they pull back. The vehicle gets stuck in the turnaround spot in the draw, and fire runs through the draw (4).

While intense heat and wind channel up through the draw, winds stay relatively calm over the fire. Standing on the road above the western edge, E1 crewmember Pat sees that the smoke "just hung there." Near the ridgeline on the left flank, IC (b) Blake is seeing more smoke, but the winds are still relatively light: "there wasn't a blast or anything."

Along the western edge, there is very little fire activity and the line is holding. Working near the anchor point (about 6 chains away from the draw and Entrapment Site 2), Alex is surprised to hear radio traffic about trouble on the road:

"Over the radio I hear something like, 'We can't catch these spots.' I stop the saw, head to the heel of the fire, and look around. From my vantage point there was nothing of concern, no obvious smoke color, not much of anything, nothing out of the ordinary or significant with the wind. I look around and there's no immediate danger. Light winds, swirly, but nothing of concern. Then I hear the Mayday. And still, I don't see anything of concern, nothing extremely threatening—or even of curiosity. There's nothing out of the ordinary with fire behavior. I hear the call and I'm like 'What?' I look around and I'm like 'How?'" (see Fig. 9)



Figure 9. Anchor Point. On the fire's western edge, the anchor point and right flank held through the shift.



Figure 10. Aerial photo showing key locations and approximate fire perimeter when the second spot fire occurred.

Key locations - 1 Strike tree, 2 Anchor point, 3 Location of E2 parked while stringing hose downhill, 4 The "flat rock," 5 Where Kyle lay in the road, 6 Where E2 parked to attack the initial spot, 7 The draw, where the bottleneck occurred and where E2 was entrapped, 8 Area reached during rescue attempts, 9 Where fire blocked the hand crew's ingress

Rescue (1506–1520)

Others hear the emergency and mobilize to help E2. Near the anchor point, Helo1 Crewmember Alex calls Helo1 on the Air-to-Ground frequency and requests bucket drops on the engine. Up on the left flank, IC (b) Blake starts walking, then running toward the road. As he is moving, Blake activates life flight response through dispatch, designates Reese as the IC of the “*Incident Within the Incident*” (IWI), and has Helo1 crewmembers Alex and Morgan serve as lookouts on the left flank. From the Custer Office, (b) (6)(b) (6) Terry, begins the drive to the fire.

E8 Captain Sandy is just arriving to the (b) (6)(b) (6) He directs personnel in the meadow to stay off the radio and begins organizing EMTs for a rescue attempt.

Reese establishes radio contact with E2 and asks them their location. They tell Reese they are stuck in the draw and ask for help. Kendall and Reese make multiple attempts to reach E2 on foot.

Kendall uses his fire shelter to shield himself from the heat below the road. (b) (6) Kendall makes it to within 20 feet of the engine but the intense heat forces him to stop and kneel behind his fire shelter.

The entire vehicle bears the brunt of the convective heat channeling up the narrow chimney. The back half of the engine is blazing, paint on the vehicle’s hood is aflame, yet the cab itself is not on fire. A

tire blows, and Kendall retreats. Kendall and Reese take turns pressing in as close to the engine as they can, trying to reach the firefighters inside. The heat keeps driving them back. After one attempt, Kendall collapses from exhaustion and overheating. He comments to Reese that the heat is survivable not far down from the engine, “If they could get out, they'd only have to make it 15 feet and they'd be alright.”

Inside the cab, it is getting hotter and harder to breathe. Rory pulls his shirt over his mouth and nose, which helps. As Reese starts up toward the draw again, he sees the fire in the draw subside slightly, and tells the entrapped firefighters if they can make it out of the engine, now's the time to go, they just need to get 50 feet back down the road. Drew and Rory trust Reese and decide to make a run for it on a count of three, and Rory takes a deep breath. Reese continues pressing closer to E2. In the smoke, his feet kick the end of E2’s hard line, 35 feet of which had trailed behind as E2 drove off. He looks up and sees Rory is out of the engine. In the heat and smoke Rory stumbles over the hard line; he keeps his footing but



Figure 11. Aerial view showing how close Reese and Kendall came to E2’s.

his hard hat comes off and hits the road. He's still holding his breath and he keeps his face down his shirt as he runs down the road. Reese claps him on the shoulder as he runs buy, Kendall does the same, and Rory keeps running until he reaches the group behind E1. There, Kendall and the E1 crew begin first aid for Rory and Kyle.

While Reese and Kendall try to reach the engine from their side, Sandy (E8) and the EMT's are trying to access E2 from the top of the road. They park E8 above a steep section of the road and start walking down, but they cannot reach the engine because of the smoke and heat coming out of the draw. They return to E8 and try to find some other access. At the same time, Helo1 is attempting bucket drops on the burning engine. The pilot encounters heavy smoke above the draw, and is unable to locate E2 on the road.

Helo1 makes four slow passes along the road looking for the engine. On

the fourth pass, the pilot estimates the location of the engine, drops on the thickest smoke he sees, and goes to refill his bucket for another drop.



Figure 12. View of entrapment sites and medical aid site from across the draw.

Kendall and Reese join the group at E1, and Reese asks the E1 firefighters to attempt to drive up to E2 and try to rescue the remaining crewmember. The E1 firefighters start their pump and drive up the road toward E2. When they reach the burning vehicle, E1 Chief Lee and E1 Driver Pat take turns working the nozzle, spraying the engine and the torching trees below. They try spraying water into the cab through the broken windows, but the water has no effect on the fire. They mutually decide to withdraw. E2 is fully engulfed in fire—both inside and out, and Pat and Lee can see the deployed fire shelter inside the cab.

It cannot be known with certainty, but it is believed that the crew leader of E2 inhaled as he was hit by an intense burst of superheated gases and flames and was killed almost instantly. This burst of heat may have missed the driver by only seconds, or he may have been holding his breath as he passed through it.

Treatment and Transport of Injured (1520–1610~)

E1 returns to the injured firefighters' location, just above the cool western edge of the fire, and the crew continues first aid for Kyle and Rory; the volunteer firefighters of E1 are the only Emergency Medical Technicians on the road right now.

With the road blocked by fire, the IC and others evaluate options for getting the injured firefighters off the fire line and to the hospital. IC (b) Blake tasks the Helo1 crewmembers with constructing an emergency helicopter landing zone down the road while Helo 1 sets down at the dip site to reconfigure to carry a patient. Reese orders a hoist-equipped South Dakota National Guard helicopter. E8 Captain Sandy continues to attempt access from the top to get EMTs to the injured firefighters. Reese checks whether he can hike past E2, but it is still too hot to get through.

After awhile, Reese finds the fire has cooled enough for E1 to drive past the burned engine. The E1 crew loads the injured firefighters into their engine. After the egress route is scouted for additional hazards, they slowly drive up the road with the rest of the firefighters on foot. They reach the staging area and transfer the E2 crewmembers to awaiting life flight helicopters. One crewmember is admitted to Rapid City Regional Hospital. One crewmember is transferred to Western States Burn Center in Greeley, Colorado. Reese and Kendall's injuries are assessed and treated by fellow firefighters who also happen to be EMTs, and they are transported by ground ambulances to Hot Springs and Rapid City Hospitals where they are treated and released.

Shortly after this, E8 Captain Sandy escorts a Physician's Assistant from the South Dakota National Guard helicopter down the road through the smoldering timber to the entrapment site to account for the missing firefighter. They confirm his location inside E2.



Figure 9. View of E2 from upslope, looking down the draw.

Transfer of Command

About 1610, District (b) Terry arrives when E1 is driving out and assumes command of the incident. He ensures firefighters get medical attention and arranges transportation as needed, and secures the scene along with all evidence. All firefighters are disengaged from the fire. Helo1 does a recon flight to assess the fire. Approximately one hour later, Helo1 flies a second recon mission, this time with personnel from the incoming type 3 organization.

Legend of Resources

Legend of Resources			
Resource type or number	Agency/Forest	Role or work title during incident	Title and fictitious name used in this report
Helo1	Black Hills National Forest Helitack		(b) (6) Lynn
		IC(b)	Crewmember Alex
E1	Volunteer Fire Department		Crewmember Morgan
			Chief Lee
E2	State Department of Forestry		Crewmember Pat
			Crew Leader Drew
			Crewmember/Driver Rory
E3	Black Hills National Forest	IC(b), (b) (6)	Crewmember Kyle
E4	State Department of Forestry		Captain Kendall
E5	Nebraska National Forest	(b) (6)	Captain Reese
		(b) (6) IC IW1	
E6	Volunteer Fire Department	IC(b)	Captain Blake
E7	Black Hills National Forest	(b) (6)	Captain Sandy
E8	Black Hills National Forest	(b) (6)	
(b)	Black Hills National Forest		BKF(b) Gail
District (b)	Black Hills National Forest, Hell Canyon RD		(b) (6)(b) (6) Terry
(b) Duty Officer	Black Hills National Forest		Duty Officer Prescott