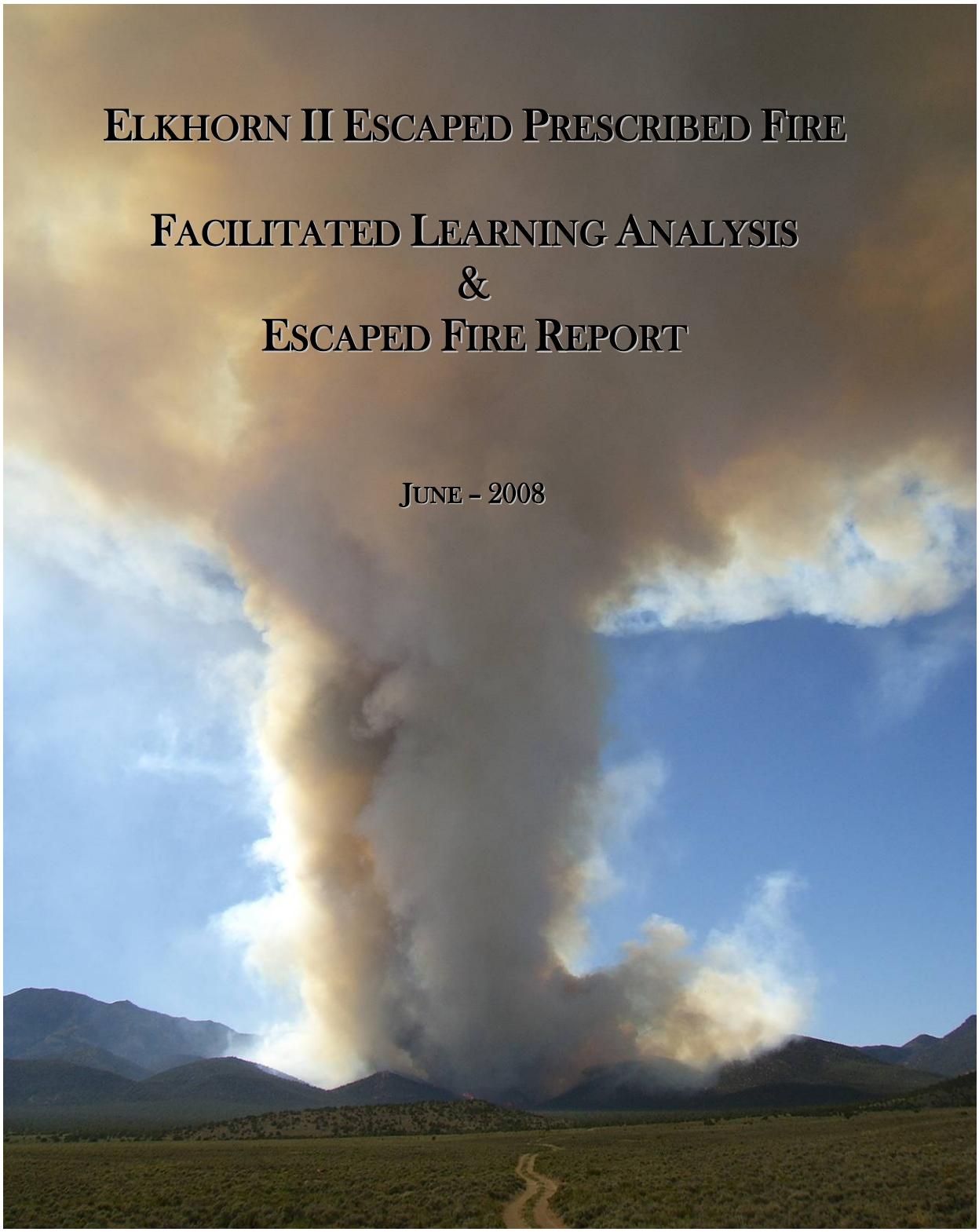
ELKHORN II ESCAPED PRESCRIBED FIRE

FACILITATED LEARNING ANALYSIS
&
ESCAPED FIRE REPORT

JUNE – 2008



U.S. Forest Service, Intermountain Region, Humboldt-Toiyabe National Forest,
Austin -Tonopah Ranger District.

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EXECUTIVE SUMMARY

On June 12, 2008, the Elkhorn 2, a prescribed fire, was ignited in the southern portion of the Monitor Range of the Austin-Tonopah Ranger District, Humboldt Toiyabe National Forest. On June 14 the prescribed burn was declared a wildfire. The planned 10,490 acre prescribed fire eventually burned 2475 acres within the original project area and 3724 acres outside the project area. No structures were involved, and no private, state or other agency land was involved.

On July 2, 2008, U. S. Forest Service Regional Fire Director, Mike Dudley assembled an interagency review team to investigate and review the planning and implementation of the Elkhorn 2 prescribed fire. The review team utilized a Facilitated Learning Analysis (FLA) approach, with the goal of improving future prescribed fire program actions by gathering lessons learned by the individuals involved. The FLA format was modified to incorporate the requirements of the Interagency Prescribed Fire Planning and Implementation Procedures Reference Guide and FSM 5140 for an escaped prescribed fire that has been declared a wildfire.

The review team conducted a site visit on July 6, 2008. A facilitated After Action Review (AAR) was held on July 7, 2008 at the Tonopah District Office. Most of the individuals who were directly involved in the prescribed burn participated in the AAR. The purpose of the AAR was to look at the planned actions, what actually happened, why it happened differently from what was planned and to develop lessons learned from the experience. Those involved were encouraged to be honest and frank in the discussions of actions and/or mistakes. Participants were assured that the intent of this report is to facilitate organizational learning from the event. In addition the team reviewed all pertinent documentation, including burn plans, weather forecasts, NEPA documents, maps and photographs.

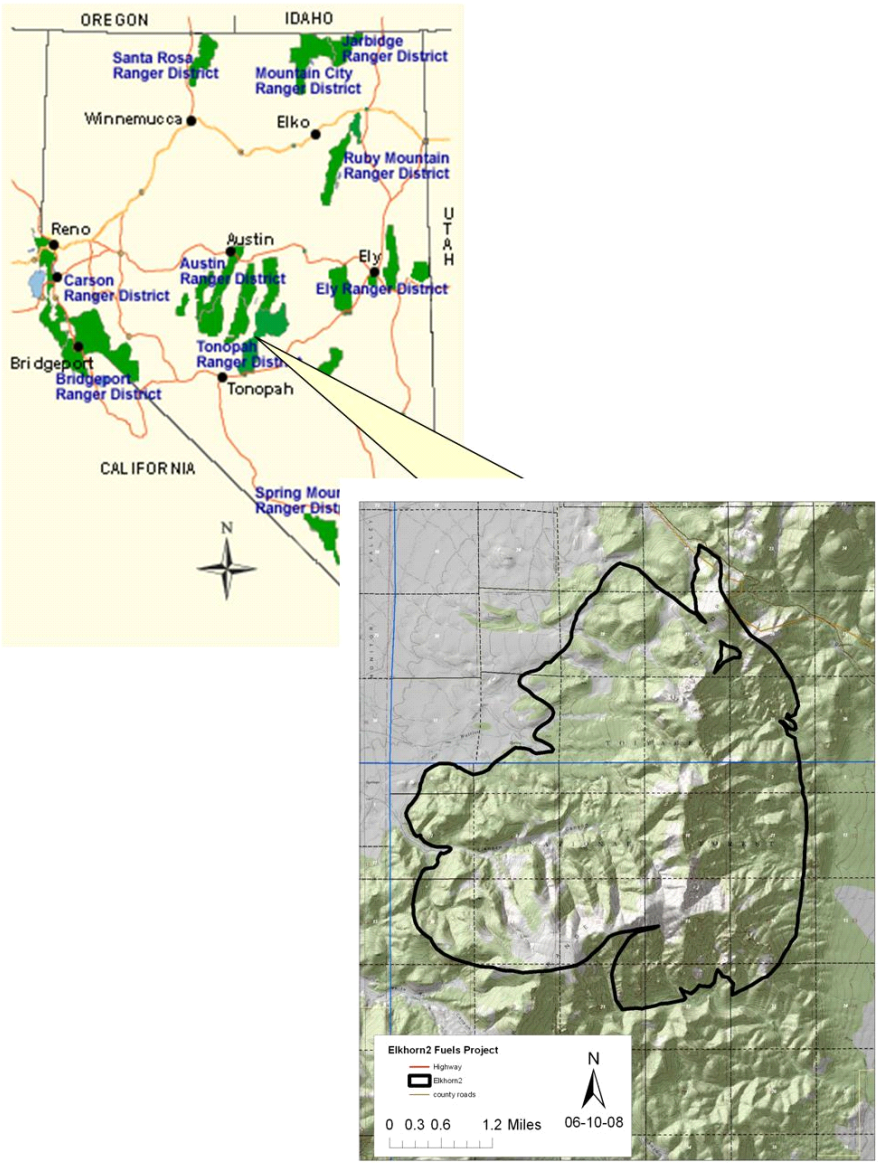
The Elkhorn 2 burn boss, burn boss trainee, and the AAR participants expressed numerous lessons that were learned from the events and the AAR process. These are described in detail in this document. The Review Team found that many of the lessons learned can be summarized into a few key findings related to Contingency Planning, the Project Boundary, The Test Fire, and Surprising Fire Behavior:

- An easily implemented contingency plan, with clear trigger points would have provided decision support which may have allowed the prescribed fire resources to bring the fire back into prescription without the need to declare it a wildfire.
- The boundary of the prescribed fire project area was difficult to defend because it utilized no natural barriers and the physical location was unclear to prescribed fire personnel.
- A better location for the test fire could have led to better decisions. In this case, the test fire location was not clearly visible to the burn boss and not in a location where it could be easily controlled.
- Fire behavior was beyond what was expected by all involved. Indications are that the heavier than average fuel loadings were extremely dry due to record low relative humidity levels for several days prior to the burn, even though the snow had melted only two weeks prior. The extended drought may have also been a contributing factor.

The Review Team Leader will retain a file that includes all documentation collected during the review.

Burn Narrative and Chronology

Vicinity Map



Elkhorn 2 Prescribed Burn

June 12, 2008

Resources arrived to the helibase just west of the burn site throughout the morning.
Prior to the burn initiation on site resources included:
Burn Boss, (RXB2)
Burn Boss Trainee (RXB2t);
Firing Boss (FIRB)
Firing Boss Trainee (RXB2t)
Holding Boss,
Mixmaster,
Helitack crew (module of 10)
Helitorch Manager,
Two Type 4 Engines,
One Type 6 Engine
Road guards.

In addition, one Fire use Module (with nine FFTRs) arrived that evening.

At approximately 0930 the RXB2, RXB2t, FIRB and FIRBt flew a reconnaissance flight over the burn area. They discussed the project boundary and agreed on the location to do the test fire. They also discussed where to begin burning operations if the test fire was successful. The burn boss decided to start on the far north end due to the forecasted northerly winds for that day.

RXB2, RXB2t, FIRBt, FIRB and the Agency Administrator reviewed and signed off on the Go/No-Go checklist.

At approximately 1200, the RXB2 and RXB2t briefed the crews. The briefing included forecasted weather, safety, helibase/mixing operations and operational assignments. The stated objective was to "punch holes into the PJ" meaning to create a mosaic of stand replacement fire with in the greater project area. Virtually all of the resources involved believed it would be difficult to get fire into the crown of the PJ.

Figure 1: general project area

The FIRB and FIRBt were then flown up to a lookout/observation point where they could direct helitorch operations.

At approximately 1430 the test firing began. The first barrel was dropped on a southwest facing slope in northeast corner of project area. The assessment of the test fire confirmed that the objectives could be met and the RXB2 issued the decision to continue burning onto west and north aspects. Later in the afternoon the RXB2 noted that the fire was burning better than expected and there was no longer any doubt they would meet the objectives.

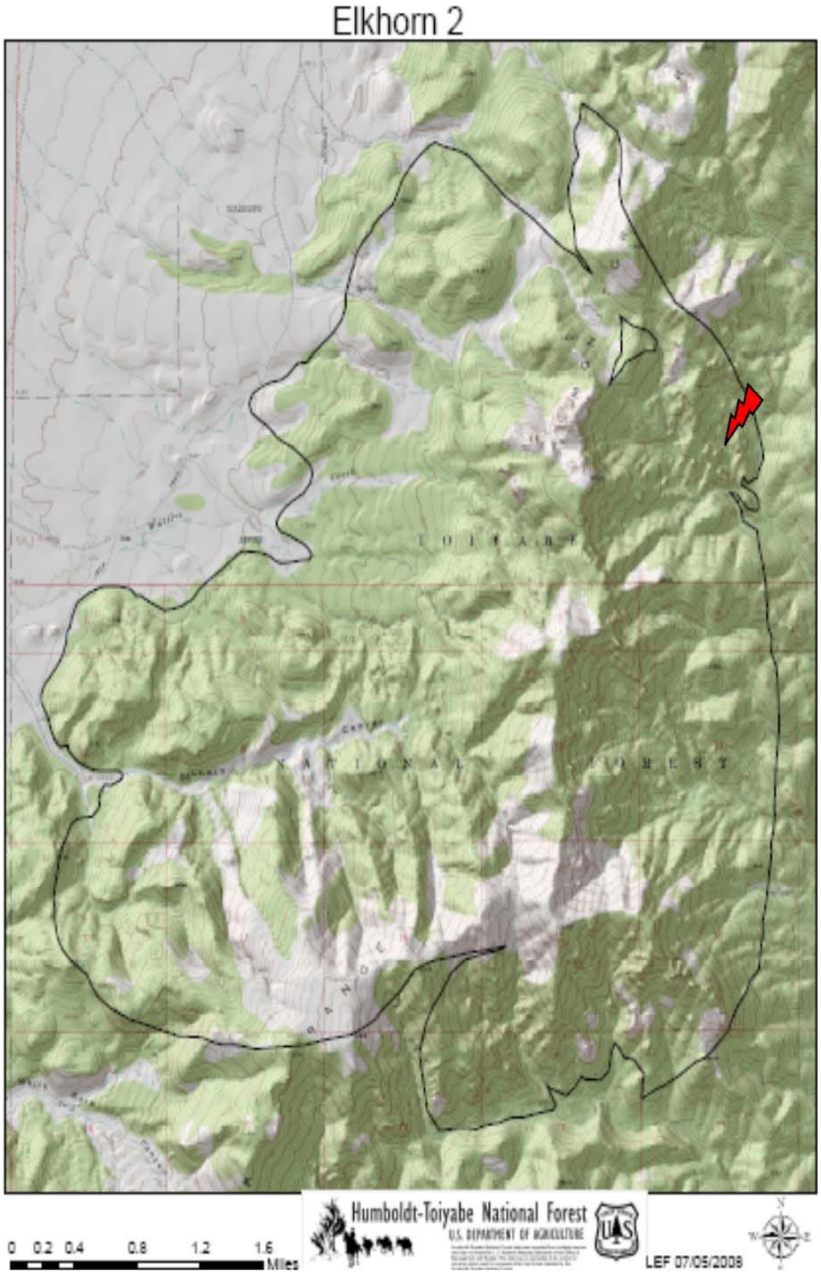


Figure 2: Project Area Boundary. The Lightning bolt shows the approximately location of test fire.

Figure 3: Test fire June 12, 2008 at approximately 1420 ~ photographer looking west.

By approximately 1800, eight barrels of gel been used and ignition was suspended for the day. Resources were redeployed to the helibase for a debriefing and then to a base came for the evening.

Figure 4: Fire activity at the end of ignitions June 12, 1800-1900 hrs looking west then east.

From 1800 to 2130 the RXB2 and RXB2t continued to monitor the fire. Their evaluation was that the fire was unexpectedly active during the day but they were confident the fire would die out over night.

June 13, 2008

An early morning reconnaissance flight with the RXB2, RXB2t, FIRB and FIRBt reconfirmed that the results of yesterday's ignitions were meeting objectives. The consensus of the leadership was that the area that was burned on the previous day looked good; there was a great mosaic pattern but there were as a few hot spots of concern.

One of the hot spots of concern was adjacent to the project boundary or possibly just outside of the project boundary. The RXB2t requested the Fire Use Module into the site to control this hotspot.

Briefing of resources began at approximately 1030. The briefing relayed the plan to continue burning operations once the hotspot in the northeast corner had been arrested.

At approximately 1200 the Fire Use Module reported that the fire intensity of the hotspot was too great and they could do nothing to arrest the spread.

Figure 5: Fire activity on north end by the time crews arrived June 13, 2008 1200.

Plans were revised and the helicopter was requested hook up the bucket to begin bucket work on the northeast corner. This was delayed for about an hour because the pumpkin had not yet been set up and filled. By this time there was some uncertainty but also a general agreement that the fire had likely crossed the project boundary in the northeast corner. {Though unknown to the firefighters, by the end of the first day the fire had breeched the project boundary by nearly 1/3 mile along a one mile long front} This hot

spot was now exhibiting very active behavior with single tree torching becoming more and more frequent.

The RXB2 reorganized the burn organization to assign the Crew Boss of the Fire Use Crew as the holding boss and the planned holding boss would then work for the new holding boss. The Helitack Crew was also assigned to the new holding boss.

By approximately 1300 the northeast hotspot had become a flaming front moving northeast and a second front slightly farther south had also become active. This second front apparently also breached the project boundary and would likely threaten the House Canyon Road. An Air Tactical Group Supervisor was flying in the vicinity and assisted operations and oversight.

Figure 6: Fire activity when bucket operations began June 13, approximately 1300.

Figure 7: Fire making a run to the east at approximately 1400.

Figure 8: Fire activity at approximately 1520.

Throughout the afternoon the RXB2 was in discussions with the Agency Administrator and the Dispatch Office concerning resources needed to contain this fire and

considerations of declaring it an escape. Because of a lack of an existing agreement with other land management wildland fire agencies, only Forest Service Resources were being considered for assistance at this time.

A reconnaissance flight at approximately 1700 revealed significant movement and intensity on several different flanks.

The forecast for 6/14/08 (next day) showed:
Sunny
Max Temp: 85-95
Max Temp Mid: 82-92
Min RH: 4-9
Min RH Mid: 6-11
20 ft. winds upslope SW 15 mph. Ridge tops 10-15.
Haines Index 6

At approximately 1800 the fire breeched the House Canyon Road but then stopped unexpectedly. Engine crews were able to contain two to three acres of fire northeast of the road. The Agency Administrator and RXB2 discussed the need for more resources and the need to declare the fire an escaped fire. There was consensus that the fire's progression to the northeast had apparently been stopped indicating there was an opportunity to postpone the evaluation of a declaration until the following day.

Figure 9: Fire crossing House Canyon Rd June 13 2008, 1800.

June 14, 2008

Through the morning of June 14th, all actions were directed to contain spread to the east and north. Fire activity was minimal until approximately 1530 when activity picked up and crowning activity resumed. The helicopter malfunctioned that day and was unavailable.

Figure 10: Fire activity at approximately 1700.

At approximately 1800 the Agency Administrator, RXB2 and RXB3t advised the Forest Duty Officer that the fire had escaped and could not be returned to prescription. At this time it is estimated the fire was approximately 1600 acres in size; 600 acres of which were outside the project area.

The RXB2t then ordered a Type 3 Incident Management Team to take over the fire. The WFSA was initiated that evening. The planned 10,490 acre prescribed fire eventually burned 2475 acres within the original project area and 3724 acres outside the project area

Lessons Learned by Firefighters

When asked what you learned that you would do differently or what you learned that should be shared with other firefighters the following responses were given. These are categorized by the following themes: ***Contingency Planning, Project Boundary, Test Fires, and Surprised by the Fire Behavior.***

Contingency Planning:

Ensure contingency plans are actually implementable. They should obviously be flexible but also specific enough to be meaningful if and when you need them.

Request RO and/or SO support in developing realistic contingency plans. Just because you're out in the middle of nowhere, or you're on a low priority district, doesn't mean that you should accept a lack of support on contingency preparation from the SO. If during the winter before, the Forest buys off on a plan that says you need XYZ available before you light; then, they must support you when the conditions are favorable but you say you're not going to light until XYZ becomes available.

Request SO and/or SO assistance in developing interagency agreements so that you can use other agency resources on Rx burns. Get agreements in place before doing a landscape burn.

Develop contingency plans that serve as trigger points. Be specific. For example think about and write out, if the fire crosses road Y, do this and order that; if it crosses ridge X, order this and do that. This isn't to say that you have to do exactly what your contingency plan says, but at least when you see what was thought about earlier it will help you transition from the tunnel vision of an Rx mentality a higher situational awareness of what your fire is really doing.

Develop contingency points or trigger points that will cause specific actions when your fire is doing things you know in foresight you do not want it to do. Otherwise the fire will gradually reach and cross these points and in the mean time you'll be talking yourself out of doing the aggressive necessary actions; and reassuring yourself that you're still in control.

Contingency planning should be thorough enough to make you prepared for the worst case.

There is a danger in a slow transition between an Rx organization and a suppression organization. Don't just gradually modify the Rx organization to become a modified suppression organization. When you make changes to the organization keep it within the ICS structure. For example, if you take a monitoring module that works for the Burn Boss, and turn them in to a holding

crew you must keep the organization clean and put that crew under the holding boss.

Establishing a predetermined suppression organization is very important for the transition from RX to suppression. When an escape is declared the holding boss in the RX organization may not always be the IC in the suppression organization. Having these roles, responsibilities and protocols in place and communicated clearly ensures a fast and smooth transition.

Use normal fire behavior for normal planning but extreme fire behavior for contingency planning.

Have the pumpkin set up and ready to go before doing the test burn.

Project Boundary

Make sure the project boundary is a boundary that you can realistically defend.

Make sure your holding and lighting bosses know exactly where that boundary is.

An arbitrary project boundary will set you up for failure. Think about the reason for having a boundary. It is a place you don't want fire to go. The boundary or somewhere between your burn and the boundary has to be a place you can and would feel good about trying to defend if necessary.

Test Fire

Make your test fire a real "test" of the burning conditions. Put it in a place where it represents worst case burning and in a place where you can put it out if the test tells you the fire will exceed your prescription.

For PJ test burns, do test fires 24 hours in advance so you can see how they behave overnight and the next morning. Make another go-no/go the following day. What it does at 1000 the next morning will tell you if you've got more than you can handle.

In PJ burns we are starting a fire that by definition is one that we firefighters aren't going to do much to stop (that is, a crown fire). Shouldn't we then put the test fire in a location where we can "test-the-fire" to show that the fire will stop on its own?

Look really hard at the test fire before deciding to accept it as a go.

Surprised by Fire Behavior

> The fire was consistently inconsistent.
> The fire kept lying to us…. It would keep giving us little bits of hope. Hope that we could keep from calling this an escape and hope that it would behave like a PJ burn.
>
> In 30 years of burning and fighting PJ, I've never seen it get up and go in the morning like it did; and with no wind.
>
> The fire would stop where you think it should go and go way beyond where it should have stopped.
>
> I'll never believe anyone that says, "It'll stop when it hits the rocks"
>
> My slides failed me. We can no longer rely on RPD {RPD stands for Recognition Primed Decision-making}.
>
> The principle that says base actions on current and expected fire behavior should be restated to say, base actions on current behavior because your expectation is probably going to be wrong.
>
> A good snow pack does not mean high spring fuel moisture. Don't trust the snow to wet your dead fuels.
>
> When a PJ backing fire looks like a flanking fire, you've got trouble

~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~

Lesson Learned Evaluation by the Escaped Prescribed Fire Review Team.

During the After Action Review the firefighters identified multiple *lessons learned* which could otherwise be defined as factors which contributed to the eventual outcome. With an outsiders perspective, the Review Team listened carefully to these lessons learned and developed the following analysis and conclusion.

Contingency Planning:

The team agrees with the firefighters that the contingency planning needed to be strengthened and the planning that was done may have contributed to the escape by creating confusion over what suppressions options were available and when actions

needed to be taken. The lack of adequate contingency planning fostered an atmosphere of indecision on when to declare the prescribed fire a wildfire.

The fire behavior narrative in the plan described a desired fire behavior to be of high intensity with torching trees producing flame lengths greater than what would be modeled by BEHAVE. When this behavior was demonstrated by the test fire, firefighters were reassured they were "in" prescription. The prescription didn't address probability of ignition parameters, spotting potential, and nighttime or morning holdover activity. These elements, while not required by policy, assists the preparer develop complete holding and contingency plans. They may also have triggered the preparer to identify the need to relocate the project boundary to a location that would facilitate holding operations and mitigate spotting consequences.

The firefighters expressed the need to develop better contingency planning. The review team agrees finding that the holding and contingency plans were not coordinated. For example, spotting is mentioned in the contingency plan but specific actions in response to spotting are not. The team believes it would have been helpful to identify a spotting distance threshold or an accumulated number of spots threshold, and then state what actions (thought out in advance) would be implemented to mitigate the spotting and what extra resources would be needed to accomplish this. Further, the contingency plan could have identified the tactical use of bucket drops from the helicopter in case of spotting over the project boundary. This level of preplanning could have triggered the helicopter bucket preparation to have been preplanned, thus eliminating the delay when it was needed.

In summary, contingency plans should be developed describing reasonably foreseeable events and the contingency resources required and actions needed to mitigate those events. Contingency resource needs should be based on fire behavior outputs tied to worst case fire behavior as identified in the prescription element.

Project Boundary:

In hindsight virtually everyone involved in Elkhorn II identified the need to have clear defensible project boundaries. The project boundary for this prescribed fire was identified in the EA and through an interdisciplinary team project development process. The boundary was located along contour lines corresponding with archeological survey requirements and in some cases vegetation changes (Pinyon-Juniper to Sage). Consequently in many areas the boundary was located at mid slope in dense continuous Pinyon-Juniper stands. The boundary did not consider a road (nearby to the north and east), natural barriers or afford the ability to prepare the areas of continuous dense vegetation crossing project boundaries.

From an outsider's perspective it seemed odd that experienced burners would accept a boundary that had no consideration for fire behavior. However, according to the prescribed fire plan preparer, previous experience with prescribed fires in the area have shown that Pinyon/Juniper fires do not burn into these vegetation change areas; they do

not back down through the Pinyon/Juniper vegetation and they go out over night. Based on this past experience, (validated by several reviewers) essentially everyone involved with the planning of the burn felt the boundary was effectively irrelevant because the burn could easily be kept well away from it. Therefore they were comfortable with the boundary that was defined entirely by archeological interests. With the mindset that the boundary really didn't matter as an area that must be defended, there was little need to precisely identify the boundary to those executing the burn plan.

The lack of a defensible boundary contributed to the escape in two ways:
(1)The Prescribed Fire Burn Boss, Burn Boss trainee, Firing Boss and Holding specialist all wished they had known exactly where the project boundary was when on the ground implementation began. As it turned out, the test fire was ignited very close to the boundary and in an area that was not accessible by holding resources. The surprisingly extreme fire behavior and unanticipated downhill spread that they experienced on the first day threatened and may have even crossed the project boundary by that first evening.
(2) The location of the boundary did not afford any opportunities for quick suppression operations when it was decided on the morning of the 13th that fire had crossed the boundary. By the time ground personnel could get to the slop over, it had become active and could not be safely contained by on the ground resources.

Test Fire

The firefighter's lesson learned concerning the test fire are valuable and certainly worth consideration in future prescribed burning. Interagency policy directs that the test fire be in a location where the test fire "…can be easily controlled" (Element 14, Interagency Prescribed Fire Guide). In retrospect, the Elkhorn II, test fire was actually designed *only* to test to see if the conditions would allow the initiation of (at least) short duration crown runs. Since there was no reasonable way to stop or contain the Elkhorn II test fire if it proved to be too intense, one could not say the test fire served the purpose of *testing* to see if fire behavior conditions were too extreme to be in compliance with the prescription. Technically therefore, the test fire was out of compliance with the Interagency Prescribed Fire Guide. Nevertheless, the test fire did not contribute to the escape.

One firefighter suggested the best use of a test burn in these conditions would be to evaluate if the fire would hold through the night and resume active spread by late morning. This is an excellent recommendation for large landscape burns where there are indicators the intensity may be too high. Importantly however, all test fires need to be ignited in locations where they can be contained without a declaration of escape.

Surprised by Fire Behavior

The firefighters recommended that in the future, burn day preparations should expect or at least plan for the worst case. The review team concurs with the firefighters. Certain

preparation such as setting up bucket drop capabilities prior to ignition should even be standard operating procedure.

In analyzing the pre-burn consideration elements, the review team found that pre-burn considerations were adequate for the project when related to the project boundary and fire behavior as identified in the plan. However, the following day's surprises of early high intensity fire and the troubling realization that the fire may already be outside of the project boundary removed any doubt that opportunities to contain any escape was severely limited and more energy *should* have been put in planning for the worst case. In the hindsight of this event, it is clear that while we don't have the capability to always predict fire behavior, we can always make it easier to manage the unexpected with good contingency planning.

Human Factors and Reluctance to Declare an Escape.

Interagency Prescribed fire policy states: *A prescribed fire must be declared a wildfire by those identified in the plan when that person(s) determines that the contingency actions have failed or are likely to fail and cannot be mitigated by the end of the next burning period by on-site holding forces and any listed contingency resources. In addition, an escaped prescribed fire must be declared a wildfire when the fire has spread outside the project boundary, or is likely to do so, and cannot be contained by the end of the next burning period. A prescribed fire can be converted to a wildfire for reasons other than an escape.*

In the opinion of the review team and in the hindsight the personnel involved in the burn, the Elkhorn 2 prescribed fire conversion to wildfire *clock* began on the morning of June 13th when the Agency Administrator, RXB2 and Trainee found the fire had likely exceeded the project boundary; also, the fire was so active early in the morning that their objective for the day changed from ignition to containment. They eventually declared it a wildfire very late in the afternoon of the 14th. While this declaration was within the time frame allowed by policy, most all the participants involved with the burn said that in hindsight there were enough indicators early on that should have led to the declaration of a wildfire even by the morning of June 13th. These indicators included: (1) High intensity fire behavior that lasted longer than expected into the night of June 12th and a backing fire in the Juniper, both indicators of above normal dryness. (2) Fire behavior was beyond what anyone had expected to see and many of the most experienced firefighters stated they had never before seen this type of behavior in PJ. The holding specialist commented "that as soon as I saw the fire behavior I knew something was not right".

There is perverse incentive to delay declaration of an escape; that is, every acre burned prior to declaration counts towards target accomplishment. The review team explored this issue and concluded that additional target accomplishment did not influence their delayed decision to declare the fire escaped.

Similarly, a second external influence was speculated to have played a factor in delaying the decision to declare the burn escaped. A letter issued just one day prior to the burn by the Forest Supervisor gave very strong emphasis to meeting burning targets even if that means canceling individual participation in incident management team assignments. The letter had been read by key leadership involved with Elkhorn II but the review team does not believe this letter influenced the managers to delay the declaration.
One way to make sense of the delay in declaring the burn an escape is alluded to in the Lessons Learned section of this report. A comment given by one of the firefighters during this review sets the stage, ***"my slides failed me"***.

In the landmark Text, *Human Error*, by Psychologist James Reason (© Cambridge University Press 1990) defines *skill-based errors*; that is, decision making that is impaired or at least hampered by past experiences. On Elkhorn II, very skilled and experienced firefighters saw fire behavior they had never seen before. It didn't match their slides (previous and extensive experience). In *Human Error*, Dr. Reason states,

"*When confronted by a problem humans are strongly biased to find a prepackaged solution rather than resort to the cognitive strain… and anxiety of learning and analysis. In short, the more complex the situation the more furious the pattern matching"*.

The natural human tendency to avoid this anxiety, especially under the stress of managing a fire may have led to what Dr. Reason refers to as the *"The illusion of control… the irrational influence caused by the knowledge of a previous outcome of a perceived similar situation; causing one to overestimate confidence in the forecast."* Virtually every experienced firefighter (in spite of abundant disconfirming evidence) clung to the belief that the fire would change behavior and become the type of PJ fire they were expecting at the outset. The natural human tendency in these situations is what Dr. Reason termed, *"confirmational bias"*; defined as, *"Satisficing (a) situation into a previously learned situation… instead of mastering the ability to understand the situation… your understanding masters the situation"*.

The value in this discussion is that it presents another lesson to be learned to enhance situational awareness. To the extent managers are aware of the natural and inevitable human inclination towards confirmational bias; it will increase their situational awareness of this potential decision trap.