Lessons Learned Review for the East Encerrito Prescribed Fire
National Park Service, Intermountain Region

April 20, 2009

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Executive Summary

During the second day of prescribed fire operations, an unexpected wind shift and change in fire behavior forced the Fire Effects Monitor (FEMO) trainee to make a hasty retreat to a safety zone. The FEMO trainee narrowly avoided serious injury and entrapment from a rapidly moving head fire, due in part from a timely warning and situational awareness. The increase in fire behavior and change in fire spread direction was compounded by communication issues between monitoring and adjoining line leadership, as well as tactical challenges in protecting numerous archaeological sites. There were several important lessons learned noted by the participants. Notably, when ground forces are working to secure a fire perimeter in deceptively light and flashy fuels, it is essential to actively maintain personnel accountability, frequent communication, and situational awareness.

The lessons learned review process for this incident was composed of a face-to-face discussion and a visit to the field location on May 13, 2009. The process of the review was to first identify the facts and underlying reasons for the near-miss event; the overarching goal and primary intent was to identify what the individuals themselves learned and what they would do differently in the future to reduce the likelihood of a future near-miss event.

Description of the East Encerrito Prescribed Fire

The East Encerrito Prescribed Burn was implemented at El Malpais National Monument (approximately 14-miles south of Grants, New Mexico) on April 19-20, 2009. Topography of the 910-acre burn unit is generally flat with some small rolling topographic features associated with past volcanic activity. Fuels are primarily low load and short sparse dry climate grass with scattered pinyon-juniper encroachment. This moderate complex rated burn plan called for a minimum staffing of nineteen (19) personnel onsite.

The long term strategy for the prescribed fire program on the monument is to reduce hazardous fuels, restore fire as a key ecosystem process, while ensuring firefighter and public safety and protection of property and resource values. El Malpais National Monument is rich in cultural resources, especially prehistoric resources. Decisions regarding the pre-burn preparation and protection of these sites were made collectively between the Superintendent, Chief Ranger, Fire Management Officer and the El Malpais Heritage Preservation staff. Thirty (30) archaeological sites are located within the treatment area boundary, each of which required protection from the effects of wildland fire in the implementation of this project.

The general goals and purpose of this treatment were to decrease risks to life, property and resources, and to perpetuate the cultural and natural resource values for which this national monument was established. Specific burn treatment goals and objectives as outlined in the burn plan include:

Resource Objective:

- To establish and maintain a vegetative structure and mosaic within the natural range of variability for southwestern grassland.

Prescribed Fire Objectives:

- Maintain live seedling tree density (diameter at breast height < 1 in.) at less than 10 trees/acre within 5 years post-burn.
- Maintain shrub density at less than 10 shrubs/acre within 5 years post-burn.
- Maintain 1, 10, and 100 hour fuels at less than 5 tons/acre within 5 years post-burn.

Operational Objectives:

- Keep fire inside boundaries of proposed prescribed fire units.
- Ensure personnel are wearing all required PPE while on the burn site.
- Implement standard prescribed fire safety mitigation strategies
- Ensure public safety by maintaining appropriate road safety and warning signs. Prevent smoke emissions from significantly impacting roadway visibility throughout the burn.

The Incident Action Plan and daily briefings emphasized the importance of protecting archaeological sites. In addition, the plan calls for a long term strategy of the prescribed fire program that provides for “protection of property and resource values.”

The East Encerrito burn unit is located in the north-central part of the monument, south of State Highway 53. The unit is bound primarily by State Highway 53 across the northern perimeter with a small 3-acre piece of private land to have been excluded. Bureau of Land Management service roads and the Monument boundary fence-line served as the western boundary. The southern and eastern perimeter of the unit consisted of a mowed line adjacent to ponderosa pinelands intermixed with broken lava flows.

Description of the Near-miss

Over the two days of implementation, operations during the burn consisted of two firing and holding teams - the "north operations", conducting firing and holding operations adjacent to New Mexico State Highway 53, and the "south operations" conducting firing and holding operations along a mowed handline.

On April 20 at approximately 1445, firing actions by south operations were temporarily ceased, and resources were holding near a stock tank. The FEMO trainee walked east, ahead of the firing and holding crews (estimated between 200-400 yards), to take 1500 hour weather observations. Shortly after arriving at this location, the wind shifted, coming out of the north. The Firing Boss (FIRB) trainee told the FEMO trainee to be heads-up over the radio. Fire activity increased, and a solid flaming front (flame lengths were estimated to be greater than 6') moved directly towards the FEMO trainee. The FEMO trainee immediately recognized the change in the fire environment, and started briskly walking back towards the mowed handline. Upon reaching the handline the FEMO trainee began jogging then sprinting towards the safety zone. While retreating into the black some gear was dropped and a hard hat was lost. The FIRB trainee was actively tracking the progress of the FEMO trainee and communicated "keep coming".

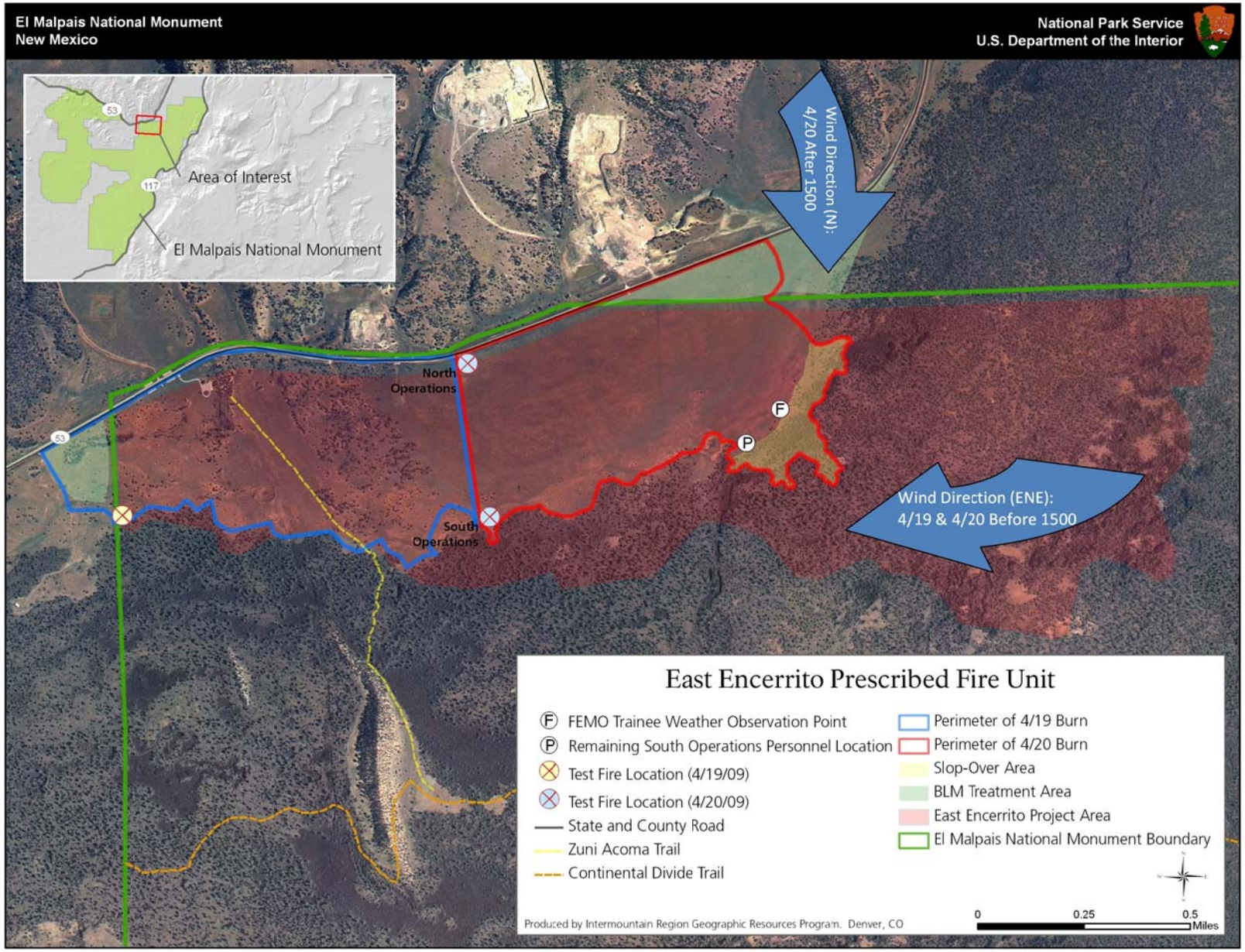
The FEMO trainee was not injured. The FEMO trainee remembers "shielding my face with my hand from the heat as I hit the blackline". Nearly instantaneously thereafter, the fire blew across the line "right in front of us". The advancing fire front resulted in 20 to 30 acre slop over outside of the target burn area.

Chronology of Events

Day 1		
April 19	Morning	Resources (30 operational personnel, plus four traffic control personnel) report to the burn unit. Briefing and assignments are given.
Refer to map	1115	Test fire is lit on the west side of the burn unit and declared successful.
	1200 (est.)	Simultaneous firing and holding operations ("north operations" and "south operations") begin, moving west to east along the Hwy 53 (north), and the mowed handline (south). Previously identified archaeological sites had been prepped and lined prior to the prescribed fire; protection of these sites within the burn unit is ongoing throughout the operational period, primarily by burning out around them in concert with perimeter blacklining operations. Progress is slower than anticipated. Wind direction is predominately from an easterly/northeasterly direction, with some variability throughout the day.
	1800	Observed fire behavior in grass: backing fire is minimal; head and flanking fire in the interior of the unit is more active.
	1830	Firing operations cease. Resources attempt to confine any additional fire growth.
	1930 (est.)	End of operational period. Resources conduct an After Action Review.
Refer to map	2045	While traveling back to town resources observe the interior fire is burning actively. The Prescribed Fire Burn Boss Type 2 (RXB2) contacts the Park Superintendent and explains the situation and the need to cut a fence in order to provide vehicular access. The Superintendent grants approval. The RXB2 directs holding forces to drive an engine off road across Monument land, into the interior of the burn unit, and successfully extinguishes the eastern edge of the prescribed fire.
Day 2		
April 20	Morning	Resources (33 operational personnel, 4 traffic control personnel) report to the burn unit. The RXB2 briefs the Chief Ranger and Park Superintendent on the previous day's operation. Burn boss travels to the burn unit. Briefing and assignments are given. The spot weather forecast for the planned ignition time of 0910 MDT calls for 20 foot winds to be "a mixture of terrain dominated and

		west/northwest winds 5 to 8 mph. Occasional gusts in the lower teens….possibly up to 15 mph during the peak heating period." The morning zone weather forecast for April 20 is slightly different, calling for the winds to be "terrain dominated 5 to 10 mph becoming northwest 10 to 15 mph in the afternoon."
	1115	Test fire is lit and declared successful. Ignition operations begin on north and south side of the burn, proceeding from where they were terminated the previous operational period. Winds are generally from the east, with some variability; the south line experiences east winds with some northern components.
	1230	The Chief Ranger for the Monument contacts RXB2 to report erratic winds. The RXB2 alerts burn personnel to erratic winds.
	1300	From the highway, RXB2 and Chief Ranger notice fire whirls in the burn interior. RXB2 alerts burn personnel to fire whirls and states to burn personnel to "get out of the interior".
	1355	Observed fire behavior in the middle of the unit continues to increase. Winds become variable pushing the fire north, east, and eventually south.
	1400 (est.)	Fire pushes north, spotting across highway and also onto adjoining private land; contained shortly thereafter.
Refer to map	1410 (est.)	Firing on the south operations hold at the stock tank as FIRB trainee scouts the line ahead, and looks for the next archeological site to protect of significance to the south line operations.
Refer to map	1445	FEMO trainee walks past the firing and holding crews, traveling east, to find a location to take the 1500 weather observations. FEMO trainee finds a location to take weather 200-400 yards in front of resources on the south line.
Refer to map	1500	FEMO trainee and FIRB trainee observe each other east of the firing operation. Shortly thereafter, the wind shift, now coming out of the north. The FIRB trainee tells the FEMO trainee to be heads-up over the radio. Fire activity increased, and a solid flaming front, with flame lengths estimated to be greater than 6', moves directly towards the FEMO trainee. The FEMO trainee immediately recognizes the change in the fire environment, and starts briskly walking back towards the mowed handline. Upon reaching the handline the FEMO trainee begins jogging then sprinting back towards the identified primary safety zone, consisting

		of burned blackline (solid black) along the southern boundary. While retreating into the safety zone, the FEMO trainee drops some gear and trips on some lava rock causing the hard hat to fall off. The FIRB trainee sees the FEMO trainee and communicates “keep coming”. The FEMO trainee was not injured. The FEMO trainee remembers “shielding my face with my hand from the heat as I hit the blackline”. Nearly instantaneously thereafter, the fire blew across the line “right in front of us”. The advancing fire front resulted in 20-30 acre slop over.


El Malpais National Monument
New Mexico
National Park Service
U.S. Department of the Interior
Area of Interest
El Malpais National Monument
53
117
Wind Direction (N):
4/20 After 1500
North
Operations
South
Operations
F
P
Wind Direction (ENE):
4/19 & 4/20 Before 1500
East Encerrito Prescribed Fire Unit
FEMO Trainee Weather Observation Point
Remaining South Operations Personnel Location
Test Fire Location (4/19/09)
Test Fire Location (4/20/09)
State and County Road
Zuni Acoma Trail
Continental Divide Trail
Perimeter of 4/19 Burn
Perimeter of 4/20 Burn
Slop-Over Area
BLM Treatment Area
East Encerrito Project Area
El Malpais National Monument Boundary
Produced by Intermountain Region Geographic Resources Program. Denver, CO
0
0.25
0.5
Miles

Underlying Reasons for Near-miss Incident

1. *Participants in the LLR believed that members of the burn organization did not anticipate a rapid change in fire spread direction and increase in fire behavior. There were several contributing conditions:*
   - Some burn personnel along the south line were surprised by the wind shifting from a light and variable easterly flow to a stronger and sustained wind from the north.
   - Participants believe that firing actions within the interior of the burn unit, initiated to protect the archaeological sites, played a role in establishing active interior fire that may have been ahead of perimeter black lining operations. Due to shifting wind direction, this interior fire became outside of the control of north and south firing operations.
   - Participants felt that communication between the FEMO trainee and personnel within the South operations group could have been improved given the rapidly changing and high tempo operational activity.
   - A fire weather observation location was chosen by the FEMO trainee based on observed fire behavior and anticipated continuation of black lining operations along the south line. As the situation evolved and fire behavior changed, the distance and travel time from the observation location to the black (safety zone) became a factor in the near miss.

2. *Participants in the LLR believed that the burn organization found unanticipated complexity and challenges brought forth by protection of 30 archaeological sites located within the interior of the 910 acre target burn area. This became especially apparent during firing operations, when the wind shifted direction and increased in velocity, changing the backing and flanking fire into a head fire. There were several contributing conditions:*
   - Participants believe that firing actions within the interior of the burn unit, initiated to protect the archaeological sites, played a role in establishing active interior fire that may have had potential to move ahead of perimeter black lining operations. Due to shifting wind direction, this interior fire became outside of the control of north and south firing operations.
   - Participants recognized the limitations of the burn organization in meeting tactical challenges.
   - Given the complexity of the project, participants recognized the limitations of using only a single FEMO trainee and the advantages of working in pairs to complete monitoring actions.
   - Participants recognized that the assigned evaluator (RXB2) to the FEMO trainee had multiple competing responsibilities and was unable to provide close observation and direct mentoring to trainee.
   - Participants recognized the impacts of fire program vacancies at El Malpais NM to the successful planning and implementation of the East Encerrito Prescribed Fire.

Lessons Learned

The following table displays many of the lessons learned as identified by the individuals during the review process and what they would do differently in the future. In addition, the table includes potential methods for sustaining the lessons learned, as appropriate, in future wildland fire operations; the intent for these recommendations is not focused on the prescribed fire program at El Malpais National Monument, but rather to have a broad range of applicability beyond the Monument boundaries and into the larger wildland fire community.

Lesson Learned	Potential Method for Sustaining
Human Factors	
Maintain and actively communicate situational awareness ("Be super heads up") when working in flashy fuels, especially if working independently.	Work in pairs, as appropriate, and continually emphasize the principles of LCES.
Maintain communication within the burn organization, especially between single resources (e.g. FEMO, lookouts, etc.) and adjoining forces. ("Communicate where I am")	During operations with potential for rapid changes and/or unfamiliar conditions, burn personnel should keep in close communication.
Ensure the burn organization is staffed and equipped to deal with tactical challenges, such as protection of valued sites and shifting wind vectors. Consider the value of exceeding the minimum staffing with additional experienced burn personnel.	Develop project action plans and staffing levels that are commensurate with the range of expected conditions and potential outcomes. Consider the added value of assigning evaluators to each trainee.
During firing and black lining operations, make sure the fire footprint gives adequate protection to line forces.	Project briefings and line leadership should continually emphasize the need to maintain adequate safety zones. When relying on the fire footprint for protection, line personnel must be keenly aware of travel times and distances from individual locations.
Deal with issues of resource protection well in advance of project implementation; clarify what is real risk versus perceived risk to the resources of concern. This would include making a determination whether the resource can be safely protected without compromise to firefighter safety.	Resource protection goals, objectives, and strategies need to be known and agreed to as developed in management planning documents. Tactical protection methods need to be reviewed and included in project planning procedures and documentation.
Design and perform prep work with consideration for intended holding actions under the full range of prescriptive conditions (e.g. Burning at the dry end of the prescription).	Consider involving a group of operational personnel in developing effective prep work standards in advance of project implementation. Carry lessons learned forward from successful and less-than-successful projects in similar fuel types. Share ideas at local and geographic area prescribed fire workshops.

Unplanned incidents and near-miss events that occur during project execution should be addressed in a timely and appropriate manner.	Annual safety refreshers, daily operational briefings, and other strategic planning efforts should emphasize that personnel be familiar with and comfortable with these definitions and processes. Fire organizations can explore additional methods to effectively use and share information from Lesson Learned Reviews, and the Wildland Fire Lessons Learned website.
Environmental Factors	
Look for a consistent wind vector when burning units with flat, rolling topography and grass fuel types. If using variable wind directions, ensure that adequate mitigations are in place.	Organizations may consider consulting with the Predictive Services staff at the Geographic Area Coordination Center and/or the National Weather Service prior to burn implementation; develop methods to provide feedback to forecasters.

Positive Factors – Factors that Contributed to a Favorable Outcome

- The RXB2 conducted operational period briefings that emphasized the importance of situational awareness, escape routes, and safety zones.
- Prior to the wind shift, the FIRB trainee made a valuable observation of the position of the FEMO trainee relative to the safety zone and firing operations.
- The FEMO trainee and the FIRB trainee acted decisively in a rapidly changing fire environment.
- The FIRB trainee recognized that the increased fire behavior and change in spread direction would quickly compromise the position and escape route of the FEMO trainee.
- The FIRB trainee took action by warning the FEMO trainee over the radio about the change in conditions and encouraged the FEMO trainee to safely move to the nearest “black” (their primary identified safety zone).
- The FEMO trainee selected and navigated an expedient escape route given the imminent threat of entrapment; the escape route was straight, over flat terrain, and was mostly clear of obstructions and trip hazards (some volcanic rock).
- The fitness level and mobility of the FEMO trainee contributed to a swift escape to the safety zone.
- As the FEMO trainee was moving to the safety zone, the FIRB trainee provided positive encouragement and a voice to follow.
- After determining that a near-miss incident had occurred, the RXB2 took action to address the affected personnel and initiate notification requirements.

Summary

A key member of the prescribed fire organization, the FEMO trainee, was forced to make a hasty retreat to a safety zone. The FEMO trainee narrowly avoided serious injury and entrapment from a rapidly moving head fire, due in part from a timely warning and situational awareness.

The participants recognized that members of the burn organization did not anticipate an increase in fire behavior and rapid change in fire spread direction. The increase in fire behavior and change in fire spread direction was compounded by communication issues between monitoring and adjoining line leadership, as well as tactical challenges in protecting numerous archaeological sites. There were several important lessons learned noted by the participants. Notably, when ground forces are working to secure a fire perimeter in deceptively light and flashy fuels, it is essential to actively maintain situational awareness, personnel accountability, and frequent communication.

The LLR participants and facilitators noted many positive factors that, in spite of the circumstances, contributed to a favorable outcome and kept the incident from becoming a serious accident. The individuals responsible for these actions and outcomes should be recognized.

The lessons learned review process for this incident was composed of a face-to-face discussion and a visit to the field location on May 13, 2009. The process of the review was to first identify the facts and underlying reasons for the near-miss event; the overarching goal and primary intent was to identify what the individuals themselves learned and what they would do differently in the future to reduce the likelihood of a future near-miss event.

Lessons Learned Review Facilitators

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