

CASA GRANDE INCIDENT  
BIG BEND NATIONAL PARK  
FIRE SHELTER DEPLOYMENT AND  
ENTRAPMENT

INTERAGENCY  
INVESTIGATION REPORT

MAY 8-11, 1999



## I. EXECUTIVE SUMMARY

This report details the deployment of fire shelters and entrapment of wildland fire fighters during fire suppression operations of the Casa Grande Incident at Big Bend National Park on May 4, 1999.

During the burning period of May 4, 1999, Park managers were executing a prescribed burn in the Chisos Basin area of the park. At approximately 1317, a spot fire from the prescribed burn became active on the west aspect of Casa Grande Peak. The prescribed burn was terminated and all available resources were assigned suppression duties in an effort to anchor, flank and pinch the spot fire using an aggressive control strategy.

Suppression resources included two Diablo crews, which are Mexican national citizens employed by the park under the Emergency Fire Fighter hiring authority. These crews were supervised by Spanish speaking park employees. The overhead organization included an Incident Commander Type 3, two Division Supervisors, and miscellaneous overhead. Several critical positions were encumbered by non-qualified individuals.

Fire behavior became extremely active as the spot fire increased in size and several strong upslope and across slope runs were experienced. At approximately 1430 on May 4, 1999, the fire made a run that entrapped four fire fighters by cutting off their escape route. Two of the fire fighters deployed their fire shelters. All four of the entrapped fire fighters were assigned to the Diablos East Crew, including the crew boss who is a permanent National Park Service employee. The other three fire fighters are Mexican national citizens.

No injuries were experienced by the four entrapped fire fighters, and after the fire passed through the area, forces were regrouped and suppression operations resumed. The four entrapped fire fighters resumed their previous assignments within the suppression organization.

Park managers requested an investigation of the incident in compliance with National Park Service policy. The Intermountain Support Office-Denver assembled an interagency investigation team, which visited the fire site, interviewed key participants and prepared this report. The team would like to recognize the preparation work the park completed and cooperation of park employees, which greatly facilitated the investigation.

The main body of the report contains a brief description of the Investigation Team, a chronology of events that occurred leading up to the entrapment and deployment, team findings that contributed to the entrapment and deployment and recommendations for corrective actions to avoid similar circumstances identified in the findings. The appendices include maps of the incident area, statements of principle participants, a roster of all personnel involved, the operational plans for the relevant day, a fire behavior and fire weather summary

for the appropriate burning period, and photos of the site. Implementation of the corrective actions listed in the recommendations may require additional assistance from out of park resources. Park staff are encouraged to request support from the Intermountain Support Office-Denver.

Additional information supported by physical evidence was discovered two weeks following the investigation and after this report was drafted. That information was added as an addendum, and is located behind the findings and recommendations. Some of the information contradicts statements provided to the team.

## II. INVESTIGATION TEAM

The Investigation Team was made up of individuals with diverse backgrounds; Paul Garcia, USFS Region 3, was assigned as SOF1; Tim Sexton, NPS Fire Management Program Center, was assigned as FBAN; Gary Carver, Big Bend National Park, was assigned as the Lead Investigator; and David Lentz, NPS Intermountain Support Office-Denver, was assigned as Team Leader.

## III. CHRONOLOGY

**0900 hours** - Incident Briefing for the Basin Campground Prescribed Burn.

**1030 hours** - ██████████ notifies Lincoln Zone that the burn in Chisos Basin will begin shortly.

**1130 hours** - Began test burn on West Burn Block near the Group Campground. Flame lengths in grass were 8"- 12" and brush torching out. Test burn site was the Group Campsite Road intersection with the Basin Campground Road. Weather observations at start 74<sup>0</sup> F, RH11% and winds W 3-5 with Gusts to 10.

**1148 hours** - Began test burn on East Burn Block with similar fire behavior. The test burn site was the Basin Campground Road intersection with the main Chisos Basin Road. There was one person igniting from that corner to the east along the road. Ignition was stopped after approximately 15 feet. The ignition was moved to the east side of the block next to the arroyo. There was a cluster of three pinyon trees in the corner adjacent to the corner of the arroyo and the road. One person was igniting five feet from the road and the second person was igniting fifteen feet from the road. They were to move to the west along the road toward the intersection. The igniter along the road traveled approximately ½ a chain and was stopped. The second igniter started next to the arroyo and went approximately fifteen feet and was stopped. This ignited the cluster of three pinyon trees and one torched. This was the only tree that completely torched during the ignition phase.

**1154 hours** - Smoke was across the Chisos Basin main road. A safety person was placed on the road for traffic control.

**1200 hours** - The East Prescribed Fire spread into the arroyo to the east and ignition was halted. Holding action began with an engine cooling down the tree and a hand crew suppressing the spread in the arroyo. The ignition backed into the wind and down slope. The highest threat was the edge of the arroyo. The ignition pattern established a secure edge then angled upslope to increase the depth. This technique was successful and the top of the East Unit was squared off.

**1317 hours** - [REDACTED] made contact with [REDACTED] stating that there was a spot fire above the main road. This spot was 10 chains east of the southeast corner of the East Unit where the pinyon tree had torched. Ignition was halted on both units. The spot fire was confirmed and located by [REDACTED]. [REDACTED] located another spot fire across the arroyo (below the paved road) from the torched pinyon.

Engine 4 and a fire monitor remained at the West Burn Block at the Group Campground to assist with the dip site and to hold and mop-up the unit. The ignition squad and the holding crew went to the escaped fire and began constructing handline.

The initial attack strategy was to anchor at the base of the spot fire and to begin flanking the fire with direct attack. The helicopter was requested to provide bucket drops to support the hand crews. A hose lay was established at the base of the spot fire by Engine 3. [REDACTED] and Squad 1 [REDACTED] contained the second spot fire.

**Division Bravo** was established on the west flank with Ledbetter as DIVS.

[REDACTED] was Crew Boss with Squad 3 [REDACTED] and Squad 7 [REDACTED]

**Division Alpha** was established on the east flank with [REDACTED] as DIVS.

[REDACTED] was Crew Boss with Squad 6 [REDACTED] and Squad 2 [REDACTED]

[REDACTED] was Crew Boss with Squad 1 [REDACTED] and Squad 8 [REDACTED]

**East Burn Block** was staffed by Squad 4 [REDACTED] and Squad 5 [REDACTED] assigned to hold and mop-up.

**1325 hours** - [REDACTED] joined [REDACTED] (Squad 6) who had already begun direct attack line construction to the east from the Division A/B break toward the first drainage (identified on maps as the "west" drainage). This line was an underslung fireline constructed without trenching.

**1335 hours** - Before line construction reached the west drainage, [REDACTED] decided to redirect the fireline, shifting to an indirect attack to avoid heavy fuels and rocky terrain. This indirect fireline dropped down toward the paved road into the west

drainage. Once through the drainage, it angled upslope away from the road to the crest of the steep, narrow ridge. The fireline then continued up the ridge toward the Kibbe Springs Trail.

**1345 hours** - [REDACTED] with Squads 1 [REDACTED] and 8 [REDACTED] arrived at the Division A/B break and began improving fireline and bumping up [REDACTED] crew. After reaching the ridge above (east of) the west drainage, [REDACTED] positioned a lookout on the ridge where the fireline reached the crest and another near the ridge intersection with the Kibbe Springs Trail. [REDACTED] was assigned as lookout at the junction of the fireline and the east ridge where he could watch the west drainage below. He was joined on the point a short time later by [REDACTED]. [REDACTED] also placed [REDACTED] as a lookout up the ridge, half way between [REDACTED] and the area where the crews were constructing hand line toward the Kibbe Springs Trail. The helicopter was supporting the constructed line with bucket drops.

**1400 hours** - [REDACTED], [REDACTED], and [REDACTED] met along the Kibbe Springs Trail east of where the line was to be constructed on the ridge. About this time, the fire made a rapid cross-slope run across the ridge above the handline, burning out a portion of the area between the indirect handline and the main fire. The crew retreated down the ridge approximately 30 feet and [REDACTED], [REDACTED], and [REDACTED] moved to the east along the Kibbe Trail to the lee side of the ridge. They waited briefly until the fire advanced up the slope above the trail.

**1410 hours** - The crew continued line construction up the ridge toward the Kibbe Trail above. Where the rapid fire run had crossed the ridge, the line construction angled to the east then up the to tie into the trail. [REDACTED], [REDACTED] and [REDACTED] met along the ridge fireline below the area that had just burned. Safety Zones were discussed with two possible choices: (1) the blackened area that had just burned, and (2) escaping down drainage to the road.

**1420 hours** - The lookouts reported that the fire had crossed below the fireline in the bottom of the drainage. [REDACTED] sent Squad 8 [REDACTED] to contain the slopover. [REDACTED] walked through the black to the slopover. He and his squad began constructing hand line, supported by an engine.

**1425 hours** - [REDACTED] called [REDACTED] and stated that the upper part of the drainage below his location was starting to heat up. [REDACTED] was located on the road at the base of the drainage and had visual contact with [REDACTED]. [REDACTED] advised [REDACTED] that flames were approaching his lookout position and the ridge route below him was getting cut off. [REDACTED] stated that he and [REDACTED] were going into the black and were looking for a safety zone. He stated that the smoke was extreme and he had difficulty seeing. [REDACTED] advised him to get his shelter ready to deploy if he thought it was necessary. [REDACTED] stated that he and [REDACTED] already had their shelters out and were ready to deploy.

The fire came out of the upper part of the drainage near the trees and was burning in lechuguilla. [REDACTED] instructed [REDACTED] to get into his shelter and [REDACTED] sat down with the shelter behind his back to shield him from the smoke. [REDACTED] continued to monitor the conditions around he and Lupe and maintained radio contact with [REDACTED] and [REDACTED].

Lookouts [REDACTED] and [REDACTED] ran up the ridge along the hand line and went just east of where [REDACTED] had deployed. They ran through flames approximately 18" to 24" in length. They squatted down in the black above the hand line and below the Kibbe Springs Trail, just east of the crest of the ridge above the deployment site. They did not deploy their shelters.

1455 hours [REDACTED] walked upslope, through the black and met [REDACTED] and [REDACTED] as they were coming down the ridge. [REDACTED] stated that from the time he left [REDACTED] to go to the slopover assignment until the time that he saw [REDACTED] coming down the ridge was about 30 minutes. [REDACTED] led [REDACTED] and [REDACTED] through the black toward the road. Independently, [REDACTED] and [REDACTED] walked through the black and joined [REDACTED]'s squad. [REDACTED] and [REDACTED] did not report their activity until Friday 05/07/99.

When the fire made the run that resulted in the shelter deployment, the remaining squads walked out the Kibbe Springs trail to the Lost Mine Trailhead parking lot.

After regrouping the operations personnel, the decision was made to abandon the direct attack tactic and use an indirect strategy. The crews gathered at the parking lot and were joined by Squad 4 [REDACTED] and Squad 5 [REDACTED].

Hand line was constructed from Lost Mine Trail to Casa Grande Trail. The Casa Grande Trail was improved for a hand line to the base of Casa Grande.

**Wednesday May 5, 1999**

Division A

Burned out along the Casa Grande Trail to the Lost Mine Trail.

Division B

Mopped up along west flank.

Constructed line from Kibbe Spring Trail to the Chisos Basin road. The line did not hold and the decision was made to utilize the Chisos Basin Road for the holding line.

**Thursday, May 6, 1999**

Burned out from Lost Mine Trailhead parking lot through the switchbacks along the Chisos Basin Road.

Burned out along the Lost Mine Trail to the trailhead parking lot.

Burned out from the lower switchback along the Chisos Basin Road to the west flank.

Completed burnout operations at 1823 hours.

**Friday, May 7, 1999**

Mopped-up a minimum of one chain length along the fire line. Completed fire line rehab along constructed line.

Fire was declared controlled as of 1700 hours.

#### **IV. FINDINGS**

1. An unusual and unexpected fuel condition existed which park managers did not recognize. Stringers of hardwood trees and shrubs are commonly found in the bottom of the arroyos that dissect Casa Grande Mountain. These hardwood stringers had previously been observed to be barriers to fire spread. However, at the time of the Casa Grande Incident, these fuel complexes burned at a higher intensity level than formerly experienced. A hardwood stringer was below the escape route and deployment area, which is where the run that entrapped the fire fighters originated.
  2. Only one escape route and one inadequate safety zone were identified along the knife ridge area. The escape route was cut off by fire spread and dense smoke. The identified safety zone served only as a deployment area due to its proximity to down slope fuels and small size.
  3. Initial strategy and tactics failed, however it was not recognized that a change in strategy was needed. The park continued to initial attack using a combination of direct and indirect attack even after that strategy/tactic failed. Indirect line was not burned out during line construction.
  4. Six of the ten Standard Fire Fighting Orders were violated: safety first as there was a shelter deployment and entrapment; current weather conditions and obtain forecasts as there were unforecasted red flag
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weather conditions: instructions are given and understood as lookouts did not receive adequate instructions regarding their own safety; intra-crew communications broke down when the crewboss was in his shelter; the safety zone was in reality a deployment area and only one escape route was identified for the knife ridge area; and supervision broke down during the deployment as the remainder of the Diablos East crew was on their own.

Eight situations that shout watch-out applied: safety zones were inadequate and escape routes were singular; lookout assignments may have been unclear; few radios within the Diablos East Crew were issued; unburned fuel between the constructed line and the fire was present; a spot fire occurred below underslung line; extreme fire weather was observed; and steep terrain and dense fuels existed within the fire area.

5. Critical overhead positions were filled by individuals who were not qualified.
  - Crew boss of crew involved in deployment was qualified as a fire fighter type 1.
  - Squad Bosses of crew involved in the deployment were qualified as fire fighter type 2.
6. Trainees were assigned to the incident without qualified trainers thereby missing valuable training and qualification opportunities.
7. The Diablo crew program provides cost effective, well-trained, and available fire fighting and prescribed fire resources in the local area.
8. Evaluation of affected individuals was not performed and Critical Incident Stress Debriefing was not offered.
9. The Fire Management program at BIBE is understaffed. The complexity of the program including fuels, topography, severity of weather, size of the park, and distance from other wildland fire agency resources warrants additional staffing. Fine fuels, which were absent during the early history of the park due to grazing of livestock, are now becoming present within the fuel complex. An examination of fire occurrence bears this out, as fires are steadily increasing in size and complexity as the fuel bed recovers.
10. Park Management support of the Fire Management Program is evident and participation at all levels is occurring.
11. Inconsistent fire weather service is provided by the Midland National Weather Service Office. Red flag warnings are not always issued unless requested, and spot weather forecasts are not always updated. The

National Weather Service Forecaster that wrote the spot weather forecast could not describe what weather conditions constituted a red flag warning when interviewed by the investigation team. When the forecaster was able to locate the written red flag warning criteria used by the Midland Office, the criteria appeared to be vague. The criteria is stated as "sustained winds of 25 mph, with lower relative humidity and high fire danger".

## V. RECOMMENDATIONS

1. Implement a more comprehensive live fuel moisture program that samples a greater variety of species that includes hardwoods. This is especially critical when severe weather and fuels trends are experienced.
2. Define critical live fuel moisture thresholds in the park Fire Management Plan.
3. Park Management should conduct a thorough review of the entrapment and deployment site with all individuals involved, including the Diablos, to insure that they have a clear understanding of:
  - Adequate safety zones by definition
  - Multiple escape routes
  - Re-evaluation of Safety Zones and Escape Routes as conditions change.
4. The Midland National Weather Service Office must update spot weather forecasts and communicate changes to requesting agencies. It is essential that the park design and implement a process that facilitates distribution of weather updates to prescribed burn and incident personnel.
5. Develop a lesson plan for use during annual refresher training based on the Casa Grande Fire that illustrates the conditions that trigger the development of new strategies and altered tactics based on personnel safety and operational success.
6. Park Management should provide a review of how and why six of the ten standard fire orders were violated, eight of the situations that shout watch-out applied and mitigation actions. This should include the Diablos crewmembers as well.
7. The team recognizes that mobilization to the park is at least six hours for off park resources. However, the park should consider mobilizing qualified individuals as needed. In the example of the Casa Grande Incident, qualified overhead could have arrived on scene prior to the second

burning period and participated in strategy selection and oversight of tactics. Mobilization of qualified personnel will assist the park in meeting critical training targets in terms of completion of Performance Task Books by using qualified personnel as trainers.

8. A less aggressive control strategy should be considered when only non-qualified individuals are available. The use of unqualified personnel until ordered resources arrive is an accepted practice. However, when doing so, selection of strategies and tactics should consider the limitations that are inherent with unqualified or inexperienced personnel.
9. Park management at Big Bend has demonstrated support for the fire management program. The Casa Grande Incident should not adversely impact that relationship. Rather, greater management participation is encouraged so that informed decisions can be made. In addition, the park is encouraged to use fire as an integrated tool to achieve resource management goals and objectives.
10. Critical Incident Stress Debriefing should be made available to all individuals involved in the Casa Grande Incident fire shelter deployment.
11. The Fire Management Program Center should consider funding an AFMO position due to the complex fire environment of the park. This position would assist the park in meeting its fire management objectives.
12. Interagency Wildland Fire Agencies should participate in a review of the fire weather protocols in use by the Midland, TX. National Weather Service Office and provide suggestions for improved services. NWCG should sponsor this review.

## APPENDIX E FIRE WEATHER AND BEHAVIOR SUMMARY

### WEATHER

#### Forecast

#### Spot

A spot weather forecast was obtained from the National Weather Service Office in Midland, Texas. Burn site physical characteristics were sent to NWS-Midland May 3, 1999 at 1700 hours. No specific weather observations for the burn site were provided. However, a RAWS unit is located immediately adjacent to the burn site. The spot weather forecast was completed and returned to Big Bend National Park (BIBE) at 0030 on May 4, 1999.

The spot weather forecast gave very broad ranges of relative humidity and windspeed. The minimum RH forecasted was 5-15% and maximum windspeed forecasted was 5-15 mph, increasing to 10-20 mph and gusty by noon.

No mention was made of "Red Flag Warning" in the forecast.

BIBE did not request another spot weather forecast on May 4, 1999, the morning of the burn. NWS-Midland did not update the spot weather forecast provided on May 4, 1999 at 0030.

The next forecast from NWS-Midland was received at BIBE at 1822 hours on May 4, 1999. This forecast noted "...red flag warning in effect until around 9 pm as high winds with gusts to around 30 mph and humidities in the single digits hold..." NWS Fire Weather Services Operations Manual Fire Weather Service Program (Part D, Chapter 6, Section 18), regarding Spot Forecasts, states that "It is particularly important to issue a revised forecast promptly in the event of a previously unforecasted or mistimed wind shift or wind increase."

**Analysis:** the spot weather forecast indicated relatively severe fire weather that likely constituted "red flag warning" conditions (RH of 5% and windspeed of 20 mph). However, these weather parameters were not identified as "red flag" by NWS-Midland, nor recognized as such by BIBE Fire Management.

#### Observations

##### Weather Monitors

Two weather monitors were assigned. Windspeed and direction, dry bulb temperature, and relative humidity were determined every 15 to 30 minutes from about 1100 until 1530. The two observers reported significantly different relative humidity readings. For example, at 1130 Roberts reported RH of 11%,

while Ward reported RH of 24%. No action was taken to reconcile these different RH readings.

## RAWS

While real time RAWS data was not available to the burn boss during the burn, post-burn analysis indicated close correlation with the drier RH observations recorded by Roberts.

## Fireline Personnel

No additional weather observations were taken by fireline personnel.

**Analysis:** When weather monitors report significantly different observations, the burn boss must determine the reason for the differences and if necessary correct any errors in observations.

## Seasonal Indices

### BI

BI for May 4, 1999 for the Panther Junction RAWS (417401 Fuel Model T) was 118. This value is equal to the historical maximum.

**Analysis:** While prescribed burns may be implemented under severe burning conditions (if necessary to meet resource management objectives), extra care should be taken to ensure well qualified and experienced personnel manage all phases of the operations. In this case, inexperienced lighters were used and there was a general lack of qualified contingency force supervision. Additionally, all personnel assigned to the burn must be made aware of the severity of the fire danger.

## FIRE BEHAVIOR

### Predicted

BEHAVE runs included in the burn prescription identified expected fire (in the burn plan) behavior as follows:

Fuel Model	ROS	Flame Length	Max Spot
Grass (FM2)	62 to 440 cph	9 to 21 feet	3 to 1.3 mi
Brush (FM5)	26 to 107 cph	6 to 11 feet	not predicted

## Observations

Observations of rate of spread from the spot fire were consistent with BEHAVE predictions. The fire ran upslope to Casa Grande Peak "within a few minutes" according to several observers. ROS was likely >100 chains per hour. Flame lengths were described as 10 to 50 feet. Photographs of the upslope run correlate well with the observers reports.

## Narrative

The Casa Grande burn prescription called for fine fuel moisture of >4%. When the burn was ignited, at about 1148s, fine fuel moisture was approximately 2% (db=74<sup>0</sup>, rh=11%, May, no shading, less than 30% slope). Windspeed at eye level was approximately 5 mph (RAWS 20 ft wind = 11 mph; Roberts' eye-level observation = 5 mph). One of the lighters was inexperienced and lit a strip that was much wider at the terminal end than desired by the ignition specialist. This strip resulted in the torching of three pinyon trees. The westerly wind blew embers upslope and to the east. Within 30 minutes two spot fires were discovered. One spot fire was across the paved road, upslope and to the east about 1/4 mile. The other spot was below the paved road, within a hundred feet to the northeast of the pinyon trees.

The closest spot fire was somewhat sheltered from the wind and did not increase in size rapidly. It was quickly suppressed by the ignition squad.

The farthest spot was exposed to the westerly wind and was located on a 40-50% southwest-facing slope. It grew rapidly and raced upslope to the monolith just below Casa Grande Peak. This run occurred in less than 30 minutes with an average spread rate of about 100 chains per hour. Observed flame lengths ranged from 10 to 50 feet (see Progression Map perimeter for 1340 hours).

As the fire was running upslope, the northeast flank vectored to the northeast. The spread rate of this flanking movement was approximately 15 chains per hour with flame lengths of about 4-6 feet. During this flanking spread the fire crossed into a small arroyo. When it reached the bottom of the arroyo it made another upslope run. Fire behavior characteristics of this run were very similar to the first run (ROS averaged about 80 - 100 ch/hr and flame lengths ranged from 10 to 50 feet). This fire run forced the line construction crew to withdraw down the narrow ridge (to the southwest) and the Division Supervisor and other overhead to withdraw down Kibbe Springs Trail (to the northeast). This run burned over the proposed fireline location on the upper portion of the narrow ridge where it would have tied into Kibbe Springs Trail. It also burned a bench area about 1/2 acre in size just below Kibbe Springs Trail and southwest of the narrow ridge. This area would later be used as a deployment zone.

The fire continued flanking to the northeast at about 10 to 15 chains per hour. Either surface spread or rolling material ignited the unburned bottom of the drainage and initiated another major run parallel (and to the northeast) of the previous two runs. Again, the rate of spread averaged 80 to 100 chains per hour with 10 to 50 ft flame lengths. This run forced the line construction crew upslope and to the northeast along Kibbe Springs Trail. Two lookouts, another crewmember, and the crewboss were below the line construction crew on the narrow ridge below Kibbe Springs Trail. These individuals found their escape route (down the ridge to the paved road) cut off by the rapidly spreading fire. Smoke obscured their vision and they elected to use the burned area (from the previous upslope run) as safety zones. Two individuals ran through 2 ft high flames (flanking spread) and sat down in a blackened area below Kibbe Springs Trail. The other two moved into the bench area and deployed shelters. Neither area experienced flame impingement. However, large volumes of smoke made the area very uncomfortable.

The fire continued to spread throughout the afternoon, mostly in a flanking fashion. Short, rapid runs occurred where the fire reached the bottom of unburned upslope areas (mostly through rolling material, spotting, and backing into arroyo bottoms).