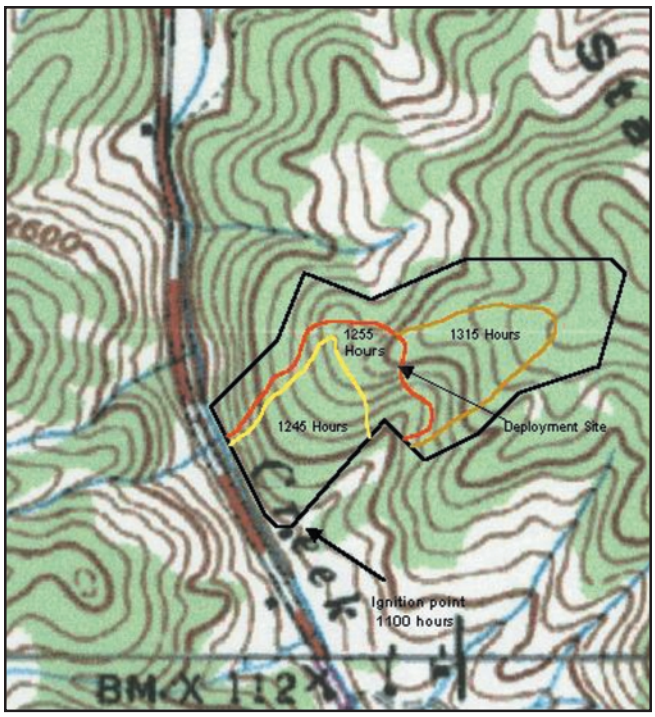
Executive Summary

On Sunday, March 24, 2002, a wildland fire was reported on private land in northeastern Tennessee in Unicoi County near the community of Flag Pond. Under an ongoing agreement between the Tennessee Department of Agriculture, Division of Forestry, and the USDA Forest Service, federal firefighting forces and one Tennessee State Division of Forestry dozer were deployed on initial attack. Two federal firefighters (one Forest Service employee and one U.S. Department of Interior, Fish and Wildlife Service employee) were assigned to initial attack on the wildland fire known as the Back Forty Fire. The two firefighters were dispatched to the scene and begin flagging a dozer line for the forestry dozer to work from. Shortly after arrival at the incident, at approximately 1330, the employees were entrapped by the wildland fire and deployed their fire shelters. The wildland fire burned over the two employees. There were no fatalities and the employees were not injured.

On Monday, March 25, at approximately 0830, management officials on the district were notified that there had been a shelter deployment on the afternoon of March 24. The district management officials immediately contacted higher headquarters and an Entrapment Investigation Team was assigned. Since the incident involved multiple Federal and State jurisdictions, a State and Federal official (John Kirksey, State Fire Chief, Tennessee Department of Agriculture, Division of Forestry, and William Damon, Forest Supervisor, George Washington and Jefferson National Forest) were assigned as co-leaders of the Entrapment Investigation Team.



Back Forty Fire fire progression map, March 24, 2002.

The Entrapment Investigation Team arrived in Greeneville, TN, on Tuesday, March 26, and began their investigation at 1000 hours.

Sequence of Events

District-Wide Events on Sunday, March 24, 2002

The Nolichucky/Unaka District was planning to do a prescribed burn on Sunday, March 24, if conditions were right and the burning parameters were within prescription.

The weather conditions on the morning of March 24 were not within the prescription parameters required for initiation of a prescribed burn, and therefore the prescribed burn did not take place. At 0600 it was determined that they would not be able to conduct the prescribed burn because the mixing heights were too low. District FMO, Guy Street, went to the work center and released all personnel who had come in to work on the prescribed burn. The Cherokee Hotshots were told, however, to report back to the work center at 1300 hours for fire standby duty. At that point, everyone, including district FMO Street went home.

At 0900 hours, District FMO Street was called at home and notified that there was fire in Wyatt Hollow in Sullivan County. District FMO Street got a crew together and left to go to that fire. While enroute to the fire in Sullivan County, at approximately 1030, District FMO Street called Dennis Nelson and Tony Garland and directed them to report to the fire he was headed to in Sullivan County. Nelson then left home to go to the District Work Center. Street then ordered air tankers for the Sullivan County Fire. Shortly after reaching the Work Center Dennis Nelson called Street and told him they had gotten a phone call about a fire in Unicoi County. Street told Nelson to go to the fire in Unicoi County.

District FMO Street contacted Nelson several times during the afternoon and was told everything was fine. Sometime after dark Street talked to Nelson on the radio and was told that Nelson and his people were finishing up the fire in Unicoi County. They all agreed to meet at a third fire near Stoney Creek. At approximately 2100 they met at a church near Stoney Creek and saw that the fire at Stoney Creek had been contained. They had a brief conversation and sent everyone home. No mention was made to Street of a shelter deployment until after reporting for work the following morning.

Events at the Back Forty Fire, Sunday, March 24, 2002

Nelson arrived at the fire in Unicoi County (hereafter referred to as the Back Forty Fire) between 1130 and 1200 noon and called Street back and said that he (Nelson) needed some help. Street then called T.J. Wharton, the superintendent of the Cherokee Hotshots, and told them to report to the fire in Unicoi County.

After arriving at the Back Forty Fire, Nelson (who was now the Incident Commander for the Back Forty Fire) looked for a way to size-up the fire. He visited with some Volunteer Fire Department personnel protecting the residence and was told by them that he could drive to the top of the fire. Nelson and Garland drove in on the left (northern) flank behind the fire. They drove as far as they could along a logging road and then walked 20 to 25 minutes to the head of the fire. As they drove in Nelson observed that the logging road could be used as a fire line.

Nelson and Garland reached a location they could observe the head of the fire from an old logging road. Nelson left Garland there. Nelson followed the logging road around the contour and then down toward a drainage that was near the right flank of the fire. Nelson thought that they could use that road to cut the head of the fire off. Nelson walked approximately 100 yards to the drainage flagging it for the dozer to follow and then went back to where Garland was waiting. By that time the fire had crossed the logging road above them.

At that point Nelson decided to get their fire shelters out to keep from getting burned. Nelson did not feel they were in a life-threatening situation but he did feel that they would get "scorched" if they tried to get out another way. Nelson felt that deploying the fire shelters would keep them from getting burned at all.

Nelson and Garland then burned a spot, raked it out, and cleared an area for their shelter deployment. They then got into their shelters. While in the shelters they talked with each other and Nelson advised Wharton (via radio) that they were in their shelters.

The fire went over Nelson and Garland. They remained in their shelters for about 10 minutes and then tried to fold the shelters up and walk out of the fire with the shelters. They then decided not to continue to carry the shelters and buried them near the site of the deployment.

Nelson and Garland then went back to the fireline, flagged a line from the top of the hill to the drainage that constituted the right flank of the fire. They then continued to work with the Cherokee Hotshots and Forestry dozer crew, building line and backfiring, until the Back Forty Fire was contained at approximately 1800 to 1830.

Events Following Shelter Deployment

According to the statements from both Nelson and Garland (and confirmed by Wharton), Nelson advised Wharton that they were in shelters via radio while they were deployed in their fire shelters. Subsequently, when Nelson and Garland met Wharton on the fireline later that afternoon, Nelson and Garland again discussed with Wharton the fact that they had had to deploy their fire shelters.

Later that evening, when they reported to Stoney Creek to see if they were needed on that fire, they had a brief conversation with District FMO Street but neither Nelson nor Garland mentioned the fact that they had had to deploy fire shelters earlier that day. The next morning, Nelson sought out District FMO Street at approximately 0800 and advised Street that he and Garland had deployed their fire shelters on the Back Forty Fire the previous afternoon. IC Nelson advised Street that they did not regard it as a big deal. Street immediately reported the deployment up the chain of command.

Fire Weather/Fire Behavior Summary

Fire Weather

Weather readings for the incident were obtained from the Unicoi weather station (station ID # 403602), approximately 20 miles northeast of the fire location. The Unicoi station is located on a knoll, at roughly the same elevation, and was said to be a good representation of weather conditions on the fire. No onsite readings were available. Fire weather forecasts were issued from the National Weather Service (NWS) office in Morristown, TN. The Morristown station does not have established protocol for red flag warnings with area user groups. Wind measurements at the Unicoi weather station during the time of the fire were in error due to equipment problems (per Cherokee National Forest). Station wind speed and direction were obtained from Tri-city airport (10 M, 2 minute).

The Unicoi station had measured rainfall of 3.78 inches for March 1-24. Of that, 3.21 inches was received between March 12th and March 19th. The last rainfall before the fire was on March 21, when 0.38 inches fell. On March 22, the day after the rain, Unicoi station recorded a minimum relative humidity of 26 percent, and a maximum temperature of 50 °F. Winds were out of the south at 10 miles per hour.

The day before the incident, Saturday, March 23rd, the NWS fire weather forecast predicted a maximum temperature of 46-50 °F with a minimum relative humidity of 17-21%, with southwest winds 5-10 mph. The Unicoi station for that day recorded a maximum temperature of 61 °F, and a minimum relative humidity of 15%. The maximum relative humidity overnight was 74% between 0500 and 0700 March 24th, with temperatures reaching down to 27 °F.

On the day of the incident, Sunday, March 24th, the NWS Fire Weather Forecast (issued 0557 EST), called for partly cloudy skies, with a high pressure across the region, bringing dry weather that day and the next. Warmer temperatures were predicted those two days, with a front approaching Monday, and a chance of showers late Monday and Tuesday. The forecast called for temperatures to be 58-62 °F, with minimum relative humidity 25-29%. Winds were predicted to be out of the SW, 10 mph in the morning, increasing to 15 mph in the afternoon.

That day, Sunday, March 24th, the Unicoi station recorded: a temperature of 64 °F, with a relative humidity of 18% at 1200; a temperature of 66 °F and a relative humidity 20% at 1300; and a temperature of 69 °F and a relative humidity of 20% at 1400. The minimum relative humidity that day was 15% at 1600, reaching 27% by 2000. The archived winds, for the 1300 observation, used the Tri-City airport wind direction of 250, with 14 mph wind speed.

The Keetch-Byram Drought Index (KBDI) for the Unicoi station for March 24th was 15.

An onsite estimate of wind direction and speed near the deployment site was around 8 mph at eye-level, out of the south, turning southwest during the incident. This estimate was taken in a partially logged stand, exposed to the wind direction, in dormant hardwoods. This estimate corresponds fairly well with the predicted wind speed and direction from NWS in Morristown and the Tri-City reading, for eye-level reductions in this fuel type.

Calculations for fire danger on March 24th, for the north end of the Cherokee, used a maximum temperature of 62 °F and a minimum relative humidity of 22%, calculating a burning index of 39, a low D-class day.

Topography and Vegetation

The topography of the Back Forty Fire is characterized by steep terrain with intervening drainages. The fire was on the east side of Sam's Creek, extending uphill toward Stamp Ridge, approximately one mile south of Flag Pond, Tennessee. The south side of the fire follows a spur ridge towards Stamp Ridge, then follows a drainage on the north flank, then leaves the drainage on the northwest side of the fire, to a point back on Sam's Creek. The draw on the south side of the fire, just north of the south flank, has slopes 35-45%. Slopes directly uphill from that drainage were 60-70%. The slope below the deployment site was approximately 55%, with a south/southwest aspect.

The south half of the fire has had some intermittent, patchy logging performed in the past. Best estimates are that those operations are 5-8 years old, resulting in jack-pots of heavy fuels intermixed with dormant hardwood regeneration, briars, and residual timber stems. The fine fuels from that slash have decomposed. Logging was slightly heavier near the drainages on the south side of the fire and along the spur ridge.

Species mix varied with position on slope and aspect. The fire is generally west facing, with intervening drainages and changing aspects. Northwest aspects on the south side of the fire were predominately beech and yellow poplar, with white pine, briars, maple, and striped maple regeneration. Hardwoods were dormant, leaf off. The deployment site, on the south/southwest aspect, was predominately chestnut oak, along with white pine, other oaks and maple. Nearer the spur ridge, approximately 100 feet north of the deployment site, mountain laurel was more prominent. Concentrations of heavy down fuels were also found near that spur ridge.

On the north side of the fire, in north facing cove sites, yellow poplar was the dominant species, with little evidence of recent logging.

Fire Behavior

Fuel model selection weighed the impact of logging residue, litter species, and observed fire behavior and weather readings. The logging residue contributed to difficulty in line location, flame lengths and the amount of heat generated, smoke generation, and control efforts, but had little effect on the fire spread and sustained flame lengths, due to the decomposition of the finer fuels in that residue. Enough residual stems remained in most of the area where leaf litter was the chief carrier of the fire. The northern most section of the fire, where fuels were mostly yellow poplar litter, a fuel model 8 was selected as the best fit. For most of the fire, however, fuel model 9 was selected as the best fit. Oak litter tends to remain fluffy, not compacting like mesic species and can influence fire behavior much like a grassy fuel, particularly when litter is fluffy. Along the spur ridge, where mountain laurel was present as a minor component, flame length and rate of spread was probably greater than a fuel model 9. Under these low relative humidities, mountain laurel will contribute to fire behavior much like a fuel model 6.

Back Forty Fire aerial view.

The residual fuels generated from the past logging were not consumed, for the most part, with 15-20 tons per acre remaining in the heavy concentration areas.

Char heights near the south flank were 4-5 feet, decreasing to 2-4 feet near the drainage. On the south/southwest slope, below the deployment site, north of the drainage, char heights ranged from 10-20 feet, higher in jackpots of fuel. Along the spur ridge, just 100 feet north of the deployment site, char heights reached 20-30 feet, an area with heavier fuel concentrations.

Onsite Fire Behavior Observations

The fire most likely began just before 1100 on Sunday, March 24, 2002. The point of origin was most likely in the south-west corner of the fire (still under investigation). Volunteer Fire Department personnel were on scene when Forest Service personnel arrived around 1200. At that time, the fire was still confined to the lower southwest corner of the incident, probably 5 acres in size.

Shortly thereafter, at approximately 1230, the fire was estimated at 8 acres. Initial rate of spread was low, until the fire reached drier, exposed slopes. At approximately 1245, the fire began to spread more rapidly uphill, spreading first up the spur ridge. Slope and drainage alignment with the wind, along with these dried surface fuels and low relative humidi-ties, caused the fire to push up the spur ridge and draft up the drainages. Flame-lengths on the south flank at that time were estimated at 3-4 feet. The fire then moved upslope towards the top, near Stamp Ridge, traveling about 1000 feet in 30 minutes.

As the fire pushed past the deployment site, near the spur ridge in an area of heavy fuels and some mountain laurel, flame length was estimated at 6-8 feet. The time was probably around 1255.

The fire reached the top of the spur ridge around 1315, then slowly backed and flanked off of the spur ridges. North of the main spur ridge, just north of the deployment site, the fire backed down into the north-facing yellow-poplar stand, resulting in a patchy burn for the first 100-200 feet downhill, and eventually went out on it's own after approximately 200 feet.

Final fire size was approximately 28 acres.

Findings

The findings section of this report address three separate and distinct decision processes:

- Shelter deployment decision process.
- Reporting of shelter deployment and followup items related to shelter deployment.
- Tactical decisions that led to the firefighters finding themselves in a situation where it was necessary to deploy fire shelters.

Shelter Deployment Decision Process

Commendations: IC Dennis Nelson recognized that he and firefighter Tony Garland were in a situation that was rapidly deteriorating to the point where their personal safety was endangered. Nelson took quick, decisive action regarding shelter deployment and those actions in all likelihood saved both Nelson and Garland from potentially serious injuries.

- Nelson recognized the deteriorating situation well enough in advance of the arrival of the fire at their location to give him and Garland time to take the proper steps to ensure a successful shelter deployment.
- Garland recognized that Nelson had much more fire fighting experience (approximately 26 years) and deferred to Nelson's experience in both the decision to deploy and in the selection of a survivable deployment location.
- Nelson and Garland selected a spot that provided them with adequate room for shelter deployment. The spot that they chose:
  - —Was relatively clear of unburned fuels
  - —Shelters were deployed against a cut bank of the abandoned logging road decreasing the probability of direct flame contact to the shelter.
  - —Had a smooth surface that would ensure an adequate seal to help protect them from smoke and superheated gases.
- Nelson and Garland burned out additional space around the area in which they chose to deploy their shelters.
- Nelson and Garland did not take their tools, including their drip torch, into their shelters with them.
- Nelson and Garland remained in their shelters for a sufficient amount of time to allow the fire to pass over them and for the situation in their immediate area to be survivable.

Concerns: The firefighters kept their fire packs on when they got into their fire shelters. Compounding this concern was the fact that one of the firefighters had a fusee in his fire pack.

In summary, the decision to deploy shelters was made promptly, decisively, and implemented almost completely in accordance with the training that firefighters have received on shelter deployment. The only mistake made in the shelter deployment itself was when the firefighters kept their packs on when they got into their fire shelters.

Reporting of Shelter Deployment and Followup Items Related to Shelter Deployment

The team found that there has been insufficient emphasis in shelter deployment training on the significance of a shelter deployment and the importance of immediately reporting all shelter deployments up the chain of command to the appropriate authorities. It was clear to the team that the firefighters involved had not received adequate training on the actions that should be taken immediately following the shelter deployment. It was also clear to the team that the firefighters involved did not initially recognize the importance of immediate reporting of a shelter deployment.

Specifically, the team found:

- The shelter deployment was not reported until the following morning. It is clear that agency policy regarding followup actions after a shelter deployment have not been communicated to employees during shelter deployment training. Employees were aware that shelter deployments needed to be reported but were not aware of the importance of making those reports immediately.
- The firefighters involved in the deployment were not taken off the incident immediately following the deployment. In fact, they continued to work on the incident for the remainder of the day. To further compound this error, the firefighters apparently returned to the fireline without

replacement fire shelters, thereby violating agency policies that require every firefighter to have a functional fire shelter with them on the fireline.

- The Incident Commander, who was also one of the firefighters involved in the shelter deployment, was not taken off the incident and replaced immediately following the shelter deployment.

Back Forty Fire fire shelter deployment site.

- Agency training on shelter deployment does not provide sufficient instructions on the actions to be taken immediately following a shelter deployment. Specifically:

  —Personnel involved in the deployment were not immediately removed from the fireline nor from the incident. Different agencies have different requirements regarding the removal of personnel following shelter deployment. NWCG policy says that the IC should consider removing involved personnel from the fireline. U.S. Fish and Wildlife Service policy is that Incident Commanders will remove involved personnel from the fireline immediately.

  —Both employees took their fire shelters with them after deployment with the intent of having them available for reuse if necessary. This violates agency policy and training which clearly states that fire shelters are not to be reused after deployment.

  —Agency training on shelter deployment needs to place stronger emphasis on the need to secure the deployment scene and the need to secure all pertinent evidentiary items.

Tactical Decisions That Led to the Firefighters Finding Themselves in a Situation Where It was Necessary to Deploy Fire Shelters

It was clear to everyone on the Back Forty Fire that Dennis Nelson was the incident commander for the Back Forty Fire.

The team found a number of concerns regarding the tactical decision making that placed the employees in a situation where they were required to deploy fire shelters in order to prevent serious injuries to themselves.

- No briefings were given to Nelson, Garland, and others prior to their deployment to the Back Forty Fire. They were not given current fire weather or fire behavior fore-casts. (Nelson did, however, use his home computer at approximately 9:00 a.m. to check the fire weather forecast.)

- Nelson had difficulty articulating his overall fire suppression strategy to the investigation team. As best the team could determine, the overall suppression strategy was as follows: The west flank of the fire was along a creek and U.S. Highway US 23. There was an old logging road on the left (northern) flank of the fire that could be used as a fire line on that side of the fire. There was a drainage on the right (southern) side of the fire and Nelson told the Division of Forestry dozer and the Cherokee Hotshots to work up the right flank of the fire along (or near) that drainage. Nelson intended to indirectly attack the head of the fire and planned to do that in mid-slope. When Nelson found an abandoned logging road running across the mid-slope in front of the fire he decided to try to flag that abandoned logging road for the dozer to follow once it worked its way up the drainage to the point where the drainage and that road intersected.

- The decision by Nelson to flag a dozer line on a mid-slope abandoned logging road, rather than selecting a location at the top of the ridge above the fire, was in retrospect not the correct decision given the fire behavior and particularly rate of spread; and the lack of a clearly defined and agreed-upon anchor point. Nelson indicated that he did not feel any pressure from the land-

Findings

owner to keep the fire small. However, the decision to try and hold the fire on the mid-slope road was apparently motivated by a desire to keep the number of acres burned to a minimum.

- Neither Nelson nor Garland gave any thought to escape routes or safety zones as they walked into the area at the head of the fire. Both employees failed to assume personal responsibility for the identification of escape routes and safety zones.

- No attempt was made to determine onsite weather conditions.

- The Incident commander failed to maintain situational awareness of the fire environment. The IC was not aware of the potential for the fire to make a strong uphill run. The IC was focused on flagging a dozer line and that focus on that specific task contributed to the IC's loss of situational awareness.

- Once it was clear that the fire was making a strong uphill run towards Nelson and Garland's location, and that there were no escape routes or safety zones, Nelson acted quickly and decisively to implement shelter deployment in accordance with established procedures for a safe shelter deployment.

Back Forty Fire fire shelter deployment site.

Conclusions

- The team concluded that proper shelter deployment protocol was followed and resulted in no injuries or fatalities.

- The team concluded that proper procedures regarding reporting of shelter deployment were not followed in that the shelter deployment was not reported to any management official until the following morning.

- The team also concluded that the reporting delays were not an attempt to conceal the fact that there was a shelter deployment. The team did not believe that the burial of the shelters was motivated by any desire to conceal the deployment because there were multiple instances where the deployment was openly discussed with other people. The team found from the interviews that both IC Nelson and firefighter Garland discussed the deployment both during the time of deployment on the radio and later on the fireline with T.J. Wharton, the superintendent of the Cherokee HotShots. Wharton's statement confirms that he was told at least twice that IC Nelson and firefighter Garland were in shelters. Accordingly, the team concluded that there was no attempt to conceal the deployment but there was a failure to report the deployment to management in a timely fashion.

- The team also concluded that policies regarding the actions to be taken following shelter deployment are not clear and specific enough.

- The team concluded that a lack of situational awareness by the Incident Commander resulted in a situation where the Incident Commander and a firefighter had to deploy their fire shelters in order to avoid serious injury or fatalities.

Entrapment Investigation Elements

	No Contribution	Influenced	Significant Contribution
Fire Behavior			
Fuels		X	
Weather			X
Topography			X
Predicted v. Observed	X		
Environmental Factors			
Smoke		X	
Temperature	X		
Visibility	X		
Slope			X
Other (Logging Slash)			X
Incident Management			
Incident Objectives			X
Strategy			X
Tactics			X
No Safety Briefings/Major Concerns			X
Instructions Given	X		
Control Mechanisms			
Span of Control	X		
Communications	X		
Situation Awareness			X
10 Standard Fire Orders/18 Watchout Situations			X
Personnel Profiles of Those Involved			
Training/Qualifications/Physical Fitness	X		
Length of Operational Period/Fatigue	X		
Attitudes			X
Leadership			X
Previous Experience With Frontal Attack			X
Equipment			
Availability	X		
Performance/Nonperformance	X		
Clothing and Equipment	X		
Used for Intended Purpose?			X

Compliance With 10 Standard Fire Orders

Standard Fire Order	Discussion
Fight fire aggressively but provide for safety first	The fire was fought aggressively but safety was not the first priority.
Initiate all action based on current and expected fire behavior	Actions taken were based on the firefighters' assessment of current and expected fire behavior.
Recognize current weather conditions and obtain forecasts	IC obtained weather forecast at 9:00 a.m.
Ensure instructions are given and understood	Instructions to the firefighter regarding shelter deployment were clear and understood. Instructions to the hotshots and dozer were clear but did not include a briefing on overall strategy (However, this lack of an overall strategy briefing did not contribute to the shelter deployment.)
Obtain current information on fire status	The firefighters who deployed were in the process of gathering current information on fire status (and were in the process of flagging a dozer line at the same time) when the fire overtook them and they had to deploy.
Remain in communication with crew members, your supervisor, and adjoining forces	Communications with crew members were good; incident commander's communications with his supervisor and dispatch were poor due to inadequate radio coverage in area
Determine safety zones and escape routes	Failure to identify escape routes and safety zones led to need to deploy fire shelters
Establish lookouts in hazardous situations	Prior to the deployment no hazardous situations had been identified and thus no lookouts were established.
Retain control at all times	The IC's failure to maintain situational awareness contributed significantly to the need to deploy shelters.
Stay alert, keep calm, think clearly, act decisively	The IC remained calm and acted quickly and decisively when it was clear that entrapment was imminent.

Compliance With 18 Watchout Situations

Watchout Situation	Comments
Fire not scouted and sized up	IC was scouting and sizing up fire when incident occurred.
In country not seen in daylight Safety zones and escape routes not identified	All personnel arrived in daylight. Failure to identify escape routes and safety zones led to need to deploy fire shelters.
Unfamiliar with weather and local factors influencing fire behavior	IC obtained fire weather forecast at 0900 but was not briefed when assigned to incident.
Uninformed on strategy, tactics, and hazards	IC was responsible for developing strategy and tactics but was in process of locating a dozer line when deployment occurred.
Instructions and assignments not clear	The crewmembers and dozer operator understood they were to work their way up to the top on the right flank and were to build line if they could. However, they were not informed of the overall strategy and tactics.
No communications link with crew members/supervisor	Communications with crew members were good; incident commander's communications with his supervisor and dispatch were poor due to inadequate radio coverage in area.
Constructing firelines without safe anchor point	IC strategy was a frontal attack with the intent of establishing an anchor point at midslope above the approaching flame front.
Building fireline downhill with fire below	They were not building fireline downhill with fire below at the time of deployment.
Attempting frontal assault on fire	Was an issue; decision to try and flag dozer line on mid-slope road relatively close to fire made firefighters vulnerable when fire intensity and rate of spread increased rapidly.
Unburned fuel between you and the fire	Was an issue and contributed significantly to need to deploy shelters.
Cannot see main fire, not in contact with anyone who can	Not an issue, main fire was visible
On a hillside where rolling material can ignite fuel below	Not an issue, fire was below and running uphill
Weather is getting hotter and drier	Weather was not getting hotter and drier; incident occurred near the period of peak burning time for the day.
Wind increases and/or changes direction	Wind did change direction causing several small fires to grow together and make a concentrated run uphill.
Getting frequent spot fires across line	Not an issue, line had not been constructed yet
Terrain and fuels make escape to safety zones difficult	Steep terrain and heavy fuels made travel difficult; however, safety zones and escape routes were not identified.
Taking a nap near the fireline	Not an issue.

Common Denominators of Fire Behavior on Tragedy Fires

Common Denominator	Comments
Most incidents happen on the smaller fires or on isolated portions of larger fires.	Applicable here. Fire size was approx. 8 acres when IA resources arrived.
Most fires are innocent in appearance before the flareups or blowups. In some cases, tragedies occur in the mopup stage. was not an issue here.	Several small fingers combined into a flaming front and made a strong uphill run. Mopup stage had not begun and
Flareups generally occur in deceptively light fuels.	Applicable here. Leaf litter contributed to strong uphill run.
Fires run uphill surprisingly fast in chimneys, gullies, and on steep slopes.	Applicable here. The strong uphill run on steep slopes of approximately 60 percent led to the entrapment and deployment.
Some suppression tools, such as helicopters or air tankers, can adversely affect fire behavior. The blasts of air from low flying helicopters and air tankers have been known to cause flareups.	Not applicable here. No air resources were used on this fire.