

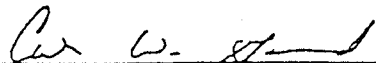
# Report of the Dutch Flat Fire Accident Investigation Team



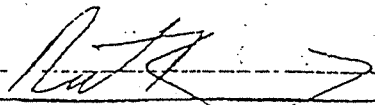
September 30, 1996



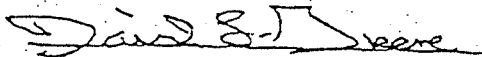
Dutch Flat Fire  
Investigation Report



Carl Gossard  
Team Leader  
State Fire Management Officer  
Bureau of Land Management  
Colorado State Office  
Lakewood Colorado



Robert Ruffridge  
Team Member  
Conservation Camp Supervisor  
Dept. of Conservation and Natural Resources  
Division of Forestry  
State of Nevada  
Las Vegas, Nevada



David Greene  
Team Member  
Engineering Staff Officer  
Toiyabe National Forest  
United States Forest Service  
Sparks, Nevada

Dutch Flat Fire  
Investigation Report

## Contents

Acknowledgments .....	iii
Executive Summary .....	1
Investigation .....	5
Incident Overview .....	6
Accident Chronology .....	7
Fire Behavior Summary .....	14
Findings .....	17
Recommendations .....	21
Glossary .....	22

Attachment:  
Site map

## Acknowledgments

The review team would like to thank the following individuals for their contribution to the completion of this investigation and report.

### Investigation

Alan Kighdinger  
Safety Officer  
Nevada Department of Forestry

Ken Loda  
Fire Behavior Analyst  
Winnemucca District  
Bureau of Land Management

### Report Preparation

Barb Perkins  
Public Affairs Specialist  
Bureau of Land Management  
Colorado State Office

Jennifer Kapus  
Visual Information Specialist  
National Applied Resource Technology Center

**Dutch Flat Fire**  
Investigation Report

## Executive Summary

### The Accident

On the afternoon of August 26, 1996, a dry lightning storm started numerous wildland fires across northern Nevada. Initial attack forces from the Winnemucca, Elko, and Battle Mountain BLM Districts were overwhelmed by the fires and several large fires escaped initial attack. Four of these fires, the Getchell, Dutch Flat, North Chimney and Two Forks became known as the upper Humboldt Complex. The Upper Humboldt Complex was comprised of low priority fires and therefore did not have resources other than initial attack assigned on August 26 or 27.

On August 26, 1996, lightning strikes ignited the Dutch Flat, Getchell, North Chimney, and Two Forks fires in BLM's Winnemucca District. These four fires became known as the Getchell Complex. These fires were lower in priority than other fires burning in the district at this time. Resources were sent to the higher priority fires. Fires were also ignited to the east in BLM's Battle Mountain District.

Competition for resources was very high nationwide at this time with the Preparedness Level at the National Interagency Coordination Center at level five (5).

On August 28, 1996, [REDACTED] Type II Incident Management Team was assigned the Slaven fire in Battle Mountain District and the Upper Humboldt Complex in Winnemucca District.

Over the next three days, suppression efforts continued on the Upper Humboldt Complex and resources assigned went from 190 personnel on August 29 to 317 personnel on August 31.

On August 31, the highest priority fire in the complex was the Dutch Flat Fire. The other fires in the complex were almost contained. It was anticipated that the fire could be contained at the top of the Osgood Mountains and most resources were assigned to this effort. As the day progressed, the fire spread past the anticipated control lines and began moving down the east flank of the Osgood Mountains toward the Getchell Mine and Christensen ranch house in Julian Creek.

[REDACTED] (Incident Commander), [REDACTED] (Operations Chief), [REDACTED] (Operations Chief), [REDACTED] (Operations Chief trainee), and [REDACTED] (Division Group Supervisor) met near the Getchell Mine along the northeast side of the fire.

At this meeting, they decided to burnout some line to keep the fire from advancing further toward the Getchell Mine and to secure an anchor point from which to continue burnout operations to halt spread of the fire to the east.

[REDACTED] left the area to stop traffic from coming up the main haul road while [REDACTED] and [REDACTED] performed the burnout operation. As they were performing the burnout, a fire whirl formed along the edge of the line and burned over [REDACTED] (who was on foot) and [REDACTED] (who was in [REDACTED] vehicle). [REDACTED] received burns to his head and hands, [REDACTED] was not injured.

## Investigation

An investigation team was requested by the Nevada State Fire Management Officer (SFMO). The team met with the SFMO to receive the delegation of authority and an initial description of the accident. The team then went to Winnemucca to meet with the involved personnel and to perform the onsite investigation.

The investigation team utilized the Fire Entrapment Investigation and Review Guidelines approved in January of 1993 by the National Wildfire Coordinating Group to perform the investigation.

The team presented the draft incident overview and causal factor to the Incident Commander (IC), the Winnemucca and Battle Mountain District Managers, and the acting Forest Service Santa Rosa District Ranger on September 4, 1996. A refined draft and recommendations were presented to the Nevada BLM State Director and Toiyabe/Humboldt Deputy Forest Supervisor on September 5, 1996.

## THE FINDINGS

### FIRE BEHAVIOR

Fuels - Influenced. Live and dead fuel moistures were very low. Probability of ignition was at 100%.

Weather - Influenced. Extremely low relative humidity was the causing factor for the dry dead fuels. Lower atmospheric instability and light but gusty winds at ground level help trigger the formation of fire whirls.

Topography - Influenced. The Osgood Mountains blocked the general wind which allowed the slope winds to dominate for most of the day. This contributed to the wind shear that could lead to fire whirl development.

Predicted -vs.- Observed - Did not contribute

Anomalous Events - Significantly contributed. The fire whirl that developed at the location of the burnout, though anticipated in the general area, could not be precisely predicted. The fire whirl instantaneously caused extreme fire behavior which, in this case, precluded escape.

### ENVIRONMENTAL FACTORS

Smoke - Did not contribute.

Temperature - Did not contribute

Visibility - Significantly contributed. Visibility became a factor in the injuries which were sustained by causing uncertainty as to the viability of planned escape routes.

Slope or Terrain - Did not contribute

**Dutch Flat Fire**  
**Investigation Report**

## INCIDENT MANAGEMENT

**Incident Objectives - Influenced.** Protection of private property and ranches was an objective for the incident management team. Both local ranchers and Getchell Mine personnel were extremely interested in the suppression effort and provided information on what was threatened by the fire to members of the incident management team.

**Strategy - Significantly contributed.** The strategy to do the burnout placed the personnel involved on the line where the fire whirl occurred.

**Tactics - Influenced.** Performing a burnout operation without holding forces in place is more risky than with holding forces are in place. The decision Webb made to introduce heat inside the fireline to draw the fire away from the line was a sound tactic.

**Safety Briefings - Influenced/significantly contributed.** There was not a safety briefing prior to the burnout operation. There was general discussion on what to do and everyone was aware of the safety concerns and their escape routes.

**Instructions Given - Influenced.** There was apparent confusion on who was actually in charge at the site. There was no operational briefing given or control established prior to the ignition sequence. No method of communication was established other than verbal.

## CONTROL MECHANISMS

**Span of Control - Did not contribute**

**Communications - Radio communications did not contribute.** Interpersonal communications influenced. Communication between Webb and Thornhill was incomplete. The sender (Thornhill) remembers discussing that he was going to drive the vehicle as Webb ignited inside the line but Webb (the receiver) does not remember the conversation.

**Ongoing Evaluation - Did not contribute.**

### Ten Standard Orders/Eighteen Situations

#### Ten Standard Orders

1. Fight fire aggressively but provide for safety first - Webb did not utilize all his personal protective equipment. Specifically, he was not wearing his glove and did not have the chinstrap of his hardhat under his chin. He was, however, wearing a "Hot Shield" across his nose and mouth.

4. Ensure that instructions are given and understood - Evidenced by the fact that all involved had a different understanding of their roles and the roles of others.

#### Eighteen Watchout Situations

6. Instructions and Assignment clear - Evidenced by the fact that all involved had a different understanding of their roles and the roles of others.



## INVOLVED PERSONNEL PROFILES

Training/Qualifications/Physical Fitness - Did not contribute

Operation Period Length/Fatigue - Did not contribute

Attitudes - Did not contribute

Leadership - Influenced. Having two operations chiefs working the same shift at the same location may have led to the confusion on who was in charge during the burnout operation.

Experience Level - Did not contribute

## EQUIPMENT

Availability - Did not contribute

Performance of the Equipment - Did not contribute

Clothing and Equipment - Did not contribute. The "Hot Shield" utilized by [REDACTED] provided additional protection and may have prevented damage to his airway.

Used for Intended Purpose Properly - Significantly Contributed. [REDACTED] did not have his gloves on at the time of the burnover. The chin strap on [REDACTED] helmet was hooked over [REDACTED] and [REDACTED] was not wearing his fire shelter at the time of the burnover, however, it was in the front seat of his truck (40 feet away). This was not a factor in this burnover. There would not have been time to deploy the shelter if it would have been with him.

**Dutch Flat Fire**  
Investigation Report

## Investigation

As soon as it was known that a firefighter had been injured in a burnover on the Dutch Flat fire, an interagency investigation team was designated by the Nevada State Fire Management Officer. The team consisted of the following three members.

Carl Gossard, Leader, Bureau of Land Management (BLM)  
Robert Ruffridge, Nevada Department of Forestry (NDF)  
Dave Greene, U.S. Forest Service (USFS)

The team met with Lee Englesby, Nevada BLM State Fire Management Officer and Kevin Hull, Manager, Western Great Basin Coordinator, at 10:00 a.m., on Sunday, September 1, 1996, to receive their initial briefing and delegation of authority.

The delegation of authority directed the following:

Carl Gossard was delegated the authority to represent the Nevada State Office in conducting an investigation relating to the fire entrapment of [REDACTED] U.S. Forest Service, which occurred on August 31, 1996. All required resources were available to Mr. Gossard and his team to conduct a thorough and complete investigation. A draft report was given to the Incident Commander, the BLM District Manager, and the Forest Service District Ranger in Winnemucca and the BLM State Director in Reno. The final report was requested no later than September 30, 1996.

The team arrived in Winnemucca, Nevada, and met with [REDACTED] Winnemucca District Manager, [REDACTED] Incident Commander, and [REDACTED] Safety Officer. The team received an initial briefing of the entrapment by [REDACTED] and [REDACTED]. [REDACTED] had done an initial assessment of the entrapment site and provided that information to the investigation team.

The investigation team set the schedule for the investigation. Interviews were completed with personnel involved in the burnout operation during the afternoon and evening of Sept. 1, 1996.

The investigation team visited the site on Sept. 2, 1996, taking control of the entrapment area at approximately 10 A.M. [REDACTED] and [REDACTED] (Fire Behavior Analyst) assisted in processing and taking measurements of the scene. Those involved in the entrapment were also escorted to the scene one at a time to supplement their initial statements.

Additional interviews and team meetings occurred on September 2 and 3 and the initial draft of the Incident Overview and Causal Factors sections of the report was prepared.

The draft Incident Overview and Causal Factors were presented to the Incident Commander, Winnemucca and Battle Mountain BLM District Managers, and the Forest Service Winnemucca District Ranger on September 4, 1996.

## Incident Overview

### Background

Northern Nevada has experienced almost a record number of wildland fires this year. Extremely dry weather with near record temperatures and high fuel densities combined to create an explosive fire situation. These factors, together with a "dry lightning" storm on September 26, set the stage for the circumstances that culminated in the accident that is the subject of this report.

On August 26, lightning strikes in the Shoshone Range ignited the first in a series of fires that collectively would be known as the Upper Humboldt complex. Driven by 50 mile per hour winds, the Slaven Fire quickly grew to approximately 200 acres. At nearly the same time, lightning also ignited five additional fires in the Osgood Mountain and Chimney Reservoir area. These fires were named: Dutch Flat, Getchell, and the Two Forks Fire. Collectively they were called the Getchell Complex. Other more active fires were also burning in the area at this time requiring managers to initially assign these new starts a lower priority for the allocation of limited suppression resources.

The following day, August 27, the Slaven Fire was very active and covered approximately 1,500 acres. Strong winds, difficult topography, and limited access severely affected suppression efforts. By the end of the day, the fire had grown to about 10,000 acres. Concurrently, a similar dramatic growth in size was occurring on the Getchell Complex. It was now over 40,000 acres and threatening nearby ranches and mines. It is significant to note that, despite the large numbers of acres consumed and immediate threat to property, the severe shortage of available resources only allowed for 100 persons to be assigned to these fires.

This changed on August 28 when a Type II team was assigned to the two incidents. The organized effort of this team, including the extensive use of air tankers, resulted in firefighters making significant advances in their suppression efforts. The rate of spread was slowed and significant natural and man-made resources were spared.

Suppression efforts continued into August 29. One hundred-ninety personnel were now involved and the incessant efforts of the air tankers resulted in the Slaven Fire being declared contained that evening. The Getchell Complex was estimated to be 80% contained.

By the August 30, progress was hampered by afternoon winds. Estimate of containment grew to 85% obscuring that a significant threat remained to the ranches and mining properties in the area. At this time, 119,000 acres had been consumed and 250 personnel committed to the battle.

There was a significant change in fire behavior during the night of August 30. The Dutch Flat fire burned actively throughout the night and continued to increase in intensity throughout the morning. A major breakout occurred on the northeast flank in the late morning and early afternoon, dramatically heightening the threat to both the Getchell Mine and the Christensen Ranches.

It was during this later period that the accident described in this report occurred.

## Accident Chronology

All times in this timeline are estimates.

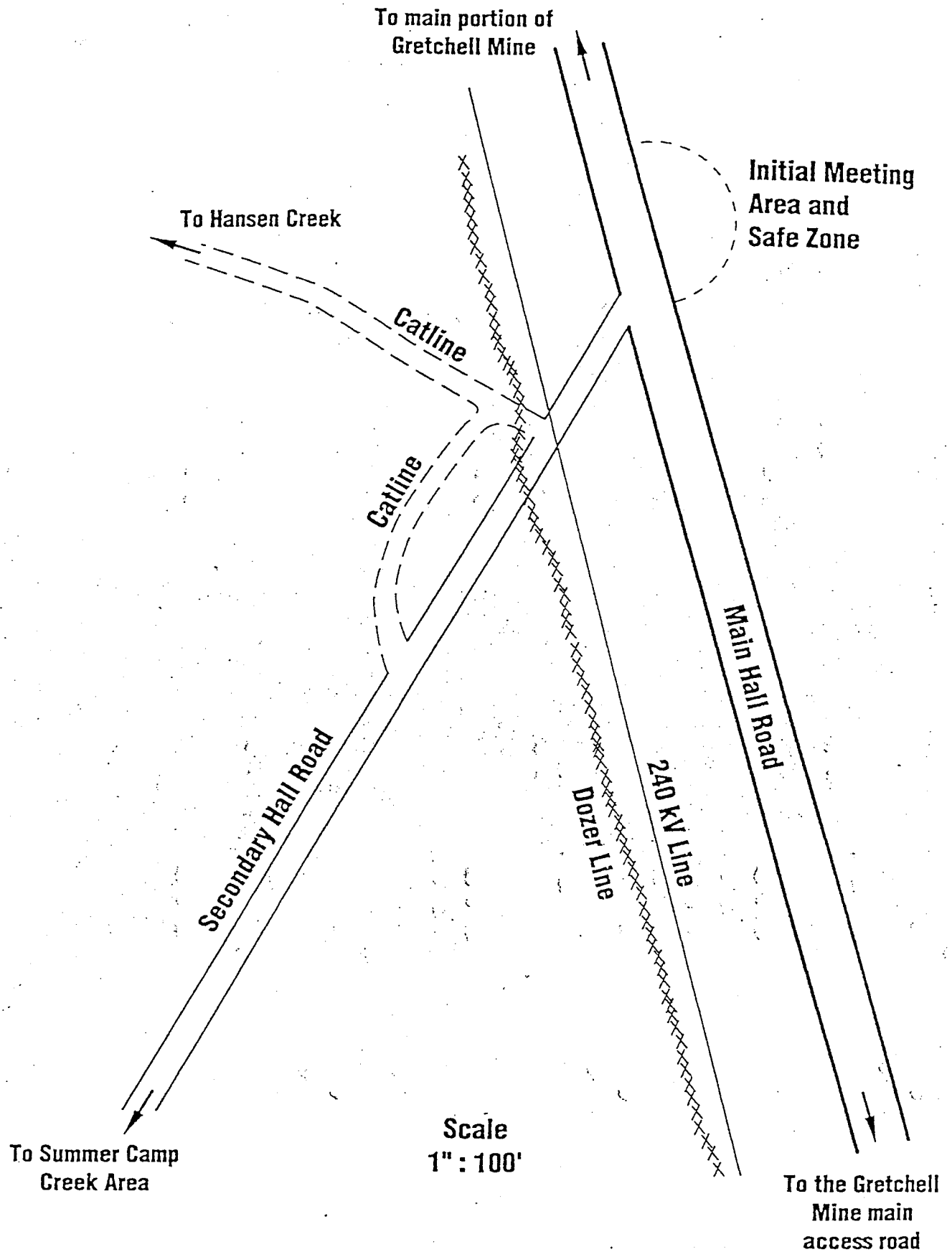
1500 Hours [REDACTED], [REDACTED], and [REDACTED] met at the junction of a haul road, secondary haul road, and a catline to look at the fires progress as it moved from the Anderson Canyon area toward the Getchell Mine (Attachment, Site Map). This appears to have been a somewhat fluid meeting with [REDACTED] arriving after the rest of the group had been discussing the options. They parked their vehicles in a large clear area at this junction. They discussed alternatives to stop the spread of the fire toward Getchell Mine and to secure an anchor point for further burnouts to secure a line between the fire and ranch houses to the south. (Mine personnel had indicated that any spark at the mine site could lead to an explosion. Local ranchers had been expressing concern about the fire for several days). The group decided that it would be necessary to burn out fuel to the west of the secondary haul road to stop the fire spread toward the Getchell Mine. Selection of the secondary haul road was made to ensure that the power line paralleling the main haul road is safe. All agreed that this was the correct course of action. [REDACTED], [REDACTED], and [REDACTED] began to implement the burnout operation. [REDACTED] proceeded south to the junction of the main haul road and the road that leads to the Getchell Mine to keep traffic from entering the area during the burnout. Specific escape routes were not discussed but all involved had an idea of where they would go if things went bad. [REDACTED] was to follow the firing operation in his vehicle as a secondary safety measure. [REDACTED] began working with the understanding that [REDACTED] would be the lookout.

Sometime between 1515 and 1525 hours, the burnout operation began - [REDACTED] and [REDACTED] began the burnout operation on the northwest end of the catline and begin burning to the southeast toward the secondary haul road. They were spaced about 10 feet apart with [REDACTED] lighting about 10 feet in from the catline, and [REDACTED] following lighting from the edge of the catline. They proceeded down the catline to the southeast tying into the secondary mine haul road. (Illustration 1, Accident Site Layout)

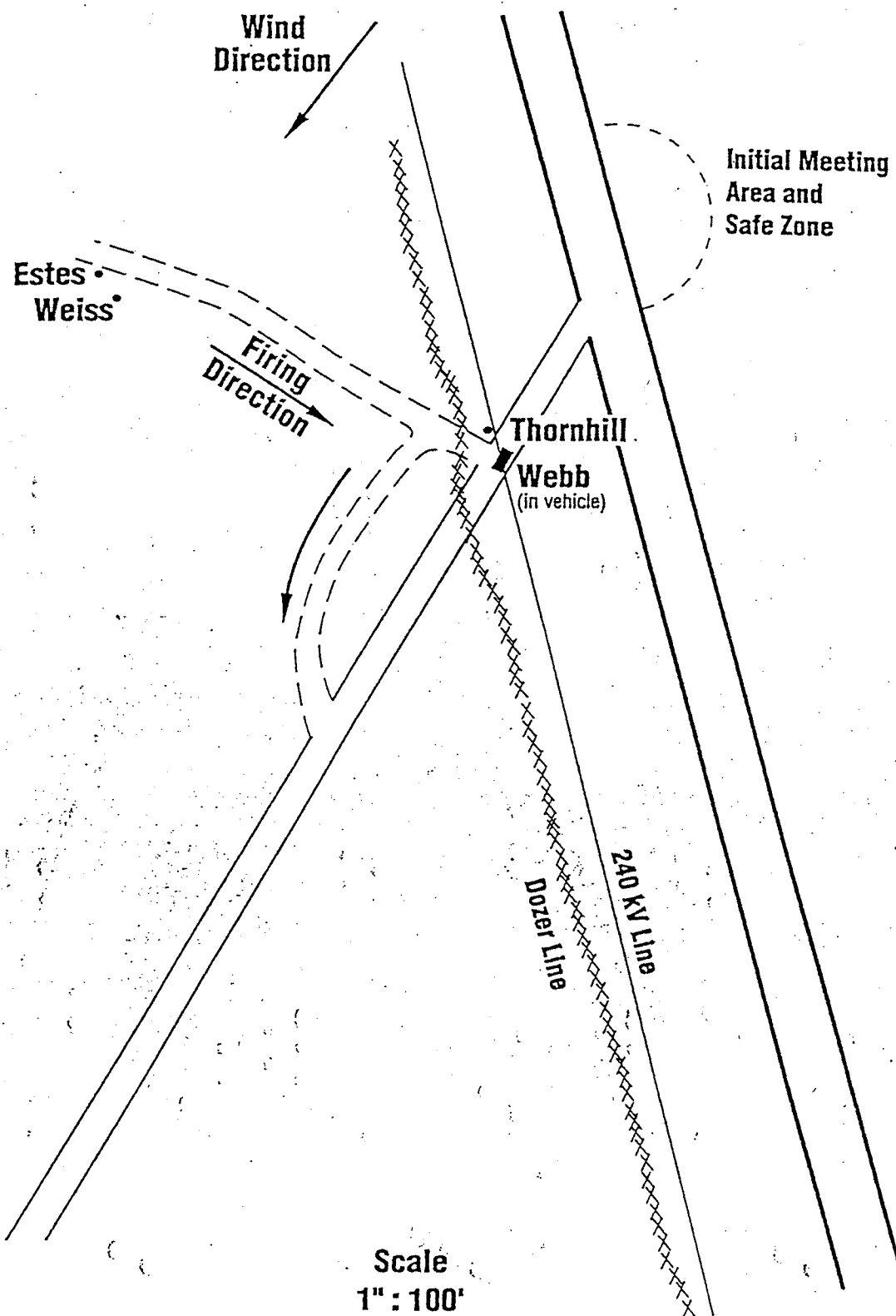
[REDACTED] and [REDACTED] reached the secondary haul road and began burning out along the secondary haul road, proceeding in a southwesterly direction. The fuel was igniting very easily so [REDACTED] and [REDACTED] both began lighting from the edge of the secondary haul road. [REDACTED] also lit a fusee to assist in the firing effort and [REDACTED] followed the three lighters in his vehicle. (Illustration 2, Personnel Position at the Beginning of the Burnout)

[REDACTED] and [REDACTED] proceeded lighting moving along the secondary haul road toward the southwest. They quit lighting when the fire began to get too hot. They let it cool down, and then began lighting again. At the same time, [REDACTED] determined that three people igniting the burnout were not necessary so he extinguished his fusee and went to the vehicle. [REDACTED] had exited the vehicle and began to load a flare in his pen launcher. [REDACTED] planned to launch flares well into the vegetation beyond that line already ignited to generate heat inside the line to draw the fire away from the road. [REDACTED] told [REDACTED] that he would drive the vehicle and act as lookout. [REDACTED] does not recall this conversation and was not aware that [REDACTED] had entered the vehicle.

Webb was positioned about 40 feet in front of the vehicle loading a cartridge in the pen flare. He was wearing his personal protection equipment (PPE) including his hardhat and gloves. He was also wearing a "Hot Shield" which provides protection to the nose, cheeks, mouth, and



**Accident Site Layout**



**Personnel Position  
at the Beginning of the Burnout**

throat. He was not wearing his line gear which included his fire shelter. At this point, he removed his gloves and held them under his arm as he loaded the pen flare.

The following happened within a matter of 1 to 2 minutes:

█████ noticed a circular motion beginning in the area of the burnout right next to the line between his location and █████. █████ recognized this as the formation of a fire whirl and shouted a warning to █████. The circular motion had turned into a fire whirl which began to move across the secondary haul road toward the southeast. █████ and █████ began running to the south along the secondary haul road to escape. (Illustration 3, Personnel Positions at Time of Fire Whirl)

█████ was looking at █████ as the fire hit both of them at the same time. █████ turned and looked in the direction of his truck but apparently did not see it. █████ then saw █████ begin running in the direction of the truck and waited believing that █████ was running toward the truck to get inside. █████ was surprised when █████ ran past the truck on the driver side. █████ then put the truck in reverse and began driving backward, intending to keep the truck between █████ and the fire. At this point the fire whirl obscured █████ vision. He could not see past the windows in the vehicle. Sparks and burning vegetation were hitting on all sides of the vehicle. █████ kept moving backwards until he backed off the road. At this point █████ was not in view of anyone.

As █████ was backing down the side of the road closest to the fire, █████ fell on the green side of the road. (This is where the GPS unit, 12 flares, the hard hat, and the gloves were found). As █████ fell, █████ passed him and backed into the ditch. █████ tried to regain his footing but fell again, this time on the side of the road closest to the fire. (This is where the radio and 2 flares were found). At this point, █████ regained his footing, saw the truck and determined that it was not going to be a safety zone as fire was coming out from underneath the vehicle. He was not aware that the █████ was in the vehicle and that the vehicle was not where he had parked it.

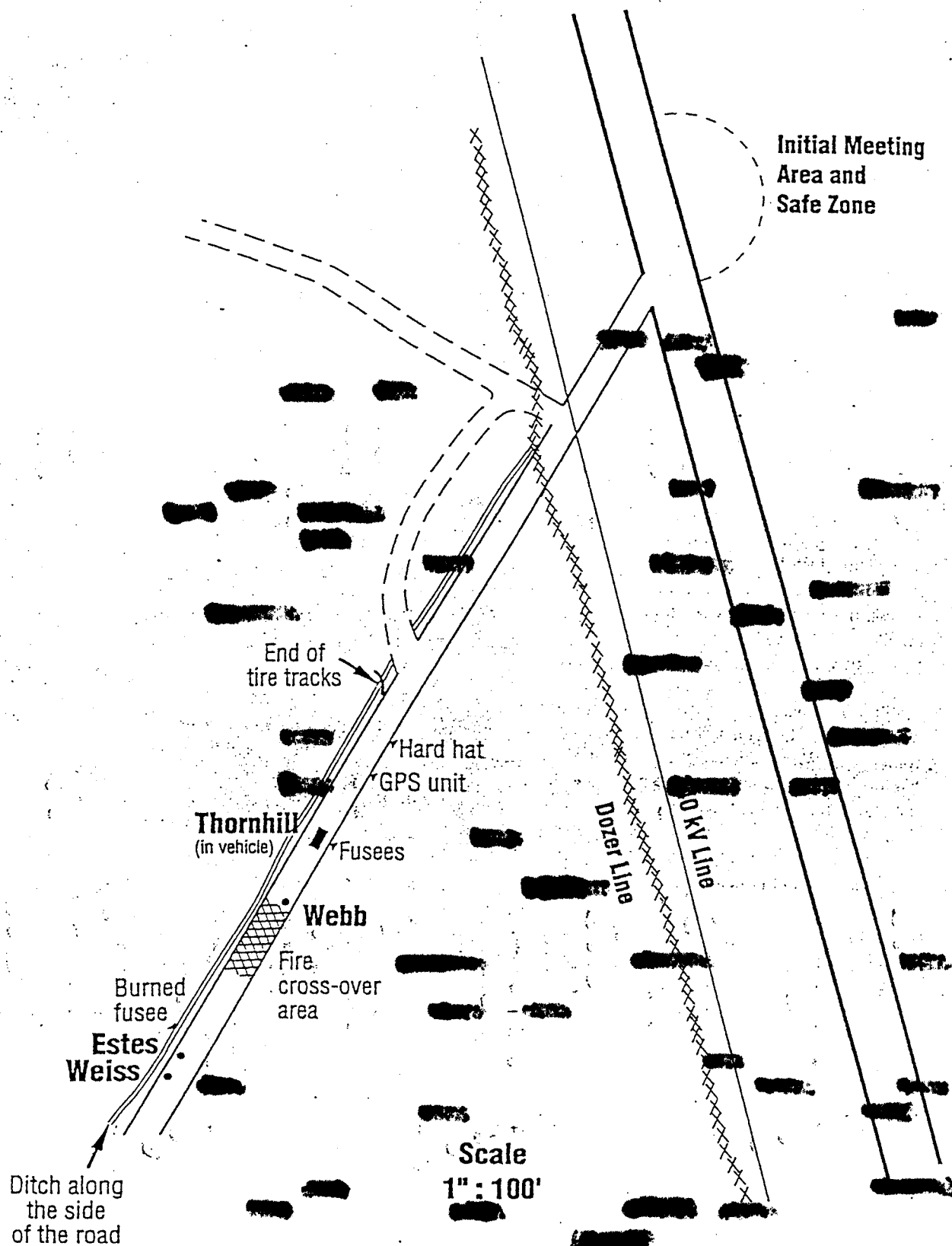
█████ ran on to the north. █████ did not see him. █████ tried to pull forward but could not. He waited a second and tried again. He pulled up out of the ditch, saw a clearing in the smoke and fire and proceeded south toward █████ and █████.

As this was occurring, █████ stopped running and turned back toward where he had last seen █████. He saw █████ fall to the ground on the side of the road closest to the fire. █████ could see █████ face and noticed that his hardhat was gone. █████ tried to get up and fell down again.

█████ got the vehicle past the fire whirl and began to turn around. █████ got to the vehicle and asked "where is █████" █████ told him that █████ had run past him. █████ dropped his fuses and jumped in the vehicle. █████ then completed turning the vehicle and they drove through the fire to find █████.

█████ saw that █████ and █████ were going back to find █████ and decided that he should continue on to the south along the secondary haul road to safety.

█████ and █████ emerged from the fire headed north. As they emerged, they saw █████



**Personnel Positions  
at Time of Fire Whirl**



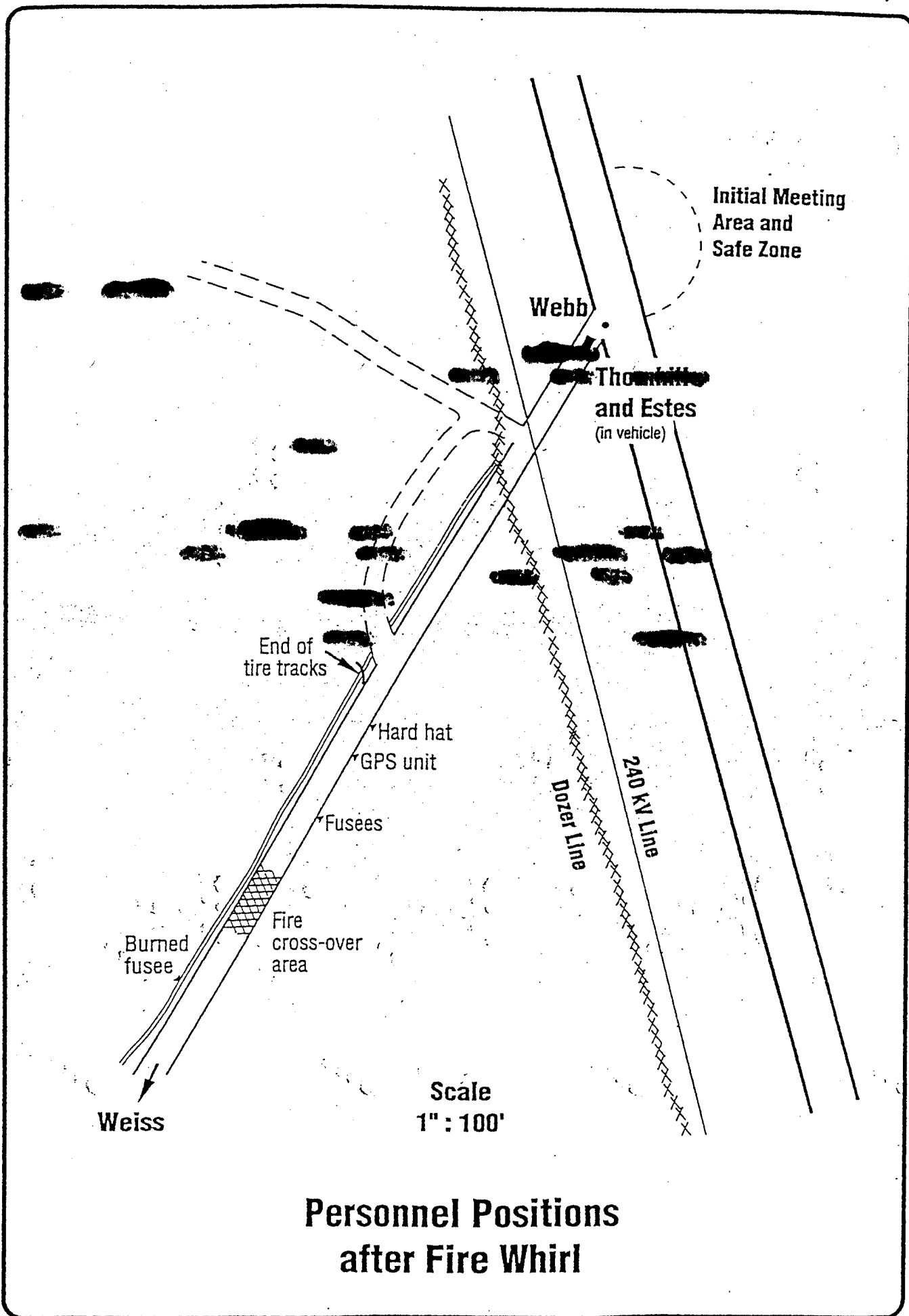
**Dutch Flat Fire**  
Investigation Report

standing at the junction of the secondary mine road and the main haul road. He was standing with his arms held out about chest high. He was bleeding from his forehead and his hands were cut and blistered. He was conscious and coherent, talking with [REDACTED] and [REDACTED] (Illustration 4, Personnel Positions after Fire Whirl)

1532 Hours - [REDACTED] declared a medical emergency and requested a medivac helicopter. [REDACTED] and [REDACTED] placed [REDACTED] in Estes's vehicle and proceeded to the junction of the main haul road and the road to the Getchell Mine where the Golconda fire department engine was located. Emergency Medical Technicians (EMTs) with the Golconda Fire Dept. and EMTs from the Getchell Mine administered first aid to [REDACTED]. They proceeded toward Golconda until met by the requested helicopter. Webb was transferred to the helicopter and flown to Winnemucca.

Once [REDACTED] was in the care of the EMTs, [REDACTED] took [REDACTED]'s vehicle back to find [REDACTED]. As [REDACTED] left, [REDACTED] made contact with [REDACTED] on the radio and [REDACTED] indicated he was in a safe location. [REDACTED] found [REDACTED] as he emerged on the main haul road, picked him up, and then proceeded back to the intersection where [REDACTED] was located.

[REDACTED] proceeded back to the scene with [REDACTED] and secured the area with flagging. Personnel from the mine also came to the scene and drove Webb's vehicle to the security office for safe keeping.



## Fire Behavior Summary

**Location:** Getchell Mine, northeast of Golconda Nevada, Township 38N Range 42E Section 4  
On the east side of the Osgood Mountains along the base of the slope.

**Fuel Type:** Sagebrush, Rabbit brush and Mixed Annual Grasses. The brush was 2 to 3 feet tall  
A continuous under story of 10-12 inch grass.

**Dead Fuel Moisture:** One hour dead fuels were 2% to 3% and ten hour dead fuels were 3% to 4%. These values are based on readings taken at the Burma Springs RAWS site at 1500 on 8/31/96 and on calculated fuel moisture using weather information from the Burma Springs weather station.

**Live Fuel Moisture:** Samples were taken from the site on September 2 and analyzed in Reno. The actual live fuel moisture on the site was 73% to 85%. This is considered to be very low and an indicator of extreme to advanced fire behavior, the highest categories.

**Topography:** The Osgood Mountains are a steep north to south orientated range in northern Nevada with numerous east to west orientated canyons on both sides of the range. The base elevation is about 5,200 feet with the upper elevations being 8,678 feet at Adams Peak. The slopes in the Osgood Mountains are steep with most slopes being over 50% and with many of the side canyons having slopes of 80% or greater.

**Slope:** Less than 10% at the site of the accident. But 40% to 80% just north and west of the accident site.

**Elevation:** 5,350 feet at the accident site.

**Wind speed and direction:** 20 foot winds at the Burma Springs RAWS site were west at 12 mph on both the 1500 hours and 1600 hours report. Reported eye level wind at the accident site were 3 to 5 mph from the east and southeast before the fire whirl started and are estimated to have been in excess of 30 mph and erratic during the accident.

**Temperature:** 87      **Relative Humidity:** 6%

**Haines index:** Estimated to be 6 (This estimate is based on a actual Haines Index of 6 at both Elko and Reno on the morning of the accident.)

### Fire Behavior at 1500

When the burning operation began, the wind was from the east and southeast at the site. This wind direction aided the operation by pushing the fire that [redacted] and [redacted] ignited away from the control line. Due to the extremely low fuel moisture, the fuel ignited easily with a fusee and continued to burn even with the light winds. Fire behavior was moderate but not intense enough to cause spotting across the 20-foot-wide road they were using as a control line. When [redacted] and [redacted] made the turn onto the secondary haul road, the winds were closer to parallel with the haul road which explains the increase in intensity noted by [redacted] and [redacted] before the accident occurred. This increased intensity still did not create a spotting problem but did cause [redacted] and [redacted] to slow their ignition and [redacted] to discontinue igniting.

## Dutch Flat Fire

### Investigation Report

Rate of Spread	15 to 35 Chains per hour
Fire line Intensity	150 to 425 BTU/FT/Second
Flame length	4 to 7 feet
Spread Direction	Away from and parallel to the road that they were burning from.
Probability of Ignition	100%

#### Fire Behavior during the fire whirl

At about 1525 hours, a fire whirl developed on the edge of the road between where [REDACTED] and [REDACTED] were igniting the burnout and where [REDACTED] was standing. As the whirl developed, the fire behavior quickly intensified over the entire burnout area due to the rapid increase in wind speed effecting the fire. When the fire whirl developed, the wind speed would have suddenly increased to over 30 mph and changing direction due to the rotation of the whirl. After the formation of the fire whirl, spotting across the road occurred due to the increased fire intensity and the physical movement of fire brands across the road by the fire whirl. The following readings are estimated peak values during the fire whirl based on a fuel model 2 (grass and sage).

Rate of Spread	800 to 1000 Chains per hour
Fire line Intensity	10,500 to 12,000 BTU/FT/Second
Flame length	30 to 40 feet
Spread Direction	In all directions including across the road when the whirl crossed the road.
Probability of Ignition	100%

#### Fire Whirls

Fire whirls are considered a type of extreme fire behavior, they are best described as a rapidly rotating column of rising fire, gas and debris. Fire whirls are similar to dust devils and tornadoes in appearance and are caused by some of the same physical processes. While there is no way to predict the timing and location of a fire whirl, the following are indicators of the potential for fire whirl development.

#### Weather

- \*\* 1. Clear skies or few clouds.
- \*\* 2. Low humidity.
- \*\* 3. Light winds.
- \*\* 4. Unstable lower atmosphere.
- 5. Cumulus cloud development.
- \*\* 6. Rough bumpy conditions reported by aircraft.
- \*\* 7. Airmass changes.

#### Topography

1. Aspects or slopes on which the sun is perpendicular.
- \*\* 2. Winds across ridge tops with heating on leeward slopes.
3. Up and down canyon winds when they:
  - a. Flow around spur ridges.
  - b. Flow around a sharp bend in a canyon.
- \*\* c. Encounter flow from adjoining canyons.

#### Fire

1. Well developed convection column.
- \*\* 2. Bare exposed soil or burned over area.
3. Strong convection column causing air to split around it and form fire whirls on the lee side of the column.
- \*\* 4. Intense heat output and turbulent winds extending vertically over the fire.

Items marked with \*\* were present on the day of the accident on the Upper Humboldt Complex.

**Dutch Flat Fire**  
Investigation Report

## Findings

### FIRE BEHAVIOR

#### Fuels - Influenced

- Fuel type was sagebrush and rabbit brush around 3 ft tall with a continuous under story of 12 inch grass
- Dead fuel moisture was 2 to 3%.
- Live fuel moisture was in the 73% to 85% range.
- Probability of ignition was 100%

#### Weather - Influenced

- Extremely low relative humidity was the causing factor for the dry dead fuels.
- Lower atmospheric instability and light but gusty winds at ground level would help trigger the formation of fire whirls.

#### Topography -Influenced

- The Osgood Mountains blocked the general wind (from the northwest) which allowed the slope winds to dominate for most of the day (from the east/southeast). This contributed to the wind shear that could have led to fire whirl development.

#### Predicted -vs.- Observed - Did not contribute

- All personnel interviewed were aware of the predicted extreme fire behavior.
- The shift plan on 8/31 was updated at the morning briefing to highlight the chance for extreme/erratic fire behavior. Observed fire behavior was consistent with predicted behavior.

#### Anomalous Events - Significantly contributed

- The fire whirl that developed at the location of the burnout operation, though anticipated in the general area, could not be predicted.
- Fire whirls develop rapidly and lead to a dramatic increase in wind speeds which instantaneously causes extreme fire behavior which, in this case, precluded escape.

## ENVIRONMENTAL FACTORS

[REDACTED] - Did not contribute (except as noted under visibility):

Temperature - Did not contribute

Visibility - Significantly contributed

- Visibility became a factor in the injuries sustained once the fire whirl reduced visibility - caused uncertainty as to the continued validity of [REDACTED]'s planned escape routes.

Slope or Terrain - Did not contribute

- The topography in the accident area is relatively flat - slope less than 10%.

## INCIDENT MANAGEMENT

[REDACTED] Incident Objectives - Influenced

- Incident objective number two states "Protect private [REDACTED] forests (ranches), wildlife habitat and livestock range."

- Both the local ranchers and the Getchell Mine personnel were extremely interested in stopping the fire and provided information on what was threatened by the fire.

Strategy - Significantly contributed

- The strategy to burn along the secondary haul road was selected to prevent the fire from reaching the powerline that parallels the main haul road.

- The strategy to do the burnout placed the personnel involved on the line where the fire whirl occurred.

Tactics - Influenced

- The tactic of performing a burnout operation is more risky without engine support. The engine support could assist in lowering fire intensity by reducing heat with water. Without engine support, the only way they could try to influence fire intensity was by stopping/pausing ignition.

- The decision to introduce heat inside the fireline to draw the fire away from the line was a sound tactic. Whether it would have been better to use another ignition method (instead of the pen flare) needs further discussion.

Safety Briefings - Influenced/significantly contributed

- There was not a safety briefing just prior to the burnout operation. There was general discussion on what to do and everyone was aware of the safety concerns and their own escape routes.

## Dutch Flat Fire Investigation Report

### Instructions Given - Influenced

- There was confusion on who was actually in charge at the site. [REDACTED] thought [REDACTED] was still on scene and in charge. [REDACTED] believed that [REDACTED] was the lookout and he [REDACTED] was in charge of the operation until the time that [REDACTED] left the vehicle to use the pen flare. At that point, [REDACTED] also assumed the role of lookout.

- There was no operational briefing given or control established prior to the ignition sequence. This led to the confusion of who was in charge and who was the lookout. In addition, a method of communication, other than verbal, was not established.

### CONTROL MECHANISMS [REDACTED]

#### Span of Control - Did not contribute

Communications - Radio communications did not contribute except that no radio communications plan was established for this burnout operation.

Communication between [REDACTED] and [REDACTED] was incomplete at best. [REDACTED] though [REDACTED] was the lookout. [REDACTED] knew [REDACTED] was gone and thought that [REDACTED] was the lookout. When [REDACTED] left the truck, [REDACTED] assumed the role of lookout and thought that he had communicated that to [REDACTED]. [REDACTED] does not recall that he and [REDACTED] discussed this - he didn't even know that [REDACTED] was in the truck.

#### Ongoing Evaluation - Did not contribute

#### Ten Standard Orders/18 Situations

##### Ten Standard Orders

1. Fight fire aggressively but provide for safety first - [REDACTED] did not utilize all his personal protective equipment.
4. Ensure that instructions are given and understood - Evidenced by the fact that all involved had a different understanding of their roles and the roles of others.

##### Eighteen Watch Out Situations

6. Instructions and Assignments not clear - Evidenced by the fact that all involved had a different understanding of their roles and the roles of others.

### INVOLVED PERSONNEL PROFILES

#### Training/Qualification/Physical Fitness - Did not contribute

#### Operation Period Length/Fatigue - Did not contribute

Even with the long season, personnel involved did not seem overly tired or over extended.



Attitudes - Did not contribute

This was a routine burnout operation until development of the fire whirl.

Leadership - Influenced

- Having two operation chiefs working the same shift at the same location may have led to the confusion on who was in charge during the burnout operation.

Experience Level - Did not contribute

## EQUIPMENT

Availability - Did not contribute

Performance of the Equipment - Did not contribute

- Protective equipment that was properly employed performed as designed. (Sunglasses did provide some level of protection as well.)

Clothing and Equipment - Did not contribute

- Nomex pants and shirt performed as designed. None of the clothing was ignited.

- "Hot shield" utilized by [REDACTED] provided additional protection to his airway and most likely prevented damage to the airway. It also prevented burns to his lower face and throat and neck.

- To load the Pen Flare, [REDACTED] had removed his gloves.

Used for Intended Purpose/Used Properly - Significantly contributed

- [REDACTED] did not have his gloves on at the time of the burnover.

- The chin strap on [REDACTED] helmet was not worn - appeared to be hooked over the top of the helmet.

- [REDACTED] was not wearing his fire shelter at the time of the burnover, however, it was in the front seat of his truck (40 feet away) but this was not a factor in this burnover. With the speed of the development of the fire whirl there would not have been time to deploy the shelter. The winds generated by the fire whirl would have made deployment difficult (if not impossible) even if there was time to get it out.

## Recommendations

1. Personal Protective Equipment should be utilized by all personnel on the fireline at all times.
2. Burnout operations conducted when extreme burning conditions are indicated should be conducted only when the appropriate holding forces are in place and ready (in this case, engine support).
3. Burnout operations should not be initiated until a tailgate safety and [REDACTED] briefing has been completed and is commonly understood by all. This briefing should include the assignment of roles during the operation and establishment of an operational plan. In addition, contingency plans must be established in the event that conditions change during the burning operation.
4. The use of the "Hot Shield" appeared to play a role in the minimization of the severity of injuries in this incident. It is beyond the scope of expertise of this investigation team to properly evaluate and make recommendations on the effectiveness of type of equipment. Further analysis of the use of this equipment is required. This should include:
  - An analysis of the protective ability of the "Hot Shield" and
  - the compatibility of the "Hot Shield" with current approved protective equipment.
5. Placement of non-tactical vehicles ([REDACTED] Bronco) should occur only outside the influence of anticipated fire behavior. Only tactically applicable vehicles (engines) should be in the immediate fire environment. In addition, the use of vehicles as safety zones should be evaluated and guidelines established.

### Supplemental Recommendations

Though not significantly contributory to the burnover, the following recommendations are offered by the review team.

1. Though pressure to protect the Getchell Mine and the ranches did not play a role in this incident, it is recommended that the threat of fire to mining operations be more fully explored and documented. This information should be given to resource advisors who will be providing information to the incident management team. In addition, fire protection stipulations should be developed and included in public land use permits.
2. The Agency Administrator's Guide to Critical Incident Management (NFES 1356) should be utilized when there is a serious accident or injury. In addition, a peer counselor or health professional should be brought in to evaluate the need for Critical Incident Stress Debriefing when a serious accident or injury occurs on a prescribed fire, wildfire, or aviation operation. This evaluation should be accomplished within 24 hours of the accident or incident.

## Glossary

**Anchor Point:** An advantageous location, usually a barrier to fire spread from which to start building a fireline. An anchor point is used to reduce the chance of firefighters being flanked by fire.

**Aramid:** The generic name for a high-strength, flame-resistant, synthetic fabric used in the shirts and jeans of firefighters. Nomex, a brand name for aramid fabric, is the term commonly used by firefighters.

**Aspect:** Direction toward which a slope faces.

**Backing Fire:** Fire spreading against the wind or downslope. A fire spreading on level ground without wind is a backing fire.

**Blowup:** A sudden increase in fire intensity or rate of spread strong enough to prevent direct control or to upset control plans. Blowups are often accompanied by violent convection and may have other characteristics of a fire storm.

**Burning Out:** A type of suppression fire used to widen control lines during line construction or to eliminate unburned fuels inside the control lines after containment.

**Contain (Confine) A Fire:** To take fire suppression action as needed, which can reasonably be expected to keep the fire within established boundaries under prevailing conditions.

**Control Line:** All built or natural fire barriers and treated fire edge used to control a fire.

**Dust Devil (Whirlwind):** Superheated air rising in columns or chimneys, establishing strong convective circulation, and drawing in air from the surface layer. An upward spiralling motion usually develops.

**Entrapment:** A situation in which a fire traps people in a life-threatening position with no, inadequate, or compromised evacuation routes or safety zones. An entrapment may or may not involve deploying fire shelters.

**Extreme Fire Behavior:** A level of fire behavior that ordinarily precludes methods of direct attack.

**Fire Behavior:** How a fire reacts to the variables of fuel, weather, and topography.

**Fire Behavior Specialist:** A person responsible to the Planning Section Chief for establishing a weather data collection system and for developing fire behavior predictions based on fire history, fuel, weather, and topography.

**Fire Intensity:** A general term relating to the heat energy released by a fire.

**Fireline:** A linear fire barrier that is scraped or dug to mineral soil.

**Dutch Flat Fire**  
**Investigation Report**

**Fire Shelter:** A personal protection item carried by firefighters that, when deployed, unfolds to form a tent-like shelter of heat reflective material.

**Fire Shelter Deployment:** The removing of a fire shelter from its case and using it properly for protection against fire.

**Fire Weather:** Weather conditions that influence fire ignition, behavior, and suppression.

**Firewhirls:** Dust devils or whirlwinds which contain flame and burning materials.

**Flame Length:** The distance between the flame tip and the midpoint of the flame depth at the base of the flame (generally the ground surface), an indicator of fire intensity.

**Fuel Moisture (Fuel Moisture Content):** Water content of a fuel expressed as a percentage of its oven dry weight.

**Fuel Type:** An identifiable association of fuel elements of a distinctive plant species, form, size, arrangement, or other characteristics that will cause a predictable rate of fire spread or difficulty of control under specified weather conditions.

**Fusee:** A colored flare designed as a railway warning device and widely used to ignite suppression and prescription fires.

**Incident Commander (IC):** The person responsible for managing all incident operations.

**Initial Attack (Action):** The first suppression action on a fire.

**Light (Fine) Fuels:** Fast-drying fuels, generally with a comparatively high surface area-to-volume ratio, which are less than 1/4-inch in diameter and have a timelag of 1 hour or less. These fuels readily ignite and are rapidly consumed by fire when dry.

**Nomex:** See ARAMID.

**Pen Flare:** An ignition device consisting of a launcher and cartridges which are used to ignite suppression and prescription fires. The launcher is approximately the size of a pen.

**Radiant Burn:** A burn received from a radiant heat source.

**Rate Of Spread:** The relative activity of a fire in extending its horizontal dimensions, expressed as the rate of increase of the perimeter, rate of increase in area, or rate of advance of its head, depending on the intended use of the information. Rate of spread is generally expressed in chains per hour for a specific period in the fire's history.

**Relative Humidity (Rh):** Percentage of the actual vapor pressure of the air to the saturation vapor pressure; the ratio, expressed as a percentage, of the amount of water vapor in the air compared to the amount the air can hold under the same conditions.

**Remote Automatic Weather Station (RAWS):** An apparatus that automatically acquires, processes, and stores local weather data for later transmission to the GOES Satellite, from which the data is retransmitted to an earth receiving station for use in the National Fire Danger

#### Rating System.

**Run (Of A Fire):** The rapid advance of the head of a fire with a marked change in fireline intensity and rate of spread from that noted before and after the advance.

**Safety Zone (Area Or Island):** An area used for escape should the fireline be outflanked or a spot fire cause fuels outside the fireline to make the fireline unsafe.

**Sizeup (Or To Size Up):** The evaluation of (or to evaluate) a fire to determine a course of action for fire suppression.

**Spot Weather Forecast:** A special forecast issued to fit the time, topography, and weather of each specific fire. These forecasts are issued upon request of the user agency and are more detailed, timely, and specific than zone forecasts.

**Strategy:** The science and art of command as applied to the overall planning and conduct of an incident.

**Surface Fuels:** Loose surface litter on the soil surface, normally consisting of fallen leaves or needles, twigs, bark, cones, and small branches that have not yet decayed enough to lose their identity; also grasses, forbs, low and medium shrubs, tree seedlings, heavier branchwood, downed logs, and stumps interspersed with or partially replacing the litter.

**Tactics:** Deploying and directing resources on an incident to meet objectives determined by strategy.

**Wildland Fire (Wildfire):** Any fire occurring on land that is essentially undeveloped except for roads, railroads, powerlines and similar transportation facilities.



