
Part One

This section provides a condensed summary of facts and information regarding the Dude Fire. Part Two provides more comprehensive and detailed information.

A. Dude Fire Summary

General Weather Summary

June 1990 proved to be one of Arizona's hottest months in recorded history. Temperatures reached record or near-record highs for the days just prior to June 26 -- the day of the Dude Fire entrapment. On this day, the temperature climbed to a record 122 F in Phoenix and 106 F in nearby Payson (located 10 miles south of the Dude Fire). An extended period of drought combined with these temperatures to produce critically high fire danger throughout Arizona. Furthermore, below normal precipitation had occurred the previous six months. At Payson, June precip was only 40% of normal. In fact, general drought conditions had persisted for three years. Late June crop moisture indices for the area reflected the persistence of "Severely Dry" conditions.

At the onset of the Dude Fire, strong high pressure persisted over Arizona. Record high temperatures with 10-15% humidities were observed and forecast in the Dude Fire area. While atmospheric moisture over the state was quite limited, enough did exist to threaten some thunderstorm activity over the mountainous areas, including the rim country north of Payson. The topography of the Mogollon Rim, the Dude Fire's origin, provides a favorable forcing mechanism which contributes to the development of thunderstorms when the convective environment is favorable.

Fuel and Fuel Moisture Summary

The Dude Fire burned through ponderosa pine with an understory of manzanita, scrub oak, needle and leaf litter, and large heavy dead fuel (greater than 6 inch logs). Due to the dry conditions, large dead and down fuels (logs) were completely consumed by fire, contributing to the development of the convection column. Because of the drought

conditions, much of the understory was heavily draped with dead, very dry pine needles. Fuel models that describe the surface fuels: 80% Fuel Model 9 and 20% Fuel Model 6.

The fire occurred in the third year of a drought. The Southwest Area Severity Chart showed that the five-day mean Energy Release Component (ERC) was in the extreme range. Heavy fuels and ground fuels were very dry – evidenced by the complete combustion of the logs and the smoldering of ground fuels. While these fuels may not contribute significantly to the fire spread, they do contribute significantly to the total heat produced by the fire – aiding in the convection column development. In addition, due to their low moisture content, the live fuels on the Dude Fire burned very well. Live fuel added both thermal energy and moisture into the convective cell.

The National Fire Danger Rating System fuel moisture values at a nearby station for June 26 (second day of the fire when the fatalities occurred) were: 1-h = 3%; 100-h = 6%; 1000-h = 8%.

Temperatures and relative humidity values recorded on the fire line by the Coconino Hotshots and Alpine Hotshots were used to calculate fine dead fuel moisture from the tables in the FBA field reference. From 2200 on the 25th to 1400 on the 25th the highest moisture: 8% at 0810; lowest moisture: 2% at 1230.

General Fire Narrative Summary

At approximately 1230 on June 25, 1990, a dry lightning storm triggered a fire under the Mogollon Rim (see enclosed Tonto Forest Map) within the Payson Ranger District, Tonto National Forest, Southwestern Region. Point of ignition (POI): a steep southwest facing slope at approximately 6400 feet – near mid-slope. The Mogollon Rim crest is located 0.6 miles northeast and 1000 feet above the POI. Below the POI, the slope becomes more gradual, falling off to about 5600 feet in two miles to the south. In this area, the rim is oriented in a northwest-southeast direction. The terrain decreases in elevation in a general southwest direction from the rim edge. (The entrapment site in Walk Moore Canyon is located approximately 2.5 miles south of the fire's origin at approximately 5560 feet.)

First sighted and reported at 1315 on the 25th, when observed from the air at 1330, the Dude Fire was estimated at five acres. Flames existed around the entire perimeter. Because flames are often visible primarily on the leading edge, this serves as an indicator of severe fire behavior. The Payson District recognized the potential of the fire and immediately called three air tankers.

An hour later, torching and making short runs, the fire had grown to 50 acres. At 1500 a Type II Incident Management Team was ordered. By 1515 the fire was approximately 100 acres. At 1615 a spot fire was sighted approximately one mile east of the main fire.

After five helicopter water bucket drops and two tanker slurry drops, the spot was still not stopped.

These three air tankers as well as a helicopter and initial attack forces from the Payson District and Tonto Forest were immediately dispatched. However, first ground crews were not on the fire until approximately 1530 due to inaccessibility. Steep terrain and "rough country" required approximately two hours to reach the fire.

As a safety precaution, at 1730 the Gila County Sheriffs Department evacuated the 58-residence Bonita Creek Estates subdivision.

By 1800, in addition to initial attack resources, 18 crews (360 firefighters) had been ordered. The Type II Incident Management Team was on the fire. In the early stages of the firefighting effort until darkness, the following resources were committed: six air tankers; two helicopters; three lead planes. On top of the rim, seven engines, one dozer, and two water tenders were available. In addition, two strike teams of six engines each had been sent to the fire.

Arrival and times of crews and overhead affected suppression efforts. Many overhead positions could not be filled from within the Region. (At this same time, other fires with overhead teams were operating in North Texas, and the Guadalupe Mountains of New Mexico and Southern Arizona.) Response time of crews due to length of travel time resulted in extremely long shifts for the initial response crews.

At 2105 a Type I Incident Management Team was ordered. This team received a Line Officers briefing at 0430 on the 26th. It was determined that the Type I Team would "shadow" the Type II Team from 0600 to 1300 and actually take over the fire at 1300 on the 26th.

The Tonto (National Forest) Fire Net used by the Type II Team had heavy use, making communication difficult. The use of multiple undesignated frequencies resulted in the lack of communication between line personnel and overhead.

Rates of spread were extreme with major uphill runs. Thunderstorm winds continued to influence fire behavior. Night shift crews continued to build line on the fire's south side, but were only partially successful due to high downslope nocturnal winds causing high rates of spread in the heavy chaparral.

By 0300 (June 26), the main fire was within one-quarter mile of the Bonita Creek Estates structures. Resource engines moved into position to make a stand. A person watching the fire from the Bonita Creek Estates subdivision for one hour beginning at 0200 noted that falling embers quickly grew to spot fires. He watched the fire move in and out of the crowns. It would run for 60-90 seconds, die down for 5-10 minutes, then run again. The fire would spot, start new fires, then the main fire would catch up to these spot fires. The brisk down-canyon winds continued to push the fire to approximately 1500 acres by

0500. At this time, the winds subsided and the fire laid down – keeping it away from the Bonita Creek Estates structures.

At 0700 the fire was active, but not crowning. By 0800 it was estimated to be 1900 acres. By noon, more than 550 fire fighters were engaged in battling the Dude Fire, which had grown to 2000 acres. At this time, Type I Operations Section Chief Derrick Cooke met with Type II Team Operations Chief Butch VanTilborg to discuss transition. At approximately 1250, Operations Chief Cooke assigned Division Supervisor Jeffrey Whitney responsibility for the Bonita Creek Estates subdivision protection and Division Supervisor Bernal Gatewood responsibility for Division E (Control Road to Road 144). Division Supervisor Gatewood did not understand that he had responsibility for the segment of Division E where the Navajo Scouts 2 Crew and the Perryville Crew were working.

The strategy was to construct and hold a line down the bottom of Walk Moore Canyon.

Convective Column

By 1000 on the 26th, a convection column -- aided by thermal energy and moisture from the combustion -- formed over the fire. Fire crews around the fire noted indrafts into the column from all sectors of the fire. The column continued to grow for the next four hours. Around 1300, fire personnel reported a few light rain sprinkles (indicating the convective cell was beginning to develop some down drafts – although no significant surface winds were reported at this time). Aerial observations at this time acknowledged that the convection column had “iced out” – indicating cell maturity and the potential for imminent decay.

At this time, fire crews in and near Walk Moore Canyon noted the indraft winds had ceased. A complete absence of wind and a “frightening calm” occurred around 1400. “The [fire]line and the world became deathly quiet,” reported Flathead Hotshot Superintendent Paul Linse.

Indeed, as this thunderstorm then did begin to decay, a strong downburst occurred. The cell collapsed dramatically, producing downburst winds estimated from 40-60 mph by crews on the ground adjacent to the entrapment site. Winds that were channeled by the topography caused dramatic down and across slope fire spread. Nearly all areas of the fire experienced these gusty winds flowing out from the center of the fire area. After this initial 5-10 minute gust front, the collapsing convective cell produced winds of 20-30 mph for another 30 minutes. (A more detailed account of fire fighter actions and fire behavior during this time is provided in the “Perryville Crew and Sequence of Events Summary” in this section.)

This initial rapid fire spread entrapped eleven fire fighters. Six of these people perished. Dry fuels, complex topography, and strong winds directly contributed to the entrapment and to these fatalities.

The fire continued to actively spread for another three days. By June 14 it was finally controlled at 24,000 acres.

Fire Weather Forecasts

An updated fire weather forecast indicating building thunderstorm activity was obtained from the National Weather Service at 1100 hours on June 26. This information was not transmitted to fireline personnel. Also on the 26th, a National Weather Service Fire Weather Forecaster was requested and arrived at the Incident Base Camp at 1200 hours. Designated weather observers were not assigned.

The general weather forecast issued at midnight on the 25th, called for continued hot and dry with scattered dry thunderstorm activity the following day.

The Shift Plan Fire Behavior Forecast issued on the 26th at 2200 cautioned that: *“severe burning will continue to be present today. Heavy brush. Heavy timber stands and steep topography. Fuel moistures are very low at this time. Fire will be active all night and pick up by as early as 0900.”*

The Forecast also called for the following “safety” considerations: *“Extreme rates of spread (100 chains per hour) possible, and predicted high temperatures and dry thunderstorms. Call for maximum alertness.”*

A Health and Safety Message signed at 2100 on 6/25 forewarns of the following “Major Hazards and Risks: *Mogollon Rim Fire – all hazards associated with a rim fire. Steep slopes, erratic fire behavior, high intensity fuels, possibility of lightning . . . Be especially aware of the following: 1. Rolling rocks and other materials on the line. 2. Spotting and other extreme fire behavior. 3. Gusty shifting winds. 4. Hazardous transportation conditions.”*

A transcription error resulted in the Spot Weather Report in the day shift plan not accurately reflecting the National Weather Service spot weather forecast.

In addition, when crews received the Shift Plan at 0530, while it had weather and fire behavior information, it didn't contain information regarding resources assigned to various divisions. The map of the fire was already outdated. (It didn't show the fire near the Bonita Creek Estates subdivision, which was being threatened at that time.)

Dude Fire Personnel

Andrews, Pat. Fire Behavior Specialist, RMRS, Investigation Team
Ashby, Dale. Type II Team Group Sup, Bonita Subdivision
Bachman, Sandra. Az Dept. Correction, Perryville Crew
Bead, Paul. Type I Team Div Sup
Berkovitz, Bob. Fire Weather Meteorologist
Birgam, Bob. Gila County Sheriff's Office
Carrillo, Robert. Perryville Crew Member
Chacon, Joseph. Perryville Crew Member
Contreras, Alex. Perryville Crew Member
Cook, Dick. Type I Team Ops Chief
Davenport, William. Perryville Crew Member
Denney, James. Perryville Crew Member
Diamond Star, Engine on Control Road
Dundas, Glen. Type II Team Ops Chief (Air)
Eckstein, Dan. Type II Div Sup
Ellis, James. Perryville Crew Member
Enriquez, Norman. Perryville Crew Member
Farnsworth, Allen. Type I Team FBA Trainee
Flippen, Patrick. Perryville Crew Member
Gatewood, Varnell. Type I Team Div Sup NE of Bonita
Gil, Phill. Type II Team Div Sup
Goens, Dave. Natl. Weather Service, Investigation Team
Gleason, Paul. Zigzag Hotshot Superintendent
Guy, Derrick. Perryville Crew Member
Haines, Donald. Haines Index, Expert Witness
Hanna, John. Delivered water via ATV to Perryville
Harder, Glen. Perryville Crew Member
Hatch, Jeff. Perryville Crew Member
Heber, Az Engine on Control Road
Heger, Jim. Engine Crew, Control Road
Hill, Fred. Perryville Crew Member
Hoke, Greg. Perryville Crew Member
Hollenshead, Ed. Type II Team Incident Commander
Hunt, Scott. State Land Dept, Perryville Trainer, Type II Div Sup West Side
Jeffries, Jerry. Safety Expert Witness
LaTour, Dave. Perryville Crew Rep from Rural Metro
Leech, George. Type I Team Ops Chief (Air)
Linse, Paul. Flathead Hotshot Superintendent
Love, Donald. Perryville Crew Member
Lucero, Nando. Prescott Hotshots Superintendent
Mangan, Dick. Fire Management Specialist, Investigation Team

B. The Perryville Crew and Sequence of Events Summary

Perryville Crew Fire Assignment

When the 20-person Perryville Crew (an inmate crew from the the Perryville Arizona Correction Facility) arrived at the Payson Ranger District at approximately 1930 on June 25, it was instructed to eat and report to Base Camp. Following dinner, it was redirected to the Bonita Creek Estates subdivision on the fireline, where it arrived at approximately 0100. Shortly afterwards, the crew was again moved to the junction of Walk Moore Canyon and the Control Road. It arrived at this location at approximately 0230.

The Perryville Crew began clearing a fireline up a jeep trail inside Walk Moore Canyon. Part way up the canyon they were directed to continue the line along a power line right-of-way up to the Bonita Creek Estates subdivision. They arrived at the subdivision at 0500 and worked there until 0900-1000.

Following lunch, they were directed to improve dozer line, working back down Walk Moore Canyon toward the Control Road where they had started. (By this time, the jeep trail had been bladed by a dozer.)

At 1100 the burnout operation began. At this time, the main fire was backing slowly down the slope. Several instances of short-range spotting from the burnout occurred from 1100-1300. Because of the fire behavior, the burnout was stopped.

At 1200, after discussing the overhead transition and making assignments for his division supervisors (who were in this priority area), Type I Incident Management Team Operations Section Chief Cooke walked the fireline down Walk Moore Canyon from the Bonita Creek Estates subdivision. (He arrived at the Control Road at approximately 1415.)

The Navajo Scouts 2 Crew was working just below the Perryville Crew to reinforce the dozer line. (Actually, some crew members of these two crews had mixed together where the crews dovetailed.) The Alpine Hotshot Crew was bucking logs 50 to 100 yards up the dozer line from the Perryville Crew. The Prescott Hotshot Crew was working above the Alpine Hotshots where a piece of handline had been constructed around the "Corner House" at the Bonita Creek Estates subdivision.

At approximately 1000 hours, the Flathead, Zigzag, and Redmond hotshot hiked up the line past the Alpine Crew to prepare for the burnout operation. By 1215 the hotshot crews finished the prep work at the Corner House and were burning out this line. Four structure engines and crews were also established at this Corner House.

At 1230, Louis Sorrell, Crew Boss of the Navajo Scouts 2 Crew and Dave LaTour, Crew Representative for the Perryville Crew, exchanged fire status, weather conditions, watch-out situations, and escape routes. Sorrell says that at this time his crew still had no communications with outside forces, solely among his crew and the Perryville Crew. "I warned my crew about what a dangerous place we were in," Sorrell recalls. "Our escape route was the same way we came in [back down the dozer line]. That was the only way out. There were tons of unburned fuel. The forest was dense between the fire and us."

The Blowup

By approximately 1300, the Perryville Crew, now located approximately one-third down Walk Moore Canyon, ran out of drinking water. Crew Boss Larry Terra took crew member Fred Hill to get water at the Control Road, leaving Assistant Crew Boss Sandra Bachman in charge with Crew Representative LaTour. Terra sent the water up the line on an all-terrain vehicle and began walking back toward the crew with Hill. The crew then gathered around the water supply to refill canteens. They were approximately 3300 feet from the Control Road.

At approximately 1330, as members of Type I and Type II teams attempted to leave the Bonita Creek Estates subdivision area, they discovered that it was surrounded by fire. Two dozers were then directed to build a safety zone within the burned area. At 1345 a spot was reported below the Control Road on the west side.

At 1400, the Alpine Hotshots belt weather observations recorded 87 degrees and 21 RH.

"Once we got below the houses on the dozer line, we all felt large drops of water, thinking immediately that it was the [engine] hoses, but soon realized it was a thundercell," reported Flathead Hotshot Superintendent Paul Linse. "Being on the east side of the fire, we were now at its head and soaked in with smoke as the wind in general pushed the smoke from the rest of the fire into us. Over the radio we heard that the fire had crossed the Control Road to the west of us."

At this time, approximately 1415-1420, just minutes after the Perryville crew had resupplied with water and returned to work just off the dozer line, a member of the Navajo Scouts 2 Crew yelled "*Get out!*". The Perryville Crew was physically divided into a lower and upper group. (Upper group: Dave LaTour, Donald Love, Geoffrey Hatch, Sandra Bachman, James Denney, Curtis Springfield, James Ellis, and Alex Contreras. Lower Group: Joseph Chacon, Gregory Hoke, Derrick Guy, Norman Enriquez, Robert Carillo, Patrick Flippen, William Davenport, Tim Smith, Glen Harder, and Steven Pender.)

Navajo Scouts 2 Crew Boss Sorrell: "My lookout noticed the windshift change to the east. The fire started crowning. We yelled to everyone to start running back down the

dozer line. The smoke was so intense we could barely see 20 to 30 feet in front of us. Some made it down faster than others. Some just ditched their tools.”

Realizing the fire was blowing up, all of the Navajo Scouts 2 and Perryville crew members immediately ran down Walk Moore Canyon toward the Control Road. Some remember “explosions of fire” and say they were running under a ceiling of fire with fire whirls mixed in.

Crew Boss Sorrell: “Some Perryville Crew members ran by us. Some of them behind me were running with their chainsaws. We told them to ditch their saws and run, but they did not.

“I sort of stayed behind the Perryville Crew. Because two of my crew members panicked. They did not want to run any farther. One asked me to leave and run for my life. But I couldn't. I took her pack and we kept going. The fire was right on our tail. We could hear the roaring and the crackling, running sound. I thought about deploying my fire shelter right then because both of my crew members stopped again. Somehow, I encouraged them to keep going.

“The Perryville Crew were cut in half. Some made it out with us, others were trapped behind us.”

Some Perryville Crew members threw fusees from their packs as they ran. Carillo, running with his saw, had to stop more than once to pull up his chaps. Flippen took the saw from Carillo so he could hold up his chaps and run faster. At one time, Flippen fell and a Navajo Scouts 2 Crew member helped him back up. When Carillo stopped, a Navajo Scouts 2 Crew member told him “*Don't Stop! The flame is on you!*”

As they ran, Perryville Crew Boss Terra sustained second degree burns on the back of his neck as well as upper airway thermal damage and smoke inhalation. Terra said the winds sounded like a locomotive with 100-foot orange flames on all sides.

As Flippen ran with fire all around him, the smoke and heat impaired his breathing. He had to stop several times to catch his breath. (Flippen also watched an elk running out from the fire approximately 35 feet away from him. Perryville Crew member Smith also saw the elk.) Burning debris fell into Flippen's shirt. He tried to put it out, but Terra told him to keep running. When Flippen fell a second time, Terra helped him up. Terra had to pull the saw from Flippen's grip and he ended up carrying it out. Enriquez, Flippen, and Terra were the last ones out (from the lower group who avoided the entrapment). They jumped onto the tailgate of a truck – which was already full of people.



"A GOOD SCARE IS ALWAYS
WORTH MORE THAN A GOOD ADVICE"

Shortly after Louis Sorrell, Navajo Scouts 2 Crew Boss, had escaped the Dude Fire blow-up, he took a few moments to gather his thoughts and began drawing his impression of the experience on the back of his crew time report book. Other crew members asked if they could contribute to his work. The above illustration (a duplicated rendition) is the result of their efforts – their impression of the Dude Fire, with the accompanying quote: "A good scare is always worth more than good advice."

Entrapment and Deployment

A total of 11 Perryville Crew members were cut off when fire crossed the dozer line in front of them. After turning around and running back up the canyon, LaTour ordered deployment when the fire was about 50 to 75 feet away from them. He estimates they had one minute to deploy and get inside their shelters before the fire hit them. Before LaTour got into his shelter he did a nose count and reported the deployment on his radio. He could see crew members on the ground inside their shelters. They were pushing out the corners and tops of their shelters -- consistent with training. He also saw Denney helping Bachman deploy.

Love, Springfield and Davenport deployed just above LaTour. Hatch, Denney, Contreras, Bachman, and Ellis deployed just below him.

LaTour told them: *"We're going to make it. Stay calm."* He also encouraged them to talk to each other and to pass it on down the line.

Love likewise saw Denney helping Bachman unbuckle her shelter. He also saw Chacon deployed with most of his body inside his shelter. Love said he could feel extreme heat from inside his shelter for 10 -15 minutes. He could see flames through the pin holes.(Love had a radio, but could only receive not send transmissions.)

Hoke, located the lowest on the dozer line, was cut off while running with Contreras. He stopped. It looked to him as if Contreras ran directly into the fire, but because the fire was "playing tricks" and "was real smoky" he was not sure. He reported that although he thought about trying to continue to outrun the fire, he decided to deploy his shelter in winds strong enough to almost knock him down. Hoke discarded his pack and, because it contained fuel, moved about 10 paces from it and deployed -- approximately 200 yards below the main deployment site. He believes he was in his shelter a total of 20 minutes.

At one time Hoke heard Ellis walk down to where he was deployed and say *"I'm hurt bad. My shelter didn't work."*

Right after deploying, LaTour could hear people talking. Then the wind and flames hit and he heard people screaming and moving around.

LaTour says that when the fire hit on the downhill left side of his shelter, it tore it and lifted it and heat and debris came in. However, he managed to hold it down around him. He heard lots of "noise and screaming" during the three runs he says the fire made over them. He said he tried calling on all radio channels but failed to get an answer. At one time, he heard radio traffic indicating that help was on the way.

After Denney tried helping Bachman he went back down the dozer line. He was found lying under Chacon. (Survivors say Chacon layed over Denney, who was burned, in an effort to protect him. Both men perished.)

During the second flame front, Springfield yelled "*I can't take it anymore!*" got up, stumbled into Love's shelter and proceeded down the dozer line where he expired 150 feet below Love.

Meanwhile, back up the dozer line at approximately the same time these events were occurring (1420), Alpine Hotshot Crew Superintendent Jim Mattingly relayed the following in his 8/21/90 written narrative: ". . . (I) suddenly felt a strong gust of wind from the north or northwest. It was a sustained wind that was probably a downdraft from a thunderhead. I recall no warnings of approaching thunderstorms . . . due to the forest canopy (ponderosa pine) and the smoke from the burnout and/or main fire, we couldn't see what might have actually been above us. I observed the main fire – which had been approximately mid-slope on the ridge due north of the fireline and subdivision – instantly race for the fireline with great intensity. I yelled for everyone to come up the fireline . . . and pushed the crew up the fireline to the east and toward the subdivision."

Mattingly continues: "After seeing that everyone was moving back up in that direction, I turned around and walked west, back down the fireline to where I had last seen the Perryville Crew working. As I moved briskly to that location, I tried to contact the Perryville Crew repeatedly (7-10 times) to warn them to move if they were not currently doing so. I got no response on the radio. I arrived at the position they had been and they were gone. The fire at this point was bumping the line very hard with full runs through the canopy. . . I quickly determined and hoped that Perryville had fled to the west down the fireline. I turned back and returned to where the westernmost Alpine crew members were still located. The fire was making large, crowning runs behind us and we had to run up the fireline to escape the most intense ones."

Bob Scopa, Engine Strike Team Leader for the Bonita Creek Estates subdivision, could not talk directly on the radio with the (Type I) Operations Section Chief Cooke after the transition. Scopa heard LaTour's radio message that the Perryville Crew was deploying. At 1423 Scopa tracked down a tactical radio from the PAO at Bonita Creek Estates and forwarded the deployment message to Operations Section Chief Cooke.

Rescue

The front of Hatch's shelter was either blown or kicked off. Because he had lost part of his protection, he stood and ran up the dozer line. After 200 yards he was sighted by Zigzag Hotshot Crew Superintendent Paul Gleason and Flathead Hotshot Superintendent Paul Linse who, in view of the fire blowup, were coming down the dozer line to check on the safety of the crews. Alpine Hotshot Superintendent Mattingly followed behind them.

Hatch had no hardhat, fire shelter, or tool. Severely burned around his face and back, Hatch's backpack and hair were smoking. At this time, 1434, Gleason called for Emergency Medical (EMT) assistance (from his crew and other nearby hotshot crews) and reported to Cooke that he had found an injured firefighter.

"We now heard the fire below us and realized we needed to get the victim [Hatch] and ourselves up the dozer line," Linse recalls. Gleason said the fire was making cross-slope runs from west to east in the crowns at 80 feet per minute. It was a wind-driven fire, not an independent crown fire. It was burning in strips – not a single wall of flame. There were strong convective currents and downdrafts.

Prior to the blowup, the fire's flank was approximately parallel to Walk Moore Canyon, spreading south. When the gust front hit from the west the fire shifted and quickly reached the canyon. It apparently crossed the canyon in three strips, each from 300 to 400 feet wide.

When Engine Strike Team Leader Scopa heard of burn victim Hatch on the radio, he and four Glendale Fire Department paramedics – who had advanced medical skills and burn equipment -- relieved the hotshot paramedics (who then went to the safety zone). They placed Hatch on a backboard and began an IV. The fire continued to make runs toward them. Linse recalls: "We helped him (Hatch) walk until the litter came down and then we pushed everyone up the line to the houses and road."

This intense fire activity prevented Gleason, Linse, and Mattingly from continuing down the line in search of others.

LaTour reported that he waited about an hour, stuck his hand out of his shelter (which had partially delaminated) and realized the deployment site had cooled down. He sat up and saw Davenport and Love below him, told them "*to hang on – help is on the way*". LaTour then directed them to wrap themselves in their shelters and the three made their way down the dozer line toward the Control Road. As they proceeded, they came to Bachman, then Denney and Chacon. All three had expired. (Bachman was on her back on top of her shelter. Chacon was in his shelter on top of Denney, who had abandoned his shelter.)

The three survivors continued down the dozer line and came upon Hoke who was still inside his shelter. The four continued down the canyon and met Ellis who was headed back up. Ellis had serious burns. He had tied his shelter around his forehead. All five then proceeded on until Ellis told the others "*I'm dead*". He sat down and expired 900 feet from the Control Road. The four others continued out. They met an engine crew on the Control Road at approximately 1505.

By 1515, 200 people were in the safety zone. At 1535 a helicopter landed in a helispot that had just been constructed above the safety zone for Hatch and he was medivacked directly to a Phoenix hospital. At this time, the fire was burning houses in the Bonita

Creek Estates and making runs into the subdivision's eastern half. Mattingly could see structures burning and propane tanks exploding. (A total of 47 residences were destroyed by fire and 5 were damaged by fire. Only six homes and one small trailer were saved.)

At approximately 1540, Gleason decided it had cooled to where he could leave the safety zone and scout the area where Hatch said the others had deployed. He walked down the dozer line and found the six fatalities.

After the Blowup

After the blowup, the fire continued to spread at a fairly uniform rate for two to three hours. Convective cells were noted on satellite and radar along the Mogollon Rim during this period. Weather observations from the Payson airport at 1700 indicated thunderstorm clouds (cumulonimbus clouds) along the Mogollon Rim from the northwest through the east. The building and decaying of these cells most likely aided the continued fire spread eastward through the remainder of the afternoon.

In three hours the fire tripled in size – increasing it 5,000 acres to a total of 7,000 acres. With the exception of the 300 Road on top of the Mogollon Rim, all existing firelines were lost.

At 1552 Cooke ordered a fatality investigation team. At 1554, he recorded that there had been six fatalities and that all others were accounted for.

At 1558 the decision was made to pull back all forces from the fire's South and East flanks.

At 1900 the Night Shift Plan was essentially aborted. Only fresh crews were placed on the fire's top and west side in an attempt to protect a subdivision located on the west side.

Critical Incident Stress debriefing was made available to all crews.

Fatality Conclusions

Springfield, Hatch, Denney, Ellis and Chacon all moved around during the deployment. Hatch went up and survived. Chacon moved -- at least to help Denney. Except for Hatch,

all who moved died. Bachman and Contreras apparently did not move any distance, but were nonetheless standing during a high thermal hazard and died. LaTour, Lóve, Davenport, and Hoke all stayed in their shelters and survived.

Six of the 11 entrapped Perryville Crew members perished: Sandra Bachman, Joseph Chacon, Alex Contreras, James Denney, James Ellis, and Curtis Springfield. Of the five who survived, Geoffrey Hatch received critical burns. William Davenport, Gregory Hoke, and Donald Love also received burn injuries.

Entrapment Temperatures

(Listed in the order from where initially deployed -- from the top of dozer line down.)

Donald Love

Love deployed the farthest up the dozer line. He experienced a "normal" deployment and received minor burns. Nearby objects on the ground reached 300 degrees.

Curtis Springfield

Springfield deployed second from the top on the side of the dozer line where the main flame front hit. His shelter reached 600 degrees and delaminated with greater heat on one side. Some nearby packs on the ground reached 400 degrees, while others were not burned. Springfield shouted that he couldn't take it anymore and abandoned his shelter -- hitting and damaging Love's shelter (and perhaps others') as he went down the line. His clothing reached 500 to 600 degrees with damage to front and back. The left side was worse than the right. The four other crew members who deployed around all him survived.

William Davenport

Davenport's shelter showed 500 to 800 degree temperatures. His shelter sustained the highest temperature and damage from a burning branch which fell on it, causing high temperature and delamination.

Dave LaTour

LaTour deployed fourth from the top, below Davenport and above Hatch. Both LaTour and Davenport experienced "normal" deployments, sustaining high temperatures and burns -- but surviving. LaTour's shelter revealed temperatures up to 600 degrees. It had delamination and tears from turbulence or contact by others. Nearby objects were 300 degrees.

Geoffrey Hatch

Hatch deployed fifth from the top, below LaTour and Denney. He abandoned his shelter and went up the dozer line, receiving his most severe heat damage from radiant heat on his back and side. His shelter went to 600 degrees. His clothing went from 500 to 824 degrees. Nearby objects reached 420 degrees. Rescued 10 minutes after he had deployed, Hatch was severely burned.

James Denney

Denny deployed sixth from the top above Contreras and Bachman. He was below Hatch. He helped Bachman deploy. His shelter reached 600 degrees. The ends and one side of his shelter was intact, but the rest delaminated. He got up and went 30 yards down the line where he was found under Chacon who was apparently trying to protect him with his own shelter. Denney's clothing, the most severely damaged of the group, reached 500 to 824 degrees.

Alex Contreras

Contreras' shelter almost totally delaminated, experiencing temperatures of 600 degrees. His clothing reached 500 to 824 degrees and the most charring of the group. Nearby ground articles reached 420 degrees. Burning debris rolled against him near the roadside and burned him -- probably after he had died. It is likely he breathed in hot gasses and was unable to stay under his shelter once he deployed.

Sandra Bachman

Bachman deployed eighth from the top. Except for James Ellis, her shelter and clothing was in the best condition of the lower group. Her shelter reached 600 degrees and totally delaminated, but remained intact. Her clothing reached from 500 to 824 degrees. Nearby objects were 420 degrees. Main heat damage occurred on the high side of her body, indicating she was upright in the flame front. Her hardhat melted to the inside of her shelter. This could indicate that the wind blew the shelter up and over her hardhat, pulling the legstraps where they were found around her upper thighs; and that she fell over backwards. She was found on her back on top of her shelter.

James Ellis

Ellis deployed below Bachman. His shelter reached 600 degrees and delaminated. Burns to his right leg indicate the shelter tore on that side. He got up and walked around while it was still hot. His clothing was the least damaged and indicated he sustained most burn injuries while walking upright in the thermal hazards.

Joseph Chacon

Chacon's shelter reached 600 to 700 degrees and totally delaminated. His clothing reached 500 to 824 degrees. Heat damage indicates he was exposed during a flame front – either before he deployed or as he was moving or as he was attempting to protect James Denney.

Gregory Hoke

Hoke's shelter and clothing received very little damage. His shelter reached 500 degrees and nearby objects on the ground less than 300 degrees. Hoke experienced a "normal" deployment and was not injured.

Incident Status Summary

By June 30 the Dude Fire spread was halted at just over 28,000 acres.

The fire claimed six human lives. It also destroyed 75 structures (including the historic Zane Grey Cabin and two buildings at the Tonto Creek Fish Hatchery). A total of \$12,000,000 in losses was incurred on the Dude Fire, which cost approximately \$7,500,000 to suppress.

Losses also included: 25 elk and deer, 30 head of cattle, 14 miles of range fence destroyed, and 36,000 mbf of timber (enough lumber to build 3,300 average American homes).

Total forces/resources used to suppress the Dude Fire: 14 helicopters, 14 water tenders, 10 air tankers, 12 dozers/skidders, 61 fire crews, 2632 persons.

In addition, the fire forced the temporary evacuation of 1153 persons.

Dude Fire Findings and Causal Factors

The following bold type is taken directly from the accident investigation report (July 1990). The indented type is explanation that was added by lawyers from the point of view of defending the Dude Fire litigation. The accident investigation report was completed within 10 days of the incident. A lengthy investigation was conducted during the litigation.

The "Findings" are "facts" recorded about the incident by the investigation team without implication that they were the cause. The "Causal Factors" were determined, at the time of the original investigation, to be factors that had a role in the entrapment.

(This document does not represent any actual findings, opinions or conclusions from anyone with legal authority to make them on behalf of the United States.)

Findings

(a) Incident Management

- (1). The fire was lightning caused at approximately 1230 June 25 and it was reported at 1315.**
- (2). A Type II Incident Management Team was ordered at 1500 on June 25.**
- (3). A National Type I Incident Management Team was ordered at 2105 on June 25.**
- (4). Qualifications of the Type I and II Overhead Teams were appropriate for assigned duties.**
- (5). Tonto Fire Net used by the Type II Team had heavy use, making communication difficult.**

As explained in (6) below, Perryville was operating primarily on the state mutual aid frequency as directed by his supervisor, and was not deprived of any information which would have avoided this entrapment.

- (6). The use of multiple undesignated frequencies resulted in the lack of communication between line personnel and overhead.**

Because of all the engine resources assigned to Group F which had non-programmable radios but had the state mutual aid frequency 154.280, Ashby, Group Supervisor, advised LaTour, Crew Representative, and Scopa, Strike Team Leader, to continue to use that frequency. LaTour programmed the frequency into Ashby's King radio for that purpose and they used that frequency to communicate throughout the day. Hollenshead, the IC, approved the use of this frequency until the transition to the BIFC net could be completed. During the transition, Ashby advised Whitney that the Perryville Crew could be reached through Scopa on the mutual aid frequency. LaTour was not deprived of receipt of any information prior to the deployment as a result of this situation. The frequency was thus "designated" and did not result in any "lack of communication between line personnel and overhead" of any consequence in this case.

- (7). Shift plan safety message and fire behavior forecast accurately predicted the potential for extreme fire behavior and thunderstorm buildup.**
- (8). The Type I Team planned to "shadow" the Type II from 0600 to 1300, and take over the incident at that time.**

(9). Type I Operations Section Chief Cooke met with Type II Team Operations Chief VanTilborg at approximately 1200 to discuss transition.

This may have been closer to 1230.

(10). Operations Chief Cooke assigned Division Supervisor Whitney responsibility for Bonita Creek sub-division protection and Division Supervisor Gatewood responsibility for Division "E". (Control Road to Road 144) at approximately 1250.

Cooke told Gatewood to continue the line construction being done by the Type II Team with dozers to the Northeast. Cooke never defined the area as Division E and never as from the Control Road to 144 Road.

(11). Division Supervisor Gatewood did not understand he had responsibility for the segment of Division "E" where Navajo Crew No. 2 and Perryville crews were working.

This was a correct understanding on Gatewood's part because he was not assigned to that part of the line where Perryville was working.

(12). The strategy was to construct and hold a line down the bottom of Walk Moore Canyon.

There was already a road there so no heavy fuels had to be dealt with. There was much less brush in Walkmore compared to the ridge tops which are choked with Manzanita and scrub oak. From the dozer line the burnout would burn uphill toward the main fire with the light upslope winds. If they had tried to burnout from the subdivision down into Walkmore the burnout would have torched and made crowning runs back up into the subdivision assisted by topography, upslope winds and fuel ladders. When reassessed by Cooke a few minutes before the downburst, he concluded it would be a fairly easy burnout. But for the downburst, it probably would have been. The strategy was entirely consistent with the Firefighters Guide, 52.1-17, 52.1-18, 52.2-1, 52.2-2, 52.1-20, 52.2-5.

(13). Escape routes were discussed and understood; however, safety zones were not designated or developed prior to the entrapment.

Safety zones were designated as the burnout and the other escape route was to the the Control Road vehicles for further escape to a safe area. Every fire expert consulted, including the plaintiff's expert, agrees that it was not practical to construct a safe area closer than the burnout or the vehicles at the Control Road, which were accessible in four to six minutes from the Perryville work site. The Perryville Crew had been repeatedly told by Overhead and their own Crew Rep that their escape route was down the dozer line to the Control Road. The crew had also been told when at the burnout that it could be used as a safety zone also. The Alpine Crew above them had been told either up or down depending which way the fire went, and the crews closer to the burnout had been told before the downburst that the burnout was their safety zone. Perryville had lunch at the subdivision near the burnout and knew what was up there.

(14). The Perryville Crew posted lookouts intermittently; none were out immediately prior to the entrapment.

Perryville carried out the water cans as they went down the dozer line. They had been working above the area where the investigators found the cans. They could see the main fire from where they were working. LaTour was acting as their lookout when the blowup started. Additional crew lookouts were not indicated. Terra also sent out two 2-person scout teams about 1345. Ashby had repeatedly told them to look for spots as they were part of the holding forces acting in part as lookouts as a crew.

There are no facts that would suggest that earlier warning would have occurred from a lookout, or where such a lookout could have been posted and been more effective. The entire run occurred in the five minutes a helicopter was gone to refill its bucket.

(15). Burnout operations were conducted during the heat of the day and during predicted thunderstorm activity.

The burnout operation was contingent on weather and fire behavior continuing to permit it. Although there were thunderstorm buildups in the vicinity the burnout was not done "during" thunderstorm activity at the site of the burnout. The burnout was not being conducted at the time of the downburst and entrapment. Three Operations Section Chiefs, the District Fire Management Officer/FBA, division supervisors, the Strike Team Leader and all of the Crew Superintendents personally assessed this minutes before the downburst and saw no problem. When conditions changed even fewer minutes before (or during the initial phase of calm before) the downburst, the burnout was discontinued. Neither the thunderstorms in the vicinity nor the burnout had any impact of significance to the downburst.

(b) Personnel

(1). Six Perryville Crew members did not score 45 or above on the step test. Nine Perryville Crew members scored 45 or above on the step test. Two of the fatalities had passed the step test in 1989 or 1990.

Brian Sharkey concurs with the investigation team that this was not a causal factor in the entrapment of Perryville crewmembers.

(2). The Perryville Crew Representative was a qualified Strike Team Leader/Task Force Leader and is in training for Division Supervisor.

(3). Crew personnel and Type II Overhead were in working or duty status in excess of 30 hours prior to the entrapment.

LaTour had been called on his day off. The crew was on the line for only about 14 hours. Per Brian Sharkey, studies demonstrate that a 24 hour shift on the line is suitable as long as adequate rest follows the shift. Eyewitnesses admit they were tired but they were not exhausted. No one contends this was a causal factor.

(4). The Perryville Crew had received training in shelter deployment.

Jerry Jeffries concluded that their training met the standard of care and that their actions were consistent with their training.

(5). Eleven members of the Perryville Crew were entrapped. Six fatalities occurred: 5 males, 1 female. Of the five who survived the entrapment, one received critical burns, one serious burns, and three minor burns.

(6). Blood gas carbon monoxide levels of the fatalities ranged from less than 3% to a maximum of 28.5%.

(c) Equipment

(1). The Perryville crew was properly equipped for fire line duty with personal protective equipment.

(2). The fire shelters were produced under contract to the General Services Administration using Forest Service specifications.

(3). Personal Protective Equipment functioned within design limits.

However, the thermal hazards exceeded these design limits. For example, LaTour's shelter completely delaminated on one whole side and the wind flipped it over, leaving only the glass on one side during continued thermal hazard activity. Also, the strong, turbulent winds blew fire under and into the shelters. Shelters were damaged by falling branches and other people stumbling into them.

(4). Not all personnel had sufficient time to use Personal Protective Equipment in the recommended manner.

The eyewitness testimony is that they were all deployed on the ground before the first flame front hit. There was a lot of subsequent movement and some got up while thermal hazards were still present from the first, second or third flame front. This site was uniquely chaotic compared to previous deployment sites. Chacon's pack was at the main deployment site and he may have moved down before he covered Denny. All the deceased except Bachman and Contreras definitely moved during thermal hazards. Bachman fell over backwards but the timing of her exposure to thermal hazards remains unknown. How Contreras exposed his chest to high thermal hazards also remains a mystery. It may be more appropriate to state they "may" not have had time to complete deployment before the flame front reached them, because the physical damage is consistent with movement subsequent to deployment during thermal hazards.

(5). Equipment near the victims indicates temperatures close to the ground were within survivable limits.

This is only true as to the site of the equipment itself, not necessarily the temperature somewhere else even a short distance away given the turbulence described by witnesses, the existence of multiple flame fronts and the presence of whirling hot or burning gasses.

(6). Clothing degradation of four of the deceased indicates they were caught in a flame front prior to fully deploying fire shelters.

This physical evidence is also consistent with movement in or exposure to thermal hazards after full deployment. Springfield, Hatch, Denny, Ellis and Chacon definitely exposed themselves after deployment. The four referred to include Bachman and Contreras. Bachman's position and burn patterns are consistent with standing during any of the flame fronts. Hatch saw her exposed when he left 10 minutes after deployment after the first flame front had passed. Contreras was most charred, front and back, but found chest down. At some point his chest was exposed to high heat, but it could have been any time.

(7). Fire shelters of the deceased were opened, but were not held down in the recommended position throughout the hazardous period.

(d) Weather, June 26, 1990

(1). Record high temperatures in the mid 90's, with 10%-15% humidities, were forecast and observed in the Dude Fire area.

(2). A convective cell occurred over the fire before 1000.

(3). An updated fire weather forecast indicating building thunderstorm activity was obtained from the National Weather Service at 1100. This information was not transmitted to fireline personnel.

The forecast at 1115 said "thunderstorms appeared to be developing on radar near the fire already". Buildup was visible in the vicinity of the fire from the fire camp, from Payson and from the fireline at 1000 on June 26, 1990 and throughout the day thereafter. Farnsworth recorded this buildup as located E-SE-NW of fire, 10-20% chance of lightning. LaTour had been briefed to expect thunderstorms that day and he and most other personnel had been rained on before the downburst. Farnsworth does not regard the info he received as a significant change from the previously forecasted weather.

(4). A National Weather Service Fire Weather Forecaster was requested and arrived at the Incident Base Camp at 1200.

(5). A few sprinkles of rain occurred in the fire area around 1310-1315 Hrs.

It sprinkled on LaTour at the Perryville crew and at most of the other crews. Velasco and Cooke also saw sprinkles on their way out to the fire that day along with most other fire personnel. Sprinkles continued up to the time of the downburst.

(6). Designated weather observers were not assigned.

They cannot predict downbursts.

(7). A definite calm occurred a few minutes before the blow-up.

There had been calms several times earlier in the day. Timing was probably seconds because LaTour ran down in time to see others running out, about a 30 second run distance.

(8). The sky darkened a few minutes before the blow-up.

The witnesses describe the sky turning black as part of, and concurrent with, the approaching flame front. When Hill noticed it, he checked his watch and it was about 1415. It got dark at the Water Tender in the center of the subdivision about 1 to 2 minutes before the flame front crossed the road into the subdivision.

(9). A strong blast of wind preceded the fire front.

This resulted from the downburst.

(10). A thunderstorm gust front moved over the entrapment site at 1410-1420.

According to Goens, the original author, this describes the downburst winds from above the fire and not some other thunderstorm in the vicinity.

(11). A transcription error resulted in the Spot Weather Report in the day shift plan not accurately reflecting the National Weather Service spot weather forecast.

Forecasting of 10% chance of showers rather than 10% chance of thunderstorms did not alter any actions by Incident personnel, or mislead them, or cause the entrapment by the downburst.

(e) Fire behavior

- (1). **Torching, spotting, and short runs through the crowns occurred periodically from ignition through 1400 on June 26.**
- (2). **Fuels were dry. Moisture contents of one-quarter inch sticks (10 hour) were 4%; large dead logs (1000 hour) 8%; live fuel (manzanita, scrub oak, and silver tassel leaves) 76%.**
- (3). **The fire burned through ponderosa pine, manzanita, scrub oak, needle and leaf litter, and large dead and down fuel.**
- (4). **Heavy dead and down fuels (logs) were completely consumed by the fire because of the dry conditions, contributing to development of the convection column.**
- (5). **Short range spotting resulted from the burnout operations (1100-1315).**

Each spot fire was contained by available resources. With the possible exception of a spot to the Northeast, only one spot was outside the control lines and only by a few feet, between the control line and the road where the engines were parked east of the corner house. LaTour was aware of the spot fires. Just before the downburst, or as a part of it, a spot occurred below the Control Road at about 1410 and it was observed and assessed by Overhead, VanTilborg, Dundas, Leech, while other Overhead and crews went to assess it, including Ashby and Whitney and a Forest Service engine. The blowup occurred while Overhead and crews were responding appropriately to this spot. The burnout started before 1000.

- (6). **The weather (wind) totally dominated the fire environment at the time of the blowup.**
- (7). **The fire flashed from the west to the east side of Walk Moore canyon. This was followed immediately by the burning of the surface fuels.**
- (8). **The fire spread approximately 1.5 miles during the first one-half hour of the strong wind event. The fire crossed Walk Moore Canyon during this time.**

Video from TV 12 and witnesses show fire from Walkmore to the road into the subdivision within 2 minutes after deployment. Fire also reached the Control Road and Walkmore near the time of the deployment, a spread rate about as fast as the crewmembers could run down the dozer line, about 6.67 mph per Putnam and 7.3 mph per "Fitness and Work Capacity" by Sharkey. Spread rate from where the wall of fire was first seen to where the crew was cut off was about 9+ mph. The crown model max with sustained wind of 40 mph predicted a 75% range ROS of 2.2 to 3.7 with a max of 5.2 mph. At 60 mph it goes off the chart (above 9 mph). Control Road drivers describe spread rate as following them at a high rate of speed. Timing at the site leads to spread rates up to 12+ mph.

- (9). **The fire spread and intensity were within the range of control by handcrews from 0500 until 1400.**

This control capability continued until the downburst started.

CAUSAL FACTORS

Letter/Number designations refer to documents in the investigation file which support development of causal factors

(a). Critical weather and fire behavior conditions were predicted and observed by some, but not acted upon by Incident personnel.

The entrapment was caused by the downburst. None of the Incident personnel could have predicted that such an event would probably occur. None of the Incident personnel are aware of any policy direction or practice of removing personnel to safety zones and discontinuing work merely because conditions for a possible downburst are present. The presence of thunderstorm buildup along the Mogollon Rim is a daily occurrence during fire season. This downburst did not result from such activity. Persons who agree that the downburst was not predictable include Goens, Berkovitz, Rothermel, Hains and the Incident Management Team Members.

Reference: IM-13, IM-14, IM-15, W-1, W-2, W-3, W-5, W-6, W-7, W-8, W-11, FB-1, FB-2, FB-4, FB-5.

IM-13. According to Putnam, the dozer line was a good deployment site on bare earth. The thermal hazards were not burning of nearby fuels but a flame front or fronts of hot gasses. All incident personnel and experts, even plaintiff's expert, agree that additional safety zone construction in Walkmore was not practical. The crewmembers were able to reach their vehicles within 4 to 6 minutes of the warning and escape to a safer area or they could have deployed there. There is no policy or practice of constructing large safety zones in heavy timber within 4 to 6 minutes of all fire personnel to accommodate the possibility of a downburst such as this.

IM-14. The report concluded incorrectly (due to location of water cans and information needed from a hospitalized firefighter obtained later) that the Perryville Crew could not see the main fire, and therefore should have posted lookouts. They could and did see and evaluate the main fire, which had been backing down the ridge to the west into light upslope winds with 1 foot flame lengths and some torching on the steep slope near the top to the northwest. Fire behavior at the Perryville work site was assessed as moderate at the time by the District FMO who was also an FBA. The Ops Chief also assessed the behavior from the Perryville area and concluded the burnout would be easy in the Perryville Crew area. The Alpine Hotshot Superintendent also assessed the fire behavior from the Perryville location a few minutes before the downburst.

IM-15. The burnout during the heat of the day did not contribute significantly to the convection column buildup. It was successful up until the downburst and but for the downburst, would probably have been a successful tactic to protect the subdivision and contain the southern and southeastern flank of the fire. Although possible thunderstorms were forecast, they did not influence the burnout, did not cause the entrapment and are routine along the Rim during fire season.

W-1 and W-2. The hot, dry weather in W-1 contributed to the fire's convection column structure in W-2. Neither went unrecognized but no Incident personnel by training, experience or policy guidance would have pulled all the forces from around the fire on the mere possibility of a downburst.

W-3. The updated forecast was obtained for the purpose of preparing the night shift plan. It pointed out that thunderstorm buildup was beginning to show up on radar in the vicinity of the fire. This was consistent with previous predictions in the Day Shift Plan and with the observations of numerous Incident personnel, as it was visible from the fire camp, the base of Walkmore, and the subdivision and most people had seen thunderstorm buildups or felt rain drops or showers. The downburst was not caused by thunderstorm activity in the vicinity, but by atmospheric conditions and the cloud which developed over the convection column. Although Goens, the author here, points out that any significant change in weather forecasts should be sent by Fire Behavior to Operations, he agrees this did not contribute as a cause of the entrapment. Nor would Operations have been any better able to predict this downburst with the updated forecast. Farnsworth does not consider the information a significant change from the previous forecasted weather.

IM-7. Extreme fire behavior and thunderstorm buildup was accurately predicted in the safety message.

IM-15. The burnout did not significantly contribute to the downburst or contravene any policy.

W-2. The convection column did develop by 1000 as indicated here.

W-3. If FBA had told Ops there were thunderstorms beginning to develop on radar in the vicinity the result would not have changed.

W-5, W-7 and W-9 describe sprinkles, calm and a wind blast.

W-10. This finding describes that the thunderstorm gust front occurred at the entrapment site between 1410 and 1420. This event was the downburst from the cloud over the convection column and not from any other thundercell in the vicinity, according to the author, Goens. This is purely a fireweather event which does not implicate management of the incident unless the Incident team should have pulled all crews off the fire and into safety zones just in case a strong downburst might occur.

FB-4. Heavy fuels contributed to development of the fire's convection column.

FB-6. At the time of the downburst, wind totally dominated the fire environment.

FB-7. Walkmore Canyon was consumed in a flash fire phenomenon.

FB-8. Fire spread was 1.5 miles in the first half hour. In addition, spread rate was extreme in the first few minutes of the downburst in the area where Perryville was working. As with the weather events, this causal factor of fire behavior does not implicate management of the incident unless Incident personnel should have pulled all the crews off the fire and into safety zones just in case there was a downburst.

(c). Poor radio communications and differences in frequencies caused a break down in communications between overhead and crews; and between ground personnel and air operations.

Although communications were difficult at times, there is no evidence that the Perryville Crew was deprived of any information prior to entrapment from any source which would have affected or avoided the entrapment.

Reference: IM-5, IM-6, IM-8.

IM-5. Tonto Fire Net did have heavy use. However, no one attempted to warn Perryville on Tonto Net prior to the downburst. Perryville and Navajo were the first units to encounter the approaching flamefront and escaped or deployed in a few minutes. Perryville used the State Mutual Aid frequency 154.280 in accordance with Supervisor Ashby's instructions. The deployment report was duly received by STL Scopa who was also using that frequency as instructed. Supervisor Ashby attempted to call Perryville after he heard LaTour report the deployment on State Mutual Aid but received no response. LaTour discovered a short in his microphone during the deployment which he repaired as he left the deployment site for the Control Road.

IM-6. The State Mutual Aid frequency had been duly designated and functioned properly all day. Perryville was not deprived of any relevant information prior to deployment. Perryville also programmed in other frequencies from the Day Shift Plan of J.P. Mattingly, Alpine Crew Superintendent, before the deployment. LaTour also reprogrammed the Navajo 2 radio and Navajo 2 then had communications with Perryville as well as the Hotshot Crews such as Alpine, and weather and air attack.

IM-8. The mid-shift transition did not deprive Perryville of any information which would have avoided entrapment. Perryville was cut in half and entrapped before anyone else was aware of the flame front making a run. The Class II Group Supervisor (Ashby) heard their report and tried to return the call. The STL heard the report also and relayed it to Ops in a few seconds. The Class I Group Supervisor was appropriately getting his truck to check on the spot fire when the deployment was reported. The Division and Group Supervisors had not yet pulled any crews off the divisions when Perryville reported deployment. The Alpine Hotshot Superintendent, Strike Team Leader, Operations Section Chief and District Fire Management Officer/FBA had all been with the Perryville Crew during 5 to 20 minutes before the deployment. The deployment report was heard by a dozen other crew superintendents, strike team leaders, engine crews and overhead, none of who could have done anything to undo the deployment.

(d). Transition of the overhead teams during mid-shift resulted in an uncertainty as to Division Supervisory responsibility for the Navajo Crew No. II and Perryville crews in Walk Moore Canyon.

Group F supervisors and Operations knew where Perryville and Navajo 2 were working and how to contact them. The STL was running a hose line down to them. They were at their assigned location in their assigned sequence between Alpine Hotshots and Navajo Scouts 2. Neither crew was deprived of any relevant information which would have avoided entrapment. No actions by overhead subsequent to deployment could have altered the result.

Reference: IM-8, IM-9, IM-10, IM-11, IM-13, IM-18.

IM-8. The Type I Team did shadow the Type II Team before the transition.

IM-9. Ops Chief Cooke did discuss the transition with Ops Chief VanTilborg before the transition.

IM-10. Gatewood was actually assigned to continue the line to the Northeast, not assigned to the portion of line where Perryville was working. Shortly thereafter Cooke walked down the line past Perryville. Gatewood heard radio reports of the fire making major runs, which would have been after the deployment had occurred, before his area blew up.

IM-11. Gatewood had a correct understanding of his instructions. He could not have given any information or instructions to Perryville which would have altered the result.

IM-13. Safety zones were designated as the burnout or the vehicles at the Control Road for further escape to a safe area. Everyone agrees it was not customary or practical here to build large safety zones within 5 minutes of all line crews. All but the 11 entrapped crewmembers made it to their vehicles on the Control Road and quickly reached safe areas where deployment was not necessary. Putnam states that the dozer line was a good deployment site and, as far as sites go, the Control Road would not have been a much better site physically.

IM-18. This number does not appear in the draft so it must be a typo error. Neither of the remaining IM findings, lookouts and burnout, would have made a difference nor avoided the downburst and its effects.

(e). Eight of the eighteen "Situations that Shout Watch Out" (SSWO) were not recognized, and actions consistent with seven of the ten Standard Fire Orders (SFO) were not taken.

This list of causal factors is arguably incorrect given Causal Factors (b) (downburst from the fire's own convection column cloud) and (f) (fire spread so fast there was no time to escape). Current inability to

predict strong downbursts and the lack of policy direction even now which would avoid the consequences of a sudden downburst of this magnitude, are the causes of this entrapment. None of the actions to be taken in situations that shout watchout would have removed Perryville to another location, provided earlier warning to pull out or avoided the need to deploy. None of the standard fire orders would have done so either. Putnam describes the deployment scene as uniquely chaotic compared to prior deployments. We know the design limits of the shelters were exceeded and they came apart. We know there was considerable movement during thermal hazards as well as understandable panic. There is evidence confirming turbulence of hot gasses in multiple flamefronts with extreme winds, as well as fire blowing into properly deployed shelters. Shelters performed within design limits but nonetheless delaminated from extreme temperatures and were damaged by direct flame contact, falling branches and contact by persons moving around outside.

SSWO	SFO
NO. Reference:	NO. Reference:
3 IM-II, IM-13.	2 IM-7, IM-12, IM-15, W-3, W-5,
6 IM-8, IM-9, IM-10, IM-11, IM-13.	W-6, W-7, W-8, W-11, FB-1, FB-2, FB-4.
7 IM-6, IM-10, IM-11.	3 W-3, W-11.
8 IM-12, IM-13.	4 IM-10, IM-11.
11 IM-12, IM-13, IM-15.	5 IM-6.
12 IM-6, IM-12, IM-14.	6 IM-6, IM-11.
14 IM-7, W-1, FB-2.	7 IM-13.
16 IM-15, FB-1, W-1, FB-2, FB-5.	8 IM-14.

SSWO 3 says watchout when safety zones are not designated. Escape to the Control Road and vehicles was appropriate and additional safety zones impractical. IM-11 dealing with Gatewood's supervisory role, and IM-13 dealing with safety zones did not cause the deployment.

SSWO 6 says watchout when instructions are not clear. IM-8 dealing with shadowing did not lead to any failure between Perryville and Overhead to receive or carry out instructions. IM-9, Cooke's transition with VanTilborg, did not cause this deployment. IM-10, supervisory assignments, did not cause this deployment. IM-11, Gatewood's understanding of his assignment, did not cause this deployment. IM-13, lack of a designated safety zone, did not cause this deployment or itself result from any lack of clear understanding in assignments referenced in SSWO 6.

SSWO 7 says watchout when there is no communication link between crew members or supervisor. The communication links were present and functioned as designated and intended. No communication failure caused this deployment. IM-6, undesignated frequency use with lack of communication between line personnel and overhead, did not exist and did not cause the deployment. IM-10 and IM-11, dealing with supervisory responsibility, are inaccurate and have no causal relation to Perryville's entrapment.

SSWO 8 says watchout for line construction without a safe anchor. The burnout was anchored at the Control Road at the bottom and the burnout and road system at the subdivision, similar to all other line

construction on this fire. Any weakness in the strength of the anchor points did not result in entrapment. The downburst entrapped crews on the East and West sides of the fire, and required the North and South side crews to escape in vehicles to safety zones far from the fire. IM-12, the strategy, was sound and was the best of available line location options short of abandoning the fire altogether. The strategy did not cause the entrapment of Perryville, the fortuitous location and force of the unpredictable downburst did. IM-13, safety zones, did not cause the injuries and deaths. A safe anchor may not avoid the consequences of a downburst such as this.

SSWO 11 says watchout for unburned fuel between you and the fire. No one disregarded the presence of the fuel being burned out. Had Perryville been blacklining at this location when the fire blew up they may have had even less time to escape or deploy and a further, cross country run to reach their vehicles. The presence of this fuel did not cause the deployment. IM-12 (strategy), IM-13 (safety zones) and IM-15 (burnout) did not cause this entrapment or deployment to occur.

SSWO 12 says watchout when you cannot see the main fire or communicate with someone who can. They could see the main fire and talk to dozens of others who also could. They just couldn't predict a downburst flame front with 60 mph wind and extreme rate of spread. If anyone could have, no one would have been near the fire. IM-6, undesignated frequencies, is inaccurate and didn't cause anything. IM-12 (strategy) and IM-14 (crew lookouts) did not cause this entrapment and, because they could see the fire, did not implicate this SSWO.

SSWO 14 says watchout when the weather gets hotter and drier. Everyone recognized the temperature and humidity situation. IM-7 merely notes the fire behavior forecast was accurate. W-1 merely notes the temperature and humidity. FB-2 merely notes the fuel moistures. There was no failure to recognize this situation or to respond appropriately.

SSWO 16 says watchout when you are getting frequent spot fires across line. Until the downburst the spots in the vicinity of the subdivision were all inside the line except one a few feet outside which was easily contained with water from the engines. Everyone was aware the fire was spotting and reacted appropriately. Spot fires did not cause this entrapment. IM-15 (burnout) did not cause this entrapment. FB-1, periodic torching, spotting and short runs did not go unrecognized and did not cause this entrapment. W-1, (forecast and observed record high temperatures and low humidities) did not go unrecognized. Nor does it implicate any inaction in dealing with SSWO 16 (frequent spots across line). FB-2, dry fuels, and FB-5, short range spotting from burnout, were not ignored and did not call for discontinuance. Neither spot fires, nor response to them, caused this deployment.

SFO 2 says initiate actions based on current and expected fire behavior. IM-7 merely notes the shift plan safety message was accurate. IM-12 (strategy) was consistent with current and predicted fire behavior until the unpredicted downburst occurred. IM-15 (burnout) was consistent with current and predicted fire behavior until the downburst, and was the only effective methodology for the situation with any hope of success. W-3, telling the Ops Chief that thunderstorm buildups were starting to appear on radar in the vicinity of the fire, would not have changed the level of his knowledge nor the strategy, and did not cause the downburst winds to push a flame front over Perryville. Until the downburst, the Ops Chief correctly thought the burnout down Walkmore would be fairly easy. W-5, sprinkles of rain at 1310 to 1315, are inadequate to predict a fire convection column cloud downburst, especially with thundercells and rain showers in the vicinity. Incident overhead do not routinely pull everyone off a fire because of a few sprinkles of rain. W-6, weather observers, would not have mattered unless they were able to predict a downburst in time to pull all line personnel into safety zones far from the fire. That ability did not exist and is not what they do according to the Fireline Handbook and the witnesses. W-7 and W-8, calm and darkness, occurred just before the blast of wind. There had been previous calms. Incident personnel such as LaTour reacted appropriately to the calm by looking out and checking the fire behavior. The darkness accompanied the firestorm. W-11, 10 % chance of showers rather than 10 % chance of thunderstorms, did not mislead anyone on this fire or cause any actions or inaction leading to the entrapment. FB-1, FB-2 and FB-4, fuel conditions and

behavior prior to the downburst, did not go unnoticed and management of the fire was appropriately based upon them.

SFO 3 says recognize current weather conditions and obtain forecasts. Both were done. W-3, not telling the Ops Chief that radar showed thundercells building in the vicinity, did not affect strategy or contribute to entrapment. The only way to have avoided this entrapment would have been to predict a strong downburst from the convection column cloud over the fire itself, which the Incident personnel could not be expected to do. W-11, showers versus thunderstorms, also did not cause this entrapment.

SFO 4 says be sure instructions are given and understood. This entrapment did not result from lack of instructions. IM-10 and IM-11 dealing with supervisors did not cause entrapment because supervisors would not have pulled crews or been able to warn them.

SFO 5 says obtain current fire status. Contrary to assumption underlying report, the Perryville and Navajo crews could see the main fire and assess its status. The entrapment did not result from not knowing the status of the fire. IM-6, communications, also did not deprive them of information or status or warning.

SFO 6 says remain in communication with crew members. This was done. IM-6, communications, did not deprive anyone of information which could have avoided entrapment. IM-11, supervisory responsibility, also did not deprive Perryville of any warning or change of locale.

SFO 7 says determine escapes and safety zones. Escapes were understood and the SFO does not require construction of zones within 4 minutes of every crew. M-13, lack of designated or developed zones did not cause the deployment or the injuries and deaths.

SFO 8 says to establish lookouts in potentially hazardous situations. Lookouts were posted all along the Control Road in addition to airattack, the Rim, the Subdivision and the Ops Chiefs in the helicopter. STL Scopa had just finished scouting the fire location and behavior from the highest point in the subdivision. Division supervisors on the Rim could see the fire. Lookouts beyond the Crew Superintendents and Representatives were not always out because the crews could see the main fire and assess behavior. More crew lookouts would not have predicted this downburst caused flame front or otherwise been able to warn the crews sooner. IM-14, lookouts, is thus not a cause of this entrapment.

(f). The fire spread so fast the victims, without warning, did not have sufficient time to escape.

This is an accurate statement of fact and cause but the reason is an unpredictable downburst, not all the references listed.

Reference: IM-6, IM-12, IM-13, IM-14, FB-6, FB-7, FB-8, E-4, E-6, W-9, W-10.

IM-6, communications, did not cause the entrapment.

IM-12, strategy, did not cause the entrapment.

IM-13, lack of designated or developed safety zones, did not cause the entrapment.

IM-14, lookouts, did not cause the entrapment.

FB-6, wind dominated fire behavior, did cause the entrapment but does not implicate management of this fire.

FB-7, flash fire did cause the entrapment, but does not implicate management of this fire.

FB-8, spread rate during downburst, caused this incident but was not predictable.

E-4, flame front arrival prior to deployment. LaTour testified that he counted each crewmember as he watched them deploy into shelters. According to LaTour, they had time to get into shelters after he gave the order. According to Putnam, thermal damage is consistent with movement during thermal hazards, which means they could have all been deployed before the first flame front reached them. They could also have been injured by superheated air which may not have been visible as they deployed.

E-6, similar to E-4, that the flame front reached them prior to deployment.

W-9, wind blast, caused the entrapment but does not implicate management of this fire.

The additional factual information discovered in preparation for litigation also suggests a need to revise the "Sequence of Events" portion of the Accident Investigation Report, Part II A, at page 11.

First, the Memoranda of Interviews gave a variety of estimates concerning the time the spot fire was reported across the Control Road. While the time of the spot fire is not itself of much significance, the timing of Overhead's reactions to it is. Reconstruction of this event places it at about 1410 instead of 1345. Similarly, the Overhead who attempted to leave the subdivision found it surrounded by fire at about 1425 rather than 1330. That this discovery by Overhead was after the entrapment rather than 53 minutes before the entrapment is of obvious significance to the conclusions to be drawn from this incident, as well as to any recommendations for fire fighter safety which might result from a more accurate sequence of events.

Second, Terra left with Hill to get water at about 1345, a time omitted from the Sequence, which suggests 1300. He sent out two 2-person teams to scout the fire at 1345, a fact which is omitted from the Sequence also. More importantly, the analysis of the events just before deployment rests on the assumption that the crew was working where the water cans and tools were found. The location of the water cans led the investigators to believe Perryville could not see the main fire from where they were working, which has now been unquestionably disproved.

Third, the Sequence of Events does not state that the convection column was observed to "ice out" on top before the entrapment, but several of the underlying technical reports do. Review of Leech's Memorandum of Interview and the underlying interview notes places his observation of ice over the column after the deployment when he went back up, and prior to deployment the column was still developing vertically. Another witness observed the top of the column leaning toward the Southeast prior to the deployment. Witnesses also saw the column "ice out" the previous day, and ice is not an accurate predictor of a downburst. These kinds of details may alter the conclusions reached by the investigators concerning such issues as weather events being observed but not recognized and acted upon.

Fourth, the underlying reports rely on the main fire being located two tenths of a mile West of the ridge, when it was actually already East of the ridge top a third of the way down into Walkmore. That this was a downburst is now confirmed by a helicopter pilot and witnesses who describe the black, rolling firestorm coming out of the interior of the fire. There is evidence of horizontal roll vortex both West and Southeast of the deployment site as well as eyewitness descriptions of horizontal clockwise rotating fire tornados. If the crews had been blacklining the fire on the side of the ridge rather than burning it out from the dozer line, they would have been overrun more quickly. Sketches made by witnesses and the descriptions given, characterize the thing they saw and heard and felt as something entirely unnatural, a monster or demon of some sort. This may have contributed to the unique chaos

and panic at the deployment site once the thing arrived, and thus to the performance of the equipment, performance of the crew during deployment and the issue whether they were completely deployed or not prior to thermal hazards.

Fifth, all the Class I Overhead were not yet present at 0430 so they were briefed later. The transition was initially planned for 0600 but had to be delayed until all the Class I Overhead arrived and had time to prepare. It was then decided to shadow and transition before the next shift because the Class II had been on the line so long already.

Sixth, the report assumed that the fire was .2 miles West of the ridge top when it was actually East of the ridge top only 200 to 300 yards from the crew.