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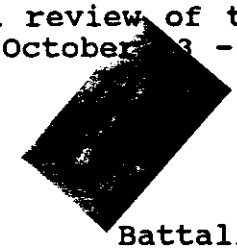
THE BODFISH FIRE BURN

OCTOBER 23, 19

A review of the burn injuries that occurred on the Bodfish Fire, October [redacted] - 24, 1993.



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THE BODFISH FIRE BURN INJURIES

OCTOBER 23, 1993

BODFISH INCIDENT SUMMARY

On October 23, 1993, at 1348 hours, personnel and equipment from the Kern County Fire Department, the U.S. Forest Service, and the Bureau of Land Management, responded to a reported watershed fire in Bodfish Canyon, off Bodfish Canyon Road. The joint response was initiated by prior arrangement of an Inter-Agency Agreement between the three agencies for watershed fire responses in the Lake Isabella area. The fire occurred on land in the jurisdiction of the State of California, so the Kern County Fire Department, operating under contract with the California Department of Forestry and Fire Protection, was the ordering point. KCFD Battalion Chief Floyd Moore was the Incident Commander.

Terrain in the area of the fire was moderately steep, with slopes in the range of 50% to 60%. The fire was burning in light fuels - mostly grass with scattered yucca, junipers, and bull pines, with some scrub oak in the drainages. The weather was typical for late October - mild temperatures (upper 70's), low relative humidities (mid 20's), and moderate winds (5-10 m.p.h.) which were heavily influenced by the local and regional topography.

The fire was initially reported as two separate fires at about an acre each, with no structures immediately threatened. The spread of the fire was moderate, backing against the wind to the East up the Bodfish Canyon drainage, and uphill to the North up the ridge separating Bodfish Canyon from the Kern River Valley. Initial attack equipment used handline construction, hose lays, and firing operations as control actions.

By 1420 hours, a request for a Type 1 engine strike team was made to provide for structure protection. The fire at this time was approximately 50 to 75 acres in size. By 1430 hours, an Air Attack Supervisor (AA-490) was on scene, followed shortly thereafter by Lead 56 and Air Tanker 19. Air Tanker 00 arrived on scene a short time later. Air operations were effective in controlling the spread of the fire to the North, and assisted in containing the fire on the East flank.

Containment of the fire was achieved at 2030 hours on October 23rd, at a final size of 150 acres. The fire was controlled at 1800 hours the next day.

During the course of investigating the cause of the fire, it was determined that the fire was deliberately set. A device that is believed to have started the fire was discovered, and arson investigators are continuing their investigation.

BURN INJURIES INCIDENT REVIEW TEAM

Following the incident, the burn injuries that had occurred represented a major concern to incident personnel, as well as local and regional fire managers. The review team established by incident and agency management was charged with determining, as precisely as possible: what happened; the specific events, circumstances, and decisions that led up to the burn injuries; the personal protection measures taken; and the lessons learned.

The intent of management, and the review team in conducting it's investigation, was not to place blame or chastise any individual or group; but to identify those positive actions, training and learning processes, and safety concerns that must be considered when facing similar conditions.

It is unfortunate whenever fire personnel suffer burn injuries. We are thankful that in this incident these injuries did not result in fatalities. Fire management personnel from the agencies involved recognize the need for a review of all critical incidents involving fire personnel. Formal review, and the documentation of those lessons learned from critical incidents, is an essential step in preventing future burn injuries and potential fire fatalities.

[NOTE: The review team would like to acknowledge the significant contributions made to this inquiry by Special Agent Dave Peeler. His expertise and creative thinking proved invaluable.]

BURN INJURIES INCIDENT DESCRIPTION

Resources that were pertinent to the burn injuries incident on this fire included the following:

Division B (KRN Patrol 72)

SQF Engine 52 (5 persons), FEO in charge.

SQF Engine 53 (5 persons), Captain in charge.

SQF Fulton Hot Shot Crew (19 persons)

At approximately 1445 hours, the assignment given by Division B to the three USFS units was to cut a handline, supported by a progressive hoselay, from the point on the main ridge where they were all located, downhill to a road at the bottom which parallelled the main ridge. This tactic was communicated to, and approved by, Operations. The distance from the main ridgetop to the road, down a small spur ridge, was later determined to be 840 feet in a southerly direction. The fire, at the time the assignment was given, was advancing moderately from the West in a sidehill fashion, and backing downhill to the South.

There was never a formal discussion over who was in charge of the hoselay operation. The Engine 52 Captain did, however, take the lead position in that operation. He advised the engine crew members, in a face-to-face meeting prior to their deployment, that their safety zone would be into the black. A progressive hoselay was started while the handcrew tooled out. The engine crews used the hoselay in a direct attack down the spur ridge.

The Fulton Hot Shots bumped down to the point to which the engine crews had extended their hoselay. At that time, the Fulton crew superintendent split his crew into two modules. One module began direct handline construction down the spur ridge. The other module was sent to a second spur ridge immediately to the West, to be held in reserve below the fire. The Fulton crew superintendent positioned himself immediately above the road at the bottom, between the two spur ridges, as a lookout for, and to supervise the handcrew operation.

The two engine crews continued the progressive hoselay down the spur ridge. Some of the hoselay was made within ten feet of the handline in the unburned grass. Line construction went rapidly for approximately the first 500 feet down the spur ridge. The hoselay progressed with, and supported, the line construction.

At about 1500 hours, the fire began to get active in the area where the crews were working. The crews were at a point slightly below the middle of the spur ridge at this time. Small, erratic runs and flareups occurred. The Fulton crew superintendent noticed a finger make a small surging run downhill about 100 feet West of the handline and then back toward the line. He advised his module leader on the ridge to expedite construction of the handline. The Engine 52 Captain also saw an increase in fire activity, and called for one of his firefighters to position himself as lookout at the top, to watch for spots over the line to the East.

The Engine 52 Captain conferred face-to-face with the Fulton module leader. They discussed their options, and decided against leaving the ridge to continue the direct line across the slope in an underslung fashion and into a small drainage to the West. They decided that the Hot Shots would take the line indirect, straight to the road at the bottom about 250 feet below, firing the line as they went. The Fulton crew superintendent came to the same tactical decision, independently and at the same time, and communicated this to his module leader. He also ordered his second module, held in reserve, to begin building line uphill from the road.

At approximately 1505 hours, the fire blew out. According to witnesses at the location, witnesses at the command post (approximately 1/2 mile away to the South), and witnesses in the air, a dust or fire whirl developed directly West of the spur ridge that the crews were on. The whirl grew in size and moved across the contour of the slope. The fire immediately began to spot and burn across the fireline amidst the Hot Shot and engine firefighters. As it moved across the South facing slope, an area ignition occurred over an area estimated to be about an acre in size, directly adjacent to, and slightly below, the crews. At this point the crews were approximately 100 - 200 feet above the road.

Witnesses stated that when the fire whirl hit, it moved uphill along the fireline on the spur ridge, built in size, and extended over the line in a northeasterly direction. Ground

reports indicated that the whirl appeared to be about 20 feet in diameter, at the largest, and about 15 feet tall. Reports from personnel in the air indicated a much larger vertical involvement. Most of the engine firefighters saw the fire coming and moved into the black, while several of the Hot Shots escaped down to the road at the bottom.

Three engine firefighters were caught in the path of the firewhirl. One of these persons was fortunately not injured. He felt the fire approaching him, and shielded his face, eyes, and airway from the swirling dust and fire, by placing his gloved hands on his face. After the whirl passed over him, he could see fire around him, with the only clear path for escape through unburned fuel downhill. He evacuated himself safely down the hill, and assisted with evacuating one of the two injured persons.

A second person, who felt the heat and saw the embers from the firewhirl, covered his face with his gloved hands and dropped to the ground to protect his airway. After the firewhirl passed, he was disoriented and was seen stumbling downhill towards the road, through the unburned and burning grass. On the way he pulled his fire shelter out of it's case, but realized it was too late to use it, then sat down in unburned fuel. His actions were consistent with a state of panic and/or shock. His supervisor, the Engine 52 Captain, assisted carrying him down to safety, along with several persons from the Hot Shot crew as directed by the module foreman. Engine firefighters and Hot Shots reported

this person to be in a diminished level of consciousness. This person suffered from first degree burns to his face and neck, second degree burns to the back of his ears and his elbows, and heat exhaustion.

The third person saw the dust devil and the body of fire approaching him, and realized he didn't have time to get away, or to deploy his shelter. He crouched down with his back to the fire, sheltering his face and airway with his ungloved hands. After the whirl passed, he felt and saw the burn injuries to his hands, and saw a clear escape route downhill, through burning and unburned grass. On the way out, he fell down hands first, further injuring his hands. By that time, the flame front had passed, and he walked down towards the road, holding his hands out in front of him. He was assisted to the road by other crew members. This third person suffered serious second and third degree burns to his hands, and first and second degree burns to his face, neck, and ears.

It is noteworthy that both of the injured persons lost their helmets at or near the time that the firewhirl hit them. It is also estimated, based on witness statements, that from the time of the development of the whirl to its impact on the crews, less than two minutes had elapsed.

After the burnover, all persons gathered on the road below the fire. The incident, and injuries, were immediately reported by the Engine 52 Captain to Operations. First aid was immediately started on the two injured persons by two members

from the Fulton crew who were trained as Emergency Medical Technicians, and equipped with a 20-person first aid kit. The Fulton crew superintendent ordered his crew to cut a break above the road to shelter the injured persons from the fire. On-scene incident management officers initiated the appropriate medical response, and notification of regional management officers.

ISSUES AND CONCLUSIONS

LCES – "INCIDENT ACTION PLAN SAFETY ANALYSIS"

Downhill line construction: When the crews were directed to begin downhill line construction, the following points influenced that decision:

- The fireline was anchored at the top by a road and was a relatively short distance (840 feet) to a road at the bottom.
- The plan was to go direct because the light fuels would give an immediate safety zone in the black.
- There were qualified personnel to make the decision.
- There were qualified observers on the ground (the Incident Commander, Operations, and the Hot Shot superintendent) and in the air (air attack and lead plane).
- The fire activity (flame production) was light to normal for that fuel type and terrain.
- There were communications between those who were on the line and those who were observing the line.
- The line was being supported by a hoselay and retardant drops.

Anchor Points: Described above.

Indirect Fireline: Fireline construction was direct until approximately 325 feet from the lower road where the fireline would have been completed and the fire contained. At this point the fire remained West of the ridgeline where the crews were constructing line. The Hot Shot crew fired the line out as it

was constructed.

The decision was made by the lead engine captain and the Hot Shot module leader, working with the engine crews, to avoid underslung line and to stay out of the draw. Fuels were light, and the fire was a backing fire. There had been no holding problems (the line behind them was safe and secure). The crews could see the road, and they had a hoselay to the point where they decided to go indirect. There was a qualified lookout on the road looking up, and a lookout stationed at the point where the line went from direct to indirect. When this change in tactic took place the Hot Shot superintendent ordered the Hot Shot module on the road to begin line construction uphill toward the hoselay, while the other module continued the downhill line construction. By going indirect, the distance was much shorter and less time would be involved.

Underslung Fireline: Was not used.

Midslope Fireline: Was not used.

Frontal Assault: Was not a factor.

Reburn Potential: Was not a factor.

Extreme Weather Conditions: When the assignment was given, the weather conditions and fire behavior were favorable for its successful completion. Conditions remained favorable through the direct line construction and up to the beginning of the indirect. Erratic fire behavior did not occur until the crews were midway

through their indirect line construction. At this time, they were hit by a fire whirl and burnover.

Communications: When the operations began, there were no identified communications problems with air or the ground. However, radio communication problems became apparent as the fire intensity increased. Operations attempted to contact both Division B and the Hot Shot superintendent without success. The pilot of the lead plane attempted to contact Division B on the tactical net and was unsuccessful. The following are among the reasons for the poor communications:

- In between the attempts by Operations to contact the line they were interrupted by more routine traffic from other personnel who were not aware of the impending problem.
- Division B expressed (to a member of the investigation team) frustration with his handheld radio and his inability to contact Operations from his position on the upper road.
- The fire moved so quickly that, by the time a warning could have been transmitted by radio, the burnover had already occurred.
- Engine Captains were not aware of communications between the Hot Shot superintendent and his module leader about the superintendent's observation of a change in fire behavior and concern with the position of his crew. The internal communications between the Hot Shot superintendent and his module leaders took place on a different tactical frequency than that used by other operational units.

STANDARD FIREFIGHTING ORDERS

The following is an analysis of the standard firefighting orders, and how those orders related to the incident on Division B of the Bodfish Fire.

1. **FIGHT FIRE AGGRESSIVELY BUT PROVIDE FOR SAFETY FIRST**

Aggressive firefighting was taking place. The crews were deployed on Division B to prevent the fire from further spreading to the East. Safety was always a consideration and this order was not violated in the opinion of the review team.

2. **INITIATE ALL ACTIONS BASED ON CURRENT AND EXPECTED FIRE BEHAVIOR**

All suppression actions employed by the crews were planned on the expected fire behavior. With the exception of the events that precipitated the burnover (two minutes), no extreme fire behavior was observed on that division. There were no changes in the predicted fire weather and none were observed until the few minutes prior to the burnover. Actions were based on the observed and predicted fire weather and fire behavior. No violation of this order is evident.

3. **RECOGNIZE CURRENT WEATHER CONDITIONS AND OBTAIN FORECAST**

The fire weather forecast predicted southeast winds at 5-10 mph and it appeared that these conditions were influencing the fire area up to the time of the burnover. The winds on Division

B were indicating a more westerly flow on the midslope of that division. There is no evidence to indicate that a spot forecast should have been requested due to the short duration of the fire, and the very localized micro-climate where the incident occurred. The burnover area involved no more than a few acres.

4. ENSURE INSTRUCTIONS ARE GIVEN AND UNDERSTOOD

Objectives were clearly stated, and the task and route were well defined and clearly visible. Safety zone and escape routes were identified and communicated to all. There was no evidence that one of the Engine Captains was formally designated as being in charge of the hoselay operation at the outset. One of the Engine Captains did assume the lead position and the operation proceeded smoothly until the firewhirl engulfed them.

5. OBTAIN CURRENT INFORMATION ON FIRE STATUS

The majority of the activity of the fire was visible to those on the line. The fire was West of the crews on Division B. They were on, and could see, the most active flank of the fire. When they began the indirect line the crews had visual observation of the fire or were in contact with someone who did.

6. REMAIN IN COMMUNICATION WITH CREW MEMBERS, YOUR SUPERVISOR, AND ADJOINING FORCES

There was no evidence of a communication problem until two minutes prior to the burnover, when Operations, the Air Attack

supervisor, and the lead plane pilot each attempted to alert Division B and/or the Hot Shot superintendent of the change in fire behavior, by radio. There was still verbal communication, which remained effective and was critical in advising the crews of the impending firewhirl, and in getting the majority of them into the black. There is evidence that the Hot Shot superintendent was using a tactical frequency to communicate with his firefighters, that was different than the frequency used to communicate with Operations, the Division Supervisor, and the engine crews. The concerns regarding the changing fire behavior, which the superintendent communicated immediately prior to the burnover to his module leader, were not overheard by the adjacent crews. This may also explain the inability of Operations to reach the superintendent by radio when she was attempting to warn him of the rapidly changing situation. The Division B Supervisor's radio was an older model, which did not have scanning ability, and may not have been functioning well. He may not have heard any of the radio traffic immediately prior to the burnover.

7. DETERMINE SAFETY ZONES AND ESCAPE ROUTES

This was done from the onset. According to those interviewed, the Hot Shots and the engine firefighters were aware of the location of their safety zones and escape routes.

8. **ESTABLISH LOOKOUTS IN POTENTIALLY HAZARDOUS SITUATIONS**

Lookouts were established from the onset of the operation. At the time of the burnover, there were lookouts above and below the burnover location. As lookout for his crew, the Hot Shot superintendent was in the process of pulling personnel down from the lower portion of the line to the road when the firewhirl hit. This was because he observed rapidly changing fire behavior, and because the backfiring was not progressing as rapidly as he had hoped.

9. **RETAIN CONTROL AT ALL TIMES**

Control was maintained prior to, during, and after the burnover. When directed to get into the black or their safety zones, those people who could or had the time to, did. After the burnover occurred, personnel immediately regrouped, evacuated the injured, and secured the area.

ALL PERSONNEL INVOLVED ARE TO BE COMMENDED FOR THEIR PERFORMANCE, AND FOR THE DISCIPLINE THAT THEY DEMONSTRATED UNDER ADVERSITY. THEIR PROMPT RECOVERY FROM THE BURNOVER RESULTED IN RAPID EVACUATION AND FIRST AID FOR THE INJURED, SECURING THE SITE, AND RETURNING TO FIRE SUPPRESSION ACTIVITIES AND THE CONTAINMENT OF THE FIRE.

10. **STAY ALERT, KEEP CALM, THINK CLEARLY AND ACT DECISIVELY**

The actions of these personnel, individually and as a group, personified this fire order.

WATCHOUT SITUATIONS

These are the "Watchout Situations" that the review team felt were applicable to the burnover incident:

9. BUILDING FIRELINE DOWNHILL WITH FIRE BELOW

- The decision to proceed with downhill line construction was made and authorized by competent firefighters.
- There was no fire directly below the starting point, and the assignment did not lie adjacent to a chimney or a chute.
- Communications were established between the top and bottom of the division.
- The fireline was anchored at the top and there was no underslung line.
- The fuels and terrain did not hinder firefighters from getting into safety zones.
- Firing was done as line was constructed.
- At the beginning of the downhill line construction there was no one at the bottom, however, this area was in full view of the Incident Commander and Operations. As they neared the bottom, a module from the Hot Shot crew went to the lower road and began constructing line uphill toward the rest of the crews. This module was in radio and voice communication with the other module of the Hot Shot crew. The short distance between the firefighters cannot be over-emphasized, as a person on the lower road would have all the line construction personnel in full view, and would be in voice contact with most of them.

11. UNBURNED FUEL BETWEEN YOU AND THE FIRE

When the decision was made to go from direct to indirect line construction, the unburned fuel bed ranged from 20 feet to 150 feet from the line to the body of the main fire. This fuel

bed was approximately an acre or so in size. Since the fuels were primarily grass, there was an unobstructed view of the total area. Prior to the burnover, the fire was backing into this area. The decision to go indirect was based on avoiding underslung line, avoiding the draw to the West, and the relative proximity of the lower road and the speed with which it could be reached.

15. **WIND INCREASES OR CHANGES DIRECTION**

Winds prior to the burnover were light from the East and with a slight westerly upslope on Division B. Prior to the burnover, dust devils were seen on the ridgetops to the West. After the burnover the winds were observed to be from the West.

COMMON DENOMINATORS OF FIRE BEHAVIOR ON TRAGEDY FIRES

The Common Denominators were reviewed and it was found that three of the five could have applied to this incident. They are:

1. **MOST INCIDENTS HAPPEN ON THE SMALLER FIRES OR ON ISOLATED PORTIONS OF LARGER FIRES.**
2. **MOST FIRES ARE INNOCENT IN APPEARANCE BEFORE THE "FLARE-UPS" OR "BLOW-UPS".**
3. **FLARE-UPS GENERALLY OCCUR IN DECEPTIVELY LIGHT FUELS.**

RECOMMENDATIONS

1. **COMMON DENOMINATORS:**

Greater emphasis should be placed on "The Common Denominators of Fire Behavior on Tragedy Fires", as an integral part of all formal and informal suppression training. The burn injuries resulting from the Bodfish Fire are a classic example of the Common Denominators. Fire suppression personnel need to be constantly aware of the Common Denominators in their extremely dangerous work environment.

2. **WILDLAND GLOVES:**

A wildland glove must be specified for use by fire suppression personnel that allows for greater digital dexterity, particularly when wet. Currently, some firefighters will remove, or not wear, their gloves while extending hoselays. Current leather gloves prove too cumbersome and/or slippery for work requiring manual dexterity, such as coupling hose and fittings. The flight glove used by Helitack crews meets the dexterity requirement, but does not meet the cost or durability needs of fire agencies.

3. **PERSONAL PROTECTIVE EQUIPMENT (PPE):**

All PPE must be properly worn or utilized in all hazardous or potentially hazardous situations. This includes Nomex, eye, ear, hand, foot, and head protection. The most severe burns sustained by one of the firefighters in this incident were

certainly preventable. If he had worn his gloves, he might not have been injured at all. Other personnel in the same immediate vicinity, who were wearing full protective clothing, were not injured.

The responsibility for utilization of PPE is both the individual's and the supervisor's. Recent California legislation has reinforced this dual responsibility. SB 198 specifically requires employers to "establish, implement, and maintain an effective injury prevention program," and further, that the employers shall ensure "that employees comply with safe and healthy practices." SB 198 provides for civil and criminal sanctions against violators. Title 8 of the California Code of Regulations specifically requires that "firefighters shall wear protective gloves whenever exposed to a hazardous environment that may cause injury to the hand or wrist."

In addition, recent experience indicates that the layering of undergarments, in conjunction with Nomex, can be an effective method of preventing thermal burns from radiant heat, or reducing the severity of those burns.

4. COMMUNICATIONS:

Frequency management by fire suppression personnel is a necessity. On multi-jurisdiction and/or mutual aid incidents, that necessity is of much greater importance. Incident overhead must ensure communications with, and between, their resources by pre-designating frequencies, and supervising their proper use.

The increased use of tactical frequencies has distinct advantages. However, as in this incident, having separate frequencies can also reduce effective communications by limiting the number of resources capable of monitoring multiple channels. While the advent of scanning radios has given fire personnel the ability to monitor more completely the activities of an incident, there are inherent risks. Increasing the number of frequencies available for use also increases the probability of important radio traffic being missed or covered when transmitting on another frequency.

Protocols should be in place to clear radio traffic during an emergency or critical situation. Something as simple as transmitting "Operations with emergency traffic" should be effective in limiting radio conversations. This again must be supported through regular training and disciplined management of incident communications.

Current efforts among fire agencies within Kern County to improve the radio communications capabilities of each agency should be continued. Upgrading to multi-channel, programmable radios that have frequency compatibility should remain a priority.

5. **TRANSPORTATION OF THE INJURED:**

The fire agencies operating within Kern County should continue working toward development of a consolidated plan for the transportation and treatment of injured incident personnel.