ACCIDENT REPORT

MOUND HOUSE FIRE #3804

Dept. of Interior
Bureau of Land Management
Carson City District

August 27,1983
Condensed 3/26/84

INVESTIGATION OBJECTIVES

At the request of the Nevada State Director, Bureau of Land Management, a team was established to identify and define those environmental and human factors that led to two, unrelated accidents on the Mound House fire, Number 3804, August 27, 1983. The first accident resulted in fatality of an engine crewman. The second accident injured two engine crewmen and severely damaged one engine. The first objective is to develop causes which resulted in the accidents. The second objective is to develop recommendations which will prevent similar accidents from occurring again. It is not the intent or charter of this investigation to fix responsibility.

Team Composition

The Bureau-established team was composed as follows. Since the Nevada Division of Forestry will use this same investigation report, they also participated unreservedly in its development.

Elliot, James	Assistant District Manager, Carson City, BLM
Kastelic, Joseph	Special Assistant to the BLM Director, BIFC (Chairperson)
Nase, Richard	Fire Information Systems Specialist, BLM-BIFC
Palmer, Stan	Safety Manager, BLM-BIFC
Range, Phil	Acting Chief, Branch of Protection, NSO, BLM
Ross, John	Northern Area Forester, Nevada Division of Forestry

The Office of Aircraft Services (OAS) conducted a separate investigation of the accident involving the engine crewmen injury since an aerial retardant tanker (aircraft) was involved. The investigator-in-charge was Mr. Michael A. Martin. Particulars from this investigation can be obtained by contacting the Director of OAS, located at the Boise Interagency Fire Center.

Since a fatality occurred in one of the accidents (Keith Lemmons), a separate investigation of fire cause which may result in legal action was conducted by the State Fire Marshal's Office in Nevada. The primary contact for particulars follows:

Jack H. Davis
Deputy State Fire Marshal
Capitol Complex
Carson City, Nevada 89710
702-885-4290

The investigating officer is employed by the Department of the /Sheriff-Coroner. He may be located as follows:

Joe Curtis
Detective Sergeant
901 East Musser Street
Carson city, Nevada 89701
702-887-2233 or 702-887-2500

FIRE SITUATION

Mound House Fire
Number 3804
Carson City District
Nevada
1983

The Mound House Fire was discovered at 1250 hours on August 27, 1983 (Saturday). It was controlled on August 29, Monday, at 2358 acres. Most acreage loss occurred on Saturday within a six hour interval. The fire area contained lands that are administered by the city, county, state, federal, and private sectors. All were represented in the suppression action. There was an urgency on this fire since it was adjacent to Carson City proper and adjacent to private structures along Highway 50.

Multi-agency jurisdictions existed within and adjacent to the fire's perimeter. Numerous cooperative agreements between involved agencies defined responsibilities. Due to the private holdings, numerous volunteer fire departments and private citizens became involved. The major fire suppression agencies were Bureau of Land Management, Nevada Division of Forestry, and Carson City.

FIRE COMMAND STRUCTURE

The majority of interviews conducted, addressed organization and management as a serious problem in this fire. It is the team's opinion that this area, coupled with inadequate communications, contributed significantly to both accidents. In this regard, it was felt a summary of this subject was necessary in the fact finding process. The following summation is not offered as critical appraisal but a positive identification of problem from which to develop an interagency solution. Further, the summation is a team understanding of events and relationships.

To put the incidents which occurred on this fire into their proper perspective it is necessary to examine the command structure. When the fire was first discovered and reported, it was located at the base of a hill within the city limits of Carson City, Nevada. As such, it was the responsibility of the Carson City fire Department (CCFD). The Chief of the Carson City Fire Department, Bernard Sease, was the first unit to arrive on the scene. He reports that the fire was less than ¼ acre in size and at that time, it was his opinion that control would be no problem.

Shortly after he began suppression operations with three engines, Alan Kightlinger of the Nevada Division of Forestry (NDF) arrived on the scene. Since Carson City FD has an agreement with NDF to fight wildland fires on private land within the city, they established co-command. Carson City units would primarily protect any threat to structures and NDF would attack the wildland portion of the fire.

While these plans were being discussed, the fire made a run up the hill, rapidly increasing in size and approaching public lands in the higher ground. Neither the CCFD nor the NDF considered using retardant aircraft on the fire at this time. Both operate on restricted firefighting budgets. Since this had been a very active fire season for both agencies, they had budgetary constraints and felt they could not finance these very expensive firefighting tools. At this point in time, Frances Hull of the Bureau of Land Management (BLM) arrived on the scene. Since the fire was now threatening (if not already on) BLM lands, she authorized the use of the retardant aircraft and explained that the BLM would pay for their services. Now the command structure on the fire undergoes a subtle change. The Chief of the CCFD believes that the NDF representative is now the Fire Boss. The NDF representative believes that he is a member of a three-person joint command organization. The BLM person believes that she is an agency liaison coordinating BLM units and efforts on this fire.

Another subtle influence at this point in time is the presence at the "Command Post" of the head of the NDF, Mr. Lowell V. Smith, the State Forester for the State of Nevada. Since the State Forester is the ranking officer of the NDF, Mr. Kightlinger (the nominal Fire Boss) is uncertain whether he will be replaced by Mr. Smith or if Mr. Smith is merely observing operations. None of the three principal agency representatives has clarified their perception of their role on this fire with others, nor is the role of Mr. Smith explained or discussed.

While uncertainty exists at the Command Post, the retardant aircraft arrived over the fire under the direction of a lead plane flown by Mr. Charles V. Destree, Chief Pilot for the Nevada Division of Forestry. Since the aircraft were dispatched and will be paid for by the BLM, he contacts Mrs. Hull on the BLM radio frequency for instructions on where to drop the retardant. None of the other agencies on the fire are able to monitor these transmissions since all three agencies operate on separate radio frequencies. Kightlinger and Sease plan to utilize an existing road on the northeast side of the fire as the basis for a backfire operation. They believe that the aerial retardant drop along this road will strengthen this section of the planned control line and ensure the control of the fire at this point. Mrs. Hull, after discussions with the lead plane and other BLM units on the northwest side of the fire, directs the aircraft to drop on the west flank of the fire because there are no firefighting units on this side of the fire.

The fire subsequently jumps the planned control line and under a fresh wind burns due east at a rapid of speed toward the residential and industrial area known locally as Mound House. At this point another experienced NDF Patrolman, Mr. Mike Rector, arrived on the fire scene. He is assigned as Line Boss by Mr. Kightlinger and together with Mr. Smith, Mr. Rector drove to Mound House to assess the danger from the approaching fire.

For the first three hours of the fire, units of the various agencies previously discussed, as well as firefighting equipment and personnel from as many as seven different volunteer fire departments, arrived on the scene and began to do whatever firefighting they thought needed to be done. Coordination efforts which were poor in the beginning, given the lack of clearly defined roles and responsibilities, now were completely uncontrolled, as the fire contained some eleven different radio nets none of which could communicate with the units of all the other agencies. While each individual unit may be performing well, in composite, effective controlled and coordinated activity was not occurring. Consequently, units of different agencies working alongside each other in the heat and smoke were often working at cross purposes without clearly defined goals and consolidated objectives, and unable to talk with each other. This situation continued until the discovery of the burn victim.

Until this point in time the three principal agency representatives had maintained their position at the Command Post in the park which was now located on the western most flank of the fire. The main head of the fire had raced to the east and from their vantage point they could no longer see what was happening. As soon as it became apparent that someone had been hurt on the fire line, the BLM representative left the Command Post to find out what was occurring. After she left, Chief Sease also departed toward the Mound House area. Now the joint command structure lost its visible existence. No planned organization had been set up. No air attack boss has been assigned. No effort to gain control of the different radio networks in one communication center had been attempted. Clearly defined work assignments and areas of responsibilities had not been identified to all personnel.

This summation of events suggests development of interagency systems (organization and communication) to mitigate impacts as discussed above. Preplanned command teams, scene-of-action radio systems, preplanned automatic dispatch, single dispatch control over fire, etc. are some options.

RECONSTRUCTED FIRE BEHAVIOR

Fire behavior is directly dependent on how fire, topographic features, fuel conditions, and weather elements interreact with each other at any given time. Topographic features were determined following the fire fuel conditions were estimated by comparing adjoining unburned areas with similar or adjacent areas and remnant plants. Good on-site weather data is more difficult to acquire because it requires specific measurements or calibrated visual estimates. Unfortunately, no on-site weather data was taken.

1. Topography

   As seen on the attached map, the fire burned across a southeast facing slope. The cross slopes varied from 5 to 10%. In the direction that the fire burned, little slope variation existed. The two exceptions are the point of ignition (approximately 44%) and one small ridge about midway through burned area. This ridge is of sufficient height to obscure the fire activity coming from the southwest. Where the fire terminated its run, the land was basically flat. Both accidents occurred on flat topography.

   The fire burned between the 4,800-5,600 foot elevation contours. The approximate centerline of the fire is the 5,000 foot elevation. The top of the mountain is over 7,000 ft. elevation. The fire burned on the lower half. No significant drainages bisected the burn area.

2. Fuel Conditions

The attached map shows the approximate vegetational boundaries. The lower half of the burn was composed of the cured cheatgrass. It was very dense, one foot high, and continuous. Sagebrush (less than 24 inches high) was scattered throughout the entire burn area, but not of sufficient density to influence the fire behavior. At the higher elevation, pinyon and juniper trees, less than 20 feet tall, dominated. At the fatality site, scattered pinyon and juniper trees were also present. There were 8-15 feet tall. Where the retardant accident occurred, fuels were cheatgrass with scattered sagebrush. The heavy stand of cheatgrass carried the fire across the lower slopes. Utilizing the Fuel Moisture Table from, Advance Fire Behavior, it is estimated that the cheatgrass had a moisture content of 2%.

3. Weather

Factual information regarding temperature, relative humidity, and wind speed from the site does not exist. The nearest recording anemometer (wind speed) was located at the airport, about ½ mile from the ignition point. Unfortunately, their equipment had a malfunction and the tape is of negligible value.

Only two sources of weather data in Carson City could be found. The following data was acquired from the State Environmental Protection Agency for August 27. The recording equipment is located downtown Carson City at the elevation of about 4,600 feet. Due to the location, it is felt that the wind speed and direction vary slightly from that which occurred at the fire.

Time	Wind Direction	Wind* Speed	Temperature
1200	254	4	85
1300	320	5	87
1400	279	8	92
1500	254	12	92
1600	284	15	90
1700	301	18	84
1800	298	14	82
1900	288	12	75

*Wind Speed is an hourly average. Gusts were not recorded. However, statements by firefighters indicated the winds were gusting.

Another source of weather data was the National Weather Service located at the Cannon International Airport in Reno, Nevada. This is 20 miles north of the burn site. The following information was taken from their Surface Weather Observations Report.

Time	Temperature	RH	Wind Direction	Wind Speed	Wind Gusts
1200	86	15	280	13	--
1300	88	12	210	13	--
1400	88	8	240	20	28
1500	87	8	220	20	28
1600	87	9	240	15	22
1700	84	10	230	15	--
1800	81	16	250	10	--
1900	73	25	210	5	--
2000	72	27	280	11	--

Two Fire Weather Forecasts (0900 and 1430) are attached. The 0900 forecast indicates surface winds of 5-15 mph and the 1430 forecast 20-30 mph winds.

The wind direction and wind speed are very close to that, as experienced at the site. Winds were from the southwest at about 15-20 mph and gusting to higher speeds. The temperature was about 90 degrees and relative humidity at 8-10%. Sky was clear.

During interviews, it was established that the winds at the fatality site were blowing to the south, thus all smoke and fire action was moving southerly. Very shortly after that, it changed to a northeast direction.

4. <u>Fire Behavior</u>

Enclosed are a map and a fire chronology as extracted from tapes and personal observations.

The rate of spread varied during the approximated 6-hour fire duration. The map shows points where the leading edge of the fire could be matched with known times. The rates o spread varied from 14 ft/min to 207 ft/min. At the start, slope contributed to a higher rate of spread. This was only for the first few minutes. For approximately the next 1 ½ hours, winds were light and no significant rates of spread occurred. At 1430, the wind increased considerably. It is estimated the rate of spread increased from 14 ft/min to 207 ft/min and slowed down (73 ft/min) somewhat after that. At the time of fatality, we estimate rate of spread at 150 ft/min.

Flame lengths were observed by only a few people. They varied considerably throughout fire, primarily due to the rates of spread. Most observations were 4-8 feet at the start. They increased considerably after that when the fire reached Lineham Road, just a short distance (1/4 mile) from the fatality site. Flames were observed laying completely across the road (estimated at 25-30 feet).

Fire Behavior Chronology Mound House

August 27, 1983, adjacent to Carson City, Nevada

1254 PST	Fire Reported to the Carson City Fire Department. Brushfire located east of airport.
1259	Fire starting to move uphill.
1301	Going over the ridge.
1305	Fire about 10 acres.
1309	50 acres.
1325	North edge of fire about 200 yards from the pipeline road.
1336	South edge crossing the drainage.
1443	Fire reached the pipeline road on the south edge. Wind increased considerably about 1430.
1511	Fire reached Highway 50.
1530	The fatality occurred.
1545	Fire was burning past houses in Mound House.
1658	Fire had jumped the road and was burning west.
1715	Retardant/vehicle accident occurred.
	After this the fire continued to burn intermittently in the P/J area near the north-center of the burn. Mop-up action continued for a couple more days.

Visibility was very poor. The following two photos show the conditions as seen at the time. Because of the 20-28 miles/hour winds, smoke, ash, and dust stayed very low to the ground. Visibility at the time of the fatality was 100 feet or less.

Spotting was not observed by anyone that been interviewed. It was thought that because of poor visibility and the fact that airborne materials stayed very low to the ground, it was just not observed.

Observations made following the burn showed many interesting phenomena. Pinyon tree burned in different degrees. Many trees were observed where on the lower branches and the down wind side burned was burned. Branches on many trees had all curled in the direction the fire was moving. Structure that would have normally burned did not because the fire moved through too fast, according to observers. Granite rock was cracked and shattered. Surface ash color was black and grey. Because of the high winds following the fire, the grey disappeared quickly. With exception of the pinyon/juniper trees, all grass and sagebrush plants were totally consumed to the ground surface.

Fire behavior calculations utilizing a Texas Instrument T1-59 Calculator were made to estimate the rates-of-spread and flame lengths based on acquired weather data (attached). The results showed rates-of-spread ranging from approximately 50-670 ft/min and flames length of 4-13 ft. These figures are probably not unrealistic. A rate-of-spread of 162 ft/min closely approximates that of 185 ft/min seen at the start of the fire. The calculations made utilizing data from Carson City closely approximates the rates-of-spread and flame lengths observed on the fire.

The value in making this T1-59 calculation is to obtain the Heat Per Unit Area (BTU 2 /FT). This value plus the rate of spread allows plotting the Fire Behavior on a Fire Characteristic Chart. A Fire Suppression Interpretation Chart is attached on order to relate flame length values to fire suppression capabilities.

FIRE SUPPRESSIONS INTERPRETATIONS

OF FLAME LENGTH AND FIRELINE INTENSITY

Flame Length (feet)	Fireline intensity (Btu/ft/sec)	Interpretation
< 4	< 100	Fires can generally be attacked at the head or flanks by persons using hand tools. Handline should hold the fire.
4 – 8	100 – 500	Fires are too intense for direct attack on the head by persons using hand tools. Handline cannot be relied on to hold fire. Equipment such as dozers, pumpers, and Retardant aircraft can be effective.
8 – 11	500 – 1000	Fires may present serious control problems--torching out, crowning, and spotting. Control efforts at the fire head will probably be Ineffective.
> 11	> 1000	Crowning, spotting, and major fire runs are probable. Control efforts at head of fire are ineffective.

DRAGON WAGON FATALITY EVENTS

Following is a synopsis of events leading to the death of Keith Lemmons, a Dragon Wagon Attack Unit crew member. The accident occurred on Saturday, August 27, 1983, approximately 1530 hours.

An attack unit (Dragon Wagon and Chase Truck) located at a removed District area was ordered to return to Carson by Fire Dispatch. The unit was comprised of the following:

1 Engine -- Dragon Wagon (DW)
1 Chase Truck (CT) -- Pickup
1 Dragon Wagon Operator – Kevin Howell
1 Crew Boss Attack Unit Supervisor – Ron Barrett
1 Chase Truck Operator – Corey Doolin
1 Crewman – Keith Lemmons

While returning to Carson, the attack unit saw wildfire approaching structures near a residence/business location along highway 50 (commonly called Mound House). Crew Boss individually decided to attack the fire at this location (a normal district attack strategy). Through the District helicopter located in the area, the Crew Boss requested backup engine support and a retardant drop at his proposed point of attack. Neither arrived, due to other fire priority needs. These actions occurred around 1504 hours, as substantiated by radio log which placed the DW (#90) in Mound House at that time.

The helicopter then, by the request of the Crew Boss, vectored the unit to an attack point. This point was a narrow gravel road generally running S to N. Fire was located on a ridge westerly of the road position. It was moving in a NE direction, generally parallel to the road. Strategy was to use a flanking action by backfiring from the gravel road toward the main fire on the ridge. The anchor point was a dry wash which had cut out the road. It is approximately 2,350' from the anchor point to pavement on Lineham Road. This stretch of gravel road is the location of all actions resulting in fatality. Of significance, it is estimated that time interval from trucks leaving pavement to anchor point and return to pavement due to extreme fire behavior was 15 minutes. A radio log entry at 1529 hours "someone in trouble" (90). This establishes an outside time window of 30 minutes, sometime during which the attack was involved. See Schematic 1 for reference.

This synopsis begins near the attack anchor point (A on Schematic). The CT was located behind the DW, both facing toward pavement 2,350' away (C). The Crew Boss briefed crew as to attack strategy. The two operators will drive their respective vehicles. The Crew Boss will be located to the right front of the DW while firing with fussees. The crewman will be located to right ear of DW while firing fussees. Fussees were located along the road with igniter caps removed. The Crew Boss, with a lit fussee, moved to position. At this point, the DW water system wouldn't prime. The Crew Boss worked on the system and solved the problem. In the process, his fussee became extinguished. The Crew Boss walked back to the CT to get a light from the Crewman's fussee.

At this point, the strong wind, estimated at 28 mph, changed so the fire was now moving directly toward the gravel road with associated dust and smoke. The Crew Boss moved forward along the left side of the Dragon Wagon toward his planned backfire position. The CT Operator was watching the Crew Boss for any direction to begin action. The crewman was in the rear area of the CT. The CT Operator perceived that the Crew Boss waved him forward to pass the DW and executed the move, accelerating down the gravel road toward pavement. When he cleared the immediate smoke and fire area (approximately 1,100 to 1,300 feet) he pulled over and stopped, awaiting the DW. During the move, the CT was visible to the DW operator less than 100'. Tool boxes mounted in the CT had obscured the DW Operator's vision as to driver or passenger occupancy. The DW Operator had no way of knowing that the Crewman was not in the CT nor reason why the Crew Boss had changed the attack plan (the normal CT following the DW during burn out).

In fact, the Crew Boss had not waved the CT to pass the DW. Further, he did not see the pass since he was on the downwind off-side of the Dragon Wagon. He did not hear the CT, since the DW engine and pump package engine were running. As the Crew Boss moved toward his originally planned firing position, he believed the CT was still behind the DW. However, unknown to the Crew Boss, the Crewman was behind the DW without vehicle support. Since fire had not yet closed on the other anchor point, the Crewman followed the original burn out plan, moving with the DW and Crew Boss as they backfired down the road.

The Crew Boss shouted "let's go" and began firing at a trot pace. After 300' (Point D), he could see the situation was becoming hazardous, due to smoke, dust, wind, and heat. He stopped, looked back and forward, seeing no one, got on side of the DW and moved out of the area. He expected the CT support vehicle and the Crewman to execute the same action when confronted with this type fire behavior (normal operating procedure for the Dragon Wagon Attack Unit). The DW proceeded to Lineham Road (pavement) where it stopped to roll up a hose it was dragging. Enroute to Lineham Road, the DW had passed the CT which had pulled over and stopped on the gravel road. However, neither the DW Operator nor the Crew Boss riding on the side of DW saw the CT on the pass. The chase truck location is substantiated by the CT Operator who said the DW passed with hoses dragging. If the CT had reached pavement first, the CT Operator would have no knowledge concerning the hoses.

When the DW stopped at Lineham Road to roll up the hose, the Crew Boss looked back up the gravel road. He saw the CT approaching and noted one occupant. At this time, he knew one of the crew was missing.

During this whole activity, the Crew Boss thought the chase truck has always been behind the Dragon Wagon. It was not until Monday, after discussion with other crew members, that he discovered the leap frog movements of the two trucks.

It is assumed that the Crewman did not realize any immediate problem during the first half of firing action since the area was a pocket of unburned vegetation adjacent to the road. Unknown to the Crewman, the fire had crossed the gravel road between himself and the pavement. It is assumed there was a period of false security as he moved down the gravel toward Lineham Road.

Once the Crew Boss noted that the Crewman was missing, he immediately ordered the District Helicopter for search and rescue. Once at the scene, it took the helicopter 15 to 20 minutes before the Crewman was located, despite the short distance (2,350') and the Crewman's road location. This is substantiated by interview statements. The significance of this fact is obscured visibility due to smoke.

This accident occurred as a result of misinterpretation of perceived actions and unperceived actions. All crew members were following the original plan and direction as understood in their minds. All actions perceived by each crew member were logical and/or according to the plan. The team finds no negligence on the part of the crew or any individual member.

Reconstructed Fatality Scene

Description

The fire made a very strong run between 151 and 1545 through a continuous layer of cured cheatgrass, mature sagebrush (20-28 in. high) with scarred P/J. In several locations the fuel presented a definite ladder arrangement.

At 1530 the returning helicopter (04) with two passengers aboard landed on Highway 50 and received a description of the past 30 minutes from the crew bosses, relative to the missing crewman. They began searching the area as the thick smoke, heat and winds would allow.

At 1600 the helicopter crew found the missing crew member and landed. He was lying in the dirt roadway at Point G of the Schematic One: Area of Fatality (enclosed). The helicopter crew indicated that the Crewman was semi-unconscious with second and third degree burns over 75% of his body. He was lying on the roadbed on his right side, with his head toward the south, southeast or down the road facing east. It appeared he had put his backside toward the oncoming fire. The yellow Nomex fire shirt, along with the red crew t-shirt, were partially (est. 60%) burned off. His 12" boots were both on his feet but one was open as though it had no laces. The leg portion of his Levi jeans were burned off, leaving the appearance of wearing Levi cut-offs. The aluminum helmet he was wearing was approximately 10-14 feet up the road, on its top with the liner smoldering at Point F. Helicopter (04) lifted up to summon medical assistance, request an ambulance along with Care Flight (a helicopter medivac). One helicopter crewman remained at the scene to comfort the victim and administer first aid. The helicopter returned very shortly with Deputy Sheriff Rod Countryman with a trauma kit and unloaded. It then lifted to pick up a second medical assistant with a burn trauma kit and oxygen, returned and unloaded. It lifted the third time to direct Care Flight to the site. Care Flight-Reno arrived at 1619. Care Flight-Reno departed at 1632.

The day pack used by the Crewman was found in a box in the bed of the chase truck. Upon inspection, one fire shelter was found near the day pack, not inside, but appearing to be put on separately when carried. The investigation team strongly believes this tragedy would have been prevented if this one firefighter would have recognized the need for the fire shelter, been carrying it, and used it properly in time.

Analysis

Based on the findings of this investigation, the following analysis reconstructs the events which possibly contributed to this tragedy. The crew entered an area which provided a favorable opportunity to control this fire's section the NE wind remained constant. They entered this area under the directions of the helicopter foreman. A burnout plan was developed and the crew quickly briefed. The Twister Dragon Wagon (TDW) No. 90 and Chase Truck No. 91 were repositioned to execute the plan, but due to a misinterpretation of signals, the Chase Truck No. 91 moved in front of the TWD No. 90. This action left one crew member behind the TWD Unit No. 90 to burnout without a supportive chase truck. The previous section discusses the action.

The fatality Crewman was well trained through S-390, Fire Behavior, with a special fire survival course. He was very familiar with suppression techniques and burning-out. He had worked as a hotshot firefighter and at helitack. Most recently, he was on the Silver State Hand Crew from the Carson City District. He had been on approximately six fires in the same fuel type as the Mound House Fire.

When the Crewman had progressed from the anchor point, Point “A”, to approximately Point “E”, he sensed danger. Until this point he was doing as instructed—burning out following the TWD unit No. 90. In the area if Points “D” and “E” he realized he was in danger and increased his pace to a trot. Shortly, his pace increased to a run, following his only recognized escape route, the dirt access road which he used to enter the area. The flame, smoke, and heat he experienced while attempting to reach a safe zone was tremendous.

This extreme fire behavior was due to the availability of fine and heavy fuels adjacent to the road. This area is identified as Extreme Fire Behavior Area on Schematic One. The photos present the erratic fire behavior that must have been occurring. Observing the area, it definitely had experienced abnormal fire behavior. We visualize this abnormal fire behavior caused the Crewman to fall just prior Point “F”. His helmet and comb were found at Point “F”, which indicates he had possibly stumbled previously. Just prior to his fatal fall, he released the fussee he had been using in the burn-out operation. In falling to the roadway partially covered with fine fuels, he hit his jaw hard enough to break it. At Point “G” he was knocked unconscious or semi-unconscious, unable to extinguish his clothing, which logically would be burning. The available fuel allowed the protective clothing, yellow Nomex shirt and Levi jeans, to continue smoldering.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

EVALUATION WORKSHEET

Date	Page	Office Evaluated	Type of Evaluation	By (office)
9/9/83	1	Carson City District Nevada	Accident Investigation Mound House Fire #3804, 8-27-83	BLM Interdisciplinary Team (Included Nevada Division of Forestry)

Worksheet Subject Fire organization and Management

Findings

The fire involved multi-land administrators and consequently multi-fire suppression agencies. During initial attack, a command structure and fire organization were formed. As the fire grew beyond initial attack, the structure/organization did not expand in size or complexity to manage the growing attack problem. Individual units of command and attack were performing without coordination on line direction. Although individually performing, in composite, attack and safety were seriously compromised. Examples include attack units working without command knowledge, line control, or communication; individual agencies working without command coordination, and existing command structure operating without defined roles, coordinated attack plans, or communication. In respect to BLM, no qualified ranking line officer was available at the District Headquarters ort fire command until late in the fire's life.

Recommendations

1. Establish a multi-agency command structure, individual employee command assignments, and organizational structure pre-fire occurrence to manage the multi agency project fire. Consider immediate implementation of the Incident Command System. Reflect these terms/decisions in the cooperative agreements which guide the interagency relationships. Due to the extreme rates of speed, these terms/decisions are not possible once the fire begins.

2. Conduct joint training sessions to develop a strong working relationship between agencies and cross-train in respect to each agency's operational procedures/fireline positions.

3. BLM State Office develop a procedure whereby it evaluates on-fire performance and insures post fire reviews. The compliance procedure must provide a vehicle for corrective action (authority, etc.).

4. Procedures should be strengthened to assure that qualified command fire management personnel are available in close proximity to district headquarters. The District Fire Management Officer and Assistant FMO are the key personnel and one or the other should be readily available during the fire seasons.

5. Develop a system to insure filling fire position with qualified personnel.

Final Reviewing Officer: State Director, Nevada Dated: 10/13/83

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

EVALUATION WORKSHEET

Date	Page	Office Evaluated	Type of Evaluation	By (office)
9/9/83	2	Carson City District Nevada	Accident Investigation Mound House Fire #3804, 8-27-83	BLM Interdisciplinary Team (Included Nevada Division of Forestry)

Worksheet Subject Communications

Findings

There were approximately eleven different fire departments operating on the fire. There were no common frequencies or cross communication links between agencies. BLM had only one frequency with repeat capability. Volume of BLM traffic alone precluded coordination between its attack units. Three dispatch points were receiving fire traffic (command center, BLM yard, and joint BLM/NDF dispatch at Washoe). Considering the number if agencies involved, there probably were more than three points. In either case, no single location was receiving all fire information. Considering these deficiencies, coordination and direction of the fire activity was not possible even 'if' an effective command and line team was in place. Line control was not possible due to inadequate communication. Consequently operations and safety were completely compromised.

Recommendations

1. Develop scene-of-action radio kits and repeater which provide common communication frequencies to all involved agencies.

2. Develop the on-fire communication system whereby all on-fire traffic is received at and controlled by the fire's command center. Subsequent traffic to parent agency headquarters/disputes will be done by the fire command center.

(Guidance is available by agencies using the Incident Command System.)

Final Reviewing Officer: State Director, Nevada Dated: 10/13/8

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EVALUATION WORKSHEET

Date	Page	Office Evaluated	Type of Evaluation	By (office)
9/9/83	3	Carson City District Nevada	Accident Investigation Mound House Fire #3804, 8-27-83	BLM Interdisciplinary Team (Included Nevada Division of Forestry)

Worksheet Subject Fatality and Serious Injury Procedures

Findings

There is no single information source (guidance) which outlines step-by-step procedures to follow in the event of fatality or serious injury. Information is located in a variety of unrelated documents, manuals, and guides. Each time an event occurs, the individual District must research all available sources. During this process necessary actions are missed, timely responses are compromised, and inordinate time is involved. This finding was made in to other investigations including the 1980 aircraft accident in Ely, Nevada. Action of the recommendation was not taken.

Recommendations

1. Develop a field guide (in lieu of source document references and quotes) to provide step-by-step procedures in handling fatality and serious injuries. BIFC does have a draft paper which could be developed into a field guide.

2. State Director formulating a policy on fatality investigations that provides assigning a Washington Office representative from Fire Management or Safety as a member of the team.

Final Reviewing Officer: State Director, Nevada Dated: 10/13/83

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

EVALUATION WORKSHEET

Date	Page	Office Evaluated	Type of Evaluation	By (office)
9/9/83	4	Carson City District Nevada	Accident Investigation Mound House Fire #3804, 8-27-83	BLM Interdisciplinary Team (Included Nevada Division of Forestry)

Worksheet Subject Fire Shelter

Findings

The crewman's fire shelter was near his day pack in the Chase truck. He was not carrying a shelter at the time of the accident. It is common practice to leave the fire shelter in the engine's tool compartments. The investigating team's opinion is that availability and use of the shelter would probably have prevented the fatality.

Recommendations

1. Strengthen State and District policies that requires all firefighting personnel to carry the fire shelter on their person while on the fire.

2. Expand and re-emphasize training of all fire personnel in the safe and proper use of the fire shelter.

3. Reflect this guidance in the State's operation policy.

4. Insure compliance through periodic State Office readiness inspection.

Final Reviewing Officer: State Director, Nevada Dated: 10/13/83

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9/9/83	5	Carson City District Nevada	Accident Investigation Mound House Fire #3804, 8-27-83	BLM Interdisciplinary Team (Included Nevada Division of Forestry)

Worksheet Subject Attack Unit Crewman Orientation

Findings

As the investigation report states, the Crewman was assigned to the Dragon Wagon Crew the morning of the accident. The briefing on the burn-out operations was very short. It appears instructions or directions regarding standard operating procedures were limited regarding the Dragon Wagon/Chase truck as a fire suppression attack unit.

Recommendations

1. Expand the orientation and/or train gin of firefighters and supervisors that will provide that each firefighter will be knowledgeable of standard operating procedures prior to actual attack mission.

2. In situations where the crew is decreased from a standard and/or crew members replaced, orientation and/or training will be increased to make all team members knowledgeable.

3. Insure compliance through periodic State Office readiness inspection.

5. Reflect items 1, 2 and 3 above in the State's CY 1984 operating plan.

Final Reviewing Officer: State Director, Nevada Dated: 10/13/83

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Worksheet Subject Attack Unit Briefing

Findings

The reconstructed Fire Behavior Analysis indicates the extreme rate of spread and fuel volume in relation to fire intensity were not anticipated. The suppression attack units had very little information of predicted fire behavior. They did not seem to realize the fire would be fast moving or threatening.

Recommendations

1. At minimum, attack unit crew bosses should be briefed daily regarding predicted fire behavior in the district.

2. The district should conduct a crew debriefing after each fire (minimum). This would also keep attack crew current and alert to changing fire conditions as experienced on the fire. It also presents a forum to correct organizational deficiencies.

3. Utilize daily ire behavior predictions to assist in determining daily manning level determinations.

4. When an aerial platform is used to direct attack units, instructions should include observed fire behavior, escape routes, and alternate line locations (example is paved road in the Dragon Wagon accident event). Any line location and attack instructions should be coordinated with the Fire Boss or his line officer.

5. Prepare guidance on items 1, 2, 3 and 4 above incorporated into the State's 1984 operating plan.

Final Reviewing Officer: State Director, Nevada Dated: 10/13/83

RETARDANT DROP ACCIDENT EVENTS

At approximately 1700 hours on August 27, 1983, the Mound House Fire was threatening private property known as the Conifer Log Homes. (H Sch 2). This facility consists of office and shop buildings, as well as a large storage yard which contained tall stacks of wooden material used in the construction of log style homes.

At this time a lead plane flown by Mr. Charles V. Destree and an air tanker (T-141) flown by Mr. Borden Schofield were orbiting over the fire. Mr. Mike Rector of the Nevada Division of Forestry was the Line Boss in charge of the line construction on this fire. He communicated to Mr. Destree that he would like the air tanker to lay a line of slurry on the east flank of the fire near the head to protect the Conifer Log facility. Mr. Destree was experiencing some trouble with his radio, so he was communicating with the tanker on the aircraft frequency 122.9MHZ. He had talked to the fire on the BLM net most of the day and he received his orders for this drop from Rector on the BLM net.

Mr. Destree flew to the head of the fire, assessed the situation, and decided to make the retardant drop from north to south along a road between the fire front and the Conifer Log facility. As Mr. Destree flew through the planned drop site, he was able to observe a number of fire engines which had positioned themselves along the boundary of the Confier Log Factory. They were facing the advancing fire front and were spraying water in an obvious attempt to protect the property. As the wind was generally out of the west, the area was very smokey. However, Destree was able to see the ground personnel and equipment and select a drop path. He relayed this information to the air tanker.

It is significant here to understand exactly how Destree performs his lead plane duties. Most lead plane pilots fly close formation drop runs with the air tanker. Customarily, the lead plane is the first to arrive on the fire site. By the time the tanker arrives, the lead plane has evaluated the drop site. The lead plane then directs the tanker to follow closely behind while they fly a practice run on the planned drop site. In this one-behind-the-other formation they fly a practice drop run with the lead pilot explaining where the drop starts and ends, which direction to turn our, and what hazards to look out for, etc. After the practice run has been completed, the aircraft circle around and line up for the real drop. Here some lead plane pilots run the actual drop exactly like the practice one while others reverse the order of flight. These others put the tanker first on the real drop and they follow closely to evaluate the tanker's drop height, speed, alignment, accuracy, etc.

Destree, however, does not lead in either of these fashions. He flies the drop route alone but under the observation of the circling air tanker and relays by radio the information he feels the tanker requires to perform the drop on his own.

The tanker pilot expressed dismay over Destree's lead method. He feels that visualizing a drop run based on a verbal description is much more difficult to interpret than actually following the run being flown by the lead aircraft. While the tanker is making his drop run, Destree observes the tanker from a distance, and usually from a higher altitude, while flying in the opposite direction. Incidentally, ground personnel are taught that aircraft customarily fly a practice run before the actual drop run and this usually alerts ground personnel working in the area that a drop is coming.

On this particular drop the practice run was only made by Destree. Due to the urgency of the situation, it was decided that in order to protect the property and the firefighters that had placed themselves in the path of the fire and because of the proximity of the approaching flame front, there would be no time for a practice run by the tanker.

Schofield lined up on the course he believed Destree had flown and proceeded with the actual drop run. When he reached the initial point, he simultaneously entered the smoke as he manually tripped the first of three doors containing the retardant chemical. The material used was fire-Trol 100. The drop consisted of three doors in rapid succession, or one thousand gallons. The total weight of this amount of this material is about 10,000 pounds. Schofield reports that he was solid IFR and had no contact with the ground nor did he see any ground units or personnel.

Destree reported that he broadcast on the air that the drop was inbound but that he received no response. Since he was probably still on the BLM radio net it is impossible for the NDF units in the vicinity of the drop to have received this transmission.

The foot print left by this drop, measured by Mr. Stanley Palmer, BIFC Safety Officer, is 720 feet long by 100 feet wide. Professional retardant experts Mr. Robert Weber, BIFC, and Mr. James Deem, Office of Aircraft Services, were given the foregoing measurement and asked to calculate the height of the aircraft from the size of the foot print. Based on the foregoing data their professional opinion places the aircraft from 85 to 115 feet above ground level. Eye witnesses variously indicated the altitude of the air tanker from 50 to 100 feet. Schofield, himself, felt he was about 150 feet and Destree believes that the tanker was even higher. However, Destree does confirm that he was not able to see the drop, due to heavy smoke.

Nevada Division of Forestry fire engines 4140 and 4023 were working on this section of the fire line. Unit 4140 (B Schematic 1) was parked directly on the centerline of the drop. The two crewmen were near Point H, Schematic 2, conferring with other firefighters protecting the lumber yard. When the operator of Unit 41023 (B1 Schematic 2) observed the lead plane fly overhead he shouted a warning about the incoming drop to all personnel in the area. The crew of 4140 ran from their position near Point H back to their truck in a futile attempt to move it before the drop arrived. The vehicle suffered heavy damage and the crew were injured by the flying glass from their demolished windshields and door glass. Doug Paul suffered an eye socket fracture and multiple facial cuts. Brian Buckner sustained multiple facial cuts. Unit 4023 lost only the driver's door glass. The operator was not hurt.

It is the team's opinion that Unit 4140 received the full amount of slurry from Gate 2. Since the drop aircraft was lower than normal in its drop configuration, the slurry had not dispersed appreciably due to air drag. The drop's compact configuration upon hitting the vehicle caused major damage and crew injury from flying glass.

Unit 4023 lost only the driver's door glass and the operator was not hurt.

The tremendous amount of force is graphically displayed by the damage suffered by Unit 4140. (See photos). Additional testimony is provided by equipment which was ripped off the truck and flung downstream in the direction of the drop. In D and E, Schematic 2, the vehicles' red light and lens were found. At Area F, a heavy metal roller type hose guide was found.

QUALIFICATIONS

Qualifications Charles V. Destree

Mr. Destree holds an FAA commercial pilot license and is rated single and multi-engine aircraft, both land and sea. He is also rated in helicopters. He is qualified as a certified flight instructor, instrument flight instructor, glider instructor, and helicopter instructor. He has accumulated over 10,000 hours of flight time and for the past 21 years he has been employed by the Nevada Division of Forestry as both an air tanker pilot and a lead plane pilot.

Qualifications Borden Schofield

Mr. Schofield holds an FAA airline transport pilot certificate. He has flown over 5,000 hours; most of this time in aircraft over 12,500 pounds. He has approximately 400 hours in the P2V-5. He is rated for single and multi-engine aircraft both land and sea. He has been flying air tankers for the past five years, mostly for the U.S. forest Service throughout much of the U.S. He is rated and holds an OAS card as initial-attack air tanker pilot.

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Worksheet Subject Organization and Management Communications

Findings

See worksheets number 1 and 2 under “Fatality Section.” They apply equally to the aerial retardant drop accident.

Recommendations

Final Reviewing Officer: State Director, Nevada Dated: 10/13/83

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9/9/83	8	Carson City District Nevada	Accident Investigation Mound House Fire #3804, 8-27-83	BLM Interdisciplinary Team (Included Nevada Division of Forestry)

Worksheet Subject Air Attack Guidance

Findings

The relationships between lead plane, aerial retardant aircraft, and ground personnel in the drop area were not established and/or understood. This was further aggravated by multiagency operating procedures, lack of communication and organization problems. The later two areas have been discussed.

Recommendations

1. Standard procedures for air attack are available. The Nevada fire community should establish an interagency procedure common to all Nevada agency operations. This recommendation should be acted on in conjunction with Worksheet #1.

2. Develop local interagency retardant guides including minimum drop heights, visibility constraints, communication constraints, lead plane pilot responsibilities and restrictions, appropriate training of ground personnel, etc.

("Standards" have long been identified in the fire community as deterrents to accidents).

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REVISED 1-10-06 bg