KATES BASIN FATALITY REPORT

August 11, 2000

U.S. Department of Interior
Bureau of Indian Affairs
Wind River Agency
Fort Washakie, Wyoming

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EXECUTIVE SUMMARY

The summer of 2000 has proved to be a long, arduous fire season throughout the country. Severe drought throughout much of the west, above normal temperatures and below normal precipitation, coupled with a 4-6 week delay in the southwest monsoon season has resulted in many fires burning at one time with rapid rates of spread and extreme fire behavior.

On August 11, 2000, in excess of 60 large fires were burning, with fires in nearly every geographic area. Resources were stretched thin and fire personnel were beginning to show the strain of a long, hard season.

On August 5, 2000, two fires were ignited on the Wind River Indian Reservation in Wyoming. The fires were reported to the agency at approximately 1400 hours on August 7th, 2000. Initial attack action was taken immediately. With the scarcity of resources geographic area-wide and nation-wide, the agency was having difficulty getting the resources it was requesting through the Rocky Mountain Coordination Center. The two fires escaped initial attack and went into extended attack under a small Type 4 organization.

On July 30, 2000, a strike team of type 6 engines had been ordered for the Middle Enos fire out of Worland BLM. The strike team consisted of three (3) Oklahoma State Forestry engines and one Chickasaw Nation engine, each with a 2 man crew. The strike team reported for duty on the Middle Enos on August 4th. On August 10th, the three Oklahoma State Forestry engines (#2, #4, and #10) were released from the Middle Enos Fire and reported to Worland BLM on severity. The fourth engine, Chickasaw Nation #2, reported directly for assignment to the Kates Basin Complex.

The afternoon of August 10th, Oklahoma #2 and #10 were dispatched to the Kates Basin Fire. Engine #2 and #10 worked on the Kates Basin fire until approximately 2230 hours on August 10th, then bedded down next to the engines.

The August 11th shift started at approximately 0500 hours with a briefing at 0830 hours from ICT4 Mike Brown. The engines were assigned suppression activities throughout the morning. At approximately 1230 hours Oklahoma Engines #2 and #10 were directed to the Mexican Pass area to assist with holding a dozer line.

Oklahoma Engine #2 arrived first and discussed a plan of action with a Hot Springs County engine crew. Oklahoma Engine #2 would continue east on the two-track, turn around at the dozer line, and hold and protect the corner. When Engine #2 was turning around, at approximately 1430 hours, the corner had ignited, forcing the unit to back eastward on the two track, about 60 feet. Foreman Burnett started the pump but didn't have time to begin any engine protection. A flaming front forced him to retreat eastward, approximately 900 feet on the two-track, then he left the two-track, heading in a southerly direction, approximately 250 feet, when he was overtaken by the fire. Burnett was found shortly after with a partially deployed fire

shelter and holding a portable hand held radio. The Hot Springs County Coroner later removed Burnett's body from the mountain.

Crewman Presley Byington was unable to leave the engine and deployed his shelter in the cab of the engine. He received minor burns and smoke inhalation. He was transported to the hospital by helicopter and released on August 12, 2000, at approximately 1300 hours. He returned home on August 13th, 2000.

On August 11, 2000, at approximately 1450 hours, FMO Bob Jacob and Perry Baker, Agency Superintendent were notified of the entrapment and fatality. The Agency's serious accident notification procedures began.

The Serious Accident Investigation Team (SAIT) was in-briefed at 1400 hours on August 12, 2000, at the Kates Basin Incident Command Post (ICP), located at Riverton Fire Academy. The SAIT has conducted the investigation as outlined in the DOI 485 DM Chapter 7.

Presley Byington and the crew members of Engines #4 and #10 returned to their home unit on August 13, 2000 on a chartered aircraft.

Engine #2 at intersection of dozer line and two-track.

INCIDENT OVERVIEW

The Kates Basin fire was ignited by lightning on August 5th, 2000 on the Wind River Indian Reservation in Wyoming. This fire and the Blondie Pass #2 fire were reported to Fort Washakie Dispatch Center at approximately 1400 hrs on August 7th. Initial attack proceeded immediately as directed by Agency Forester and Fire Management Officer, Bob Jacob. Operation of the fire was under Incident Commander Type 4 (ICT4) Mike Brown.

The Kates Basin fire and Blondie Pass #2 were initially managed as separate fires, with Charles Chavis serving as IC on Blondie. Fuels ranged from heavy timber on the Blondie Pass #2 to grass and low sagebrush (<18 inches) on the Kates Basin Fire. Pockets of juniper occurred throughout the fire area. The weather was in a hot, dry pattern with red flag warnings posted for the zone on August 10th and 11th for low humidity and gusty winds.

Fort Washakie Dispatch, working through the Cody Dispatch Center and the Rocky Mountain Coordination Center, made several requests for resources, particularly engines and crews. A Type II Incident Management Team was requested on August 10, 2000. Competition for resources was tight because of several other larger fires burning in the geographic area and in other areas of the country.

One strike team of four (4) Type 6 engines had been ordered on July 30th for the Middle Enos fire. This strike team consisted of Chickasaw Nation #2, and Oklahoma Engines #2, #4, and #10, and were signed on under emergency rental contract with the U.S. Forest Service, Region 8. This strike team was released from the Worland District Bureau of Land Management, Middle Enos fire on August 10th. One of the engines, Chickasaw Nation #2, was assigned directly to the Kates Basin Fire. The other three (3) engines, Oklahoma Engines #2, #4 and #10 were assigned on severity to the Worland BLM for initial attack. Worland agreed to loan two engines, Oklahoma Engines #2 (1997 Ford, F-350 model) and #10 to the Kates Basin fire with the understanding that they would return to Worland if needed for initial attack.

Oklahoma Engines #2 and #10 reported to the Kates Basin fire the afternoon (estimated 1500 hours) of August 10th. They were assigned suppression duties to the north of the Mexican Pass area and worked until approximately 2230 hours. They then bedded down next to their engines at the "Dip Tank" camp.

The August 11th shift started at approximately 0500 hours with a briefing at 0830 hours by the incident commander. During this briefing the forecasted weather, transmitted to IC Brown at 0630 hours, was discussed. Engines #2 and #10 were assigned suppression duties in the same area as the evening before. At approximately 1230 hours Engine #2 and #10 were directed to report to the Mexican Pass area to assist in holding line in that area. Due to unfamiliarity with the area, Engines #2 and #10 went to the west side of the fire and began working on active fire. While topping off their water tank, Foreman Burnett was directed by radio to the Mexican Pass area. Engine #10 had to refill with water and proceeded to Mexican Pass 20-30 minutes behind

Engine #2.

When Engine #2 reached the Mexican Pass area they met with Hot Springs County Engine #7, a 6 X 6, Type 4 engine, and a Hot Springs County "quick attack" engine each staffed with a two person crew. Engine #2 foreman, Jim Burnett (passenger) discussed tactics with A.J. Helm, engine foreman for Hot Springs County #7. No other supervisor was on site. The plan was to burn out the remaining fuel along the road to the dozer line, then south to the rock escarpment (B-C-D), but no burnout operations were started. (See photograph at the end of these "Incident Overview" paragraphs, and maps in Appendices 1, 2, and 3.)

The fire was making runs toward the two-track road and slopping over the grader check lines that were put in to check the spread of the fire. Oklahoma Engine #2 left Hot Springs County Engine #7 to scout the two-track and dozer line (Point B-C-D). Burnett realized they could not hold the line and decided to turn around at the intersection of the two-track road and the dozer line (Point C). At the same time the winds picked up to an estimated 40-45 mph causing rapid rates of spread and observed flame lengths of 25-30 feet. This caused Engine #2, now headed west, to retreat in reverse to the east up the two-track road and to become entrapped (Point E). After backing approximately 60 feet, Foreman Burnett told Crewman Presley Byington (driver) to remain in the engine while he wet down the immediate area for vehicle/crew protection. Burnett then left the vehicle and started the pump. Byington reported the pump engine ran for only 4 - 5 seconds before it quit.

Burnett ordered Byington to back the engine in a retreat to the east, but the engine stalled after moving approximately ten feet. Burnett then separated from the engine, retreating east up the two-track. When Byington realized the flaming front would quickly reach the vehicle, he decided to move from the driver's side and exit on the passenger's side of the vehicle. When strong winds prevented him from opening the door, Byington attempted to lie down on the floor of the vehicle, but the gear shift lever and 4X4 selector prevented this move. He opened his shelter inside the cab of the engine. While in a sitting position on the passenger side he wrapped the shelter around himself.

Hot Springs County Engine #7, recognizing Engine #2 may be in trouble, proceeded east with hoses deployed. After finding Engine #2 on fire, they suppressed the fire and found Byington alone in the cab. Byington had minor burns and smoke inhalation, but was conscious and mobile. They moved Byington into their engine and then discovered a small fire on their own engine. While Hot Springs County crew extinguished the fire on their engine, Byington retrieved a handheld radio from Engine #2 and contacted Burnett. Burnett responded and expressed concern about Byington's welfare. Byington reports that Burnett seemed calm and reported that he was "O.K." at this time. Due to heavy smoke and active fire conditions, Hot Springs County Engine #7 put Byington back in their cab and moved west away from the fire.

Burnett retreated up the two-track for approximately 900 feet, where he left the road to the south (Point F). He lost his hard hat approximately 30 feet from the road (Point G). Jim Burnett was

overcome and fatally injured by the fire approximately 230 feet south of the two-track road (Point H) at approximately 1430 hours on August 11, 2000. He was found clutching a hand-held radio with a partially deployed fire shelter, approximately 200 feet from unburned fuel.

At about this time, Oklahoma Engine #10 had arrived and was wet-lining above the two-track road to the north toward a control line being put in on the ridge by a road grader. Hearing radio traffic of the accident, Foreman Kelly Stout proceeded back to the two-track road and headed east to search for Burnett. Engine #10 proceeded around Engine #2 east toward the ridge top, but did not locate Burnett.

At 1450 hours, Fort Washakie Dispatch, Don Mitchell, Bob Jacob, and Superintendent Perry Baker were notified of the accident. Two helicopters (43T & 53F) were dispatched at 1454 hours. Both helicopters looked for Burnett and discovered the fatality. Helicopter 43T transported Byington to the Riverton Hospital. Marc Rudkin, helicopter crew member for helicopter 43T, confirmed Burnett's condition and proceeded to secure the site. Rudkin remained on-site until law enforcement personnel arrived.

Agency personnel immediately began the serious accident notification process. Agency law enforcement personnel investigated the site, and the Hot Springs County Coroner responded to the site and removed the body.

Presley Byington arrived at the Riverton Memorial Hospital at 1531 hours. He was treated for first degree burns and smoke inhalation. He was released at 1300 hours on August 12th, and was was checked into the Riverton Holiday Inn to await transportation home. On review, it was discovered that Byington had no one assigned to him from the agency while in the hospital or in the motel. There was no one to provide him with information, to assist him, or to handle calls from the media. He and the four other Oklahoma firefighters returned home on August 13th by chartered aircraft. Byington continued to receive treatment for respiratory problems after returning home.

As the accident was occurring, the NorCal #2, Type II Incident Management Team (IMT), was arriving to take over the fire. Deputy Incident Commander John Wendt and Safety Officer Mike McCourt were assigned to gather information about the entrapment and to assist investigation efforts. They also assisted the Oklahoma firefighters from Engines #4 and #10 . The fire was transferred to the IMT at 0600 hours on August 12th.

A serious accident investigation team was formed the evening of August 11th and arrived in Riverton, Wyoming in the early afternoon of August 12th. The team was briefed and given a delegation of authority to conduct the investigation at about 1400 hours on August 12th.

Aerial view of the entrapment site

INVESTIGATION PROCESS

The investigation of the Kates Basin fatality was initiated by the Bureau of Indian Affairs through the National Fire and Aviation office in Boise, Idaho.

The Serious Accident Investigation Team (SAIT) received a Delegation of Authority on August 12, 2000, from the Superintendent Perry Baker of the Wind River Agency.

A) Team Members were notified on August 11, 2000 and convened at the Riverton Fire Academy in Riverton, Wyoming.

B) The team then proceeded to use the procedure outlined in the DOI 485 DM, Accident Investigation.

C) Immediately after the initial briefing the team visited and examined the incident site. Upon their return they set up facilities and discussed procedures and assignments.

D) On August 13, 2000, the Oklahoma Engine crews #4 and #10 discussed the situation before and after the incident.

E) During the course of this investigation interviews were taken from witnesses, members of the Wind River Agency Fire Suppression organization, Hot Springs County Volunteer Fire Department, Kates Basin Type 2 IMT, and the Agency Law Enforcement Criminal Investigation Department.

F) The team collected additional information pertaining to weather data, burning conditions, fuel combustion, rate of spread, topography, and resources availability.

G) The two operable Oklahoma engines (#4 and #10) were shipped by common carrier back to the home agency on August 14, 2000. The damaged vehicle was removed from the accident scene on August 15, 2000.

H) The damaged Oklahoma Engine #2 was started and driven to check for equipment failure on August 13. No evidence of breakdown was found.

I) Clothing and other personal protective equipment was collected and sent to the U.S. Forest Service's Missoula Technical Development Center (MTDC) for determination of fire protection effectiveness. The SAIT requested that MTDC provide a written report of its findings.

J) The team updated the Superintendent Baker and Forest Manager/FMO Jacob and his staff of the progress of the investigation on August 14, 2000 at 1800 hours.

K) On August 17, 2000, at 1000 hours the SAIT held a debriefing close-out meeting with the

Wind River Agency personnel. This discussion included the events, findings, and an overview.

L) The team closed out the initial phase of the investigation with the BIA Director of Fire and Aviation in Boise, ID, on September 18, 2000.

FINDINGS AND RECOMMENDATIONS

Findings - Fire Behavior and Environmental Factors (See Appendix 3)

- The primary fuel type was native grass & sage, NFFL Fuel Model 2.
- Live woody fuel moisture averaged 56% (Grass Creek Divide RAWS); dead 1 hour timelag fuels averaged 3-5%.
- This area of Wyoming was 1.32" below normal in precipitation as of August 14th, 5.91" being normal.
- Slopes average 20-25% in accident area; there were steeper slopes of 40-45% below the accident area in SW facing draw.
- Scabby rocks with sparse fuels were not effective as natural fuel barriers or as a safety zone in this case because of the condition of the fuels.
- The site was on a west-southwest aspect with west-southwest winds.
- Haines Index was 6 (high) all the week of August 6 - 12.
- Temperature at the time of the entrapment was 86 degrees Fahrenheit, with a relative humidity of 10% (Grass Creek Divide RAWS), resulting in a Probability of Ignition (PI) of 90%.
- Morning forecast for zone 287 called for RH 15-20%; the actual observation at the Grass Creek Divide RAWS showed an RH at 1415 hours of 11%, and at 1515 hours of 10%.
- Winds were reported at up to 45 mph, as estimated by firefighters on the scene. The actual measurement at the Grass Creek Divide RAWS was 37 mph at 1415 hours.
- Terrain and the two-track width limited ability to easily turn Engine #2 around.
- Smoke and low visibility limited the engine crews' observation of an area they had not seen before.
- Fire Danger Ratings for the Grass Creek Divide RAWS exceeded the 95th percentile for the Energy Release Component, showing a very severe fire season.

Recommendations - Fire Behavior & Environmental Factors

- As stated in the FIRE ORDERS, firefighters must base all tactical actions on expected fire behavior.
- The Agency should review fire plans to assure appropriate qualified staffing for extreme conditions. Severity funding can be requested to obtain additional resources.
- Firefighters from outside the area need to be fully briefed on local weather conditions. Consider using fire danger pocket cards and geographical area fire behavior description aids.
- Natural barriers (e.g., scab rock) must be critically evaluated when used as safety zones or containment lines in extreme fire conditions.

Findings - Incident Management

- An Incident Commander Type 4 (ICT4) had been managing a Type 3 incident for three (3) days.
- Engines requested by incident were not received, because priorities set by the Rocky Mountain Geographic Area Coordination Center (RMGACC) assigned resources to numerous other fires burning throughout the geographic area and nation.
- The agency felt it could manage the incident if additional engines were sent, and did not feel a Type 2 IMT necessary until 08/10/00 at 1700 hours.
- At the time the IMT was ordered, the fire was approximately 30,000 acres.
- Resources were shifted to a different area of the fire without overhead being assigned to that area of the fire.
- Most resources, including crews of Oklahoma engines #2 and #10, were briefed. Hot Springs County engine crews were not briefed, but knew the local weather conditions.
- The only spot weather forecast requested and recorded by the National Weather Service in Riverton was for the Blondie Pass #2 on August 9th, at 1215 hours .
- Proposed burnout tactics were not sufficiently discussed and were not clear as to objectives or purpose.

Recommendations - Incident Management

- ♦ Use criteria located in the Fireline Handbook, PMS 410-1, Chapter 2, to manage an extended attack incident.

- ♦ All briefings shall fully address predicted conditions, assignments, and safety. Encourage crews to ask questions to ensure they fully understand.

- ♦ Agencies shall instruct all firefighters to monitor current weather and to use spot weather forecasts.

Findings - Control Mechanisms

- ▸ For the size of the fire and the burning conditions, there were too few resources and overhead assigned.

- ▸ Communications infrastructure was inadequate. Historically, firefighters have had to use human repeaters to improve radio coverage in this area.

- ▸ Line supervisors were left on the line during the transition to a Type 2 IMT to assure command continuity on the incident until the transfer of command.

- ▸ Nine of the FIRE ORDERS were compromised, and seven of the 18 Situations That Shout Watchout were present (see Appendix 5, 10 Fire Orders and 18 Situations).

- ▸ Six critical decision gates were passed that led to the fatality. (see Appendix 6, Operations and Critical Decision Gates/LCES Report).

Recommendations - Control Mechanisms

- ♦ If there are inadequate resources or supervisors to safely execute tactical operations, the agency fire management officer shall revise incident objectives.

- ♦ Wind River Agency should consider a radio communications study to improve coverage.

- ♦ Continue the practice of leaving key fire supervisors on the incident during transitions to maintain command continuity.

- ♦ The Agency should request NWCG to continue and enhance national training courses on high risk/low frequency decision making.

Findings - Involved Personnel

- IC was qualified as ICT4 but acting in an ICT3 capacity. Following the required training, Wind River Agency documented and used Mike Brown as ICT4. No task book for ICT4 was located for Mike Brown. (see Wildland and Prescribed Fire Qualifications System Guide PMS 310-1).

- Personnel on Oklahoma Engine #2 were qualified for their assignments. Oklahoma personnel were hired under Emergency Firefighter provisions with U.S. Forest Service, Region 8.

- Hot Springs #7 responded quickly, reducing the length of time Engine #2 was on fire, and most likely reducing the injuries to Presley Byington.

Recommendations - Involved Personnel

- All fireline personnel must be assigned within their capabilities and qualifications, as specified in PMS 310-1.

- Geographic Area Coordination Centers should continue dispatching, out of area, qualified personnel who meet NWCG standards, in accordance with the National Mobilization Guide.

- Careful evaluation, considering all protective measures, must be made when rescues are conducted.

- The Agency should consider adding provisions to its medical plan to provide a person to assist and accompany an injured person.

Findings - Equipment

- PPE was being used.

- On August 22 the Missoula Technology and Development Center (MTDC) inspected and analyzed the PPE worn by Jim Burnett. The trousers, shirt, hardhat, gloves, and fire shelter were apparently standard GSA-issued products approved and appropriate for wildland firefighting. Burnett also was wearing cotton undergarments as recommended. Additionally, there was no indication that the PPE was not serviceable prior to entrapment. The extreme temperatures and significant direct flame exposure far exceeded the design limitations of these products. Consequently, the structural integrity

of the PPE was compromised.

- Because of the condition of Burnett's boots MTDC is unsure if his boots were appropriate footwear for wildland firefighting.

- Presley Byington had difficulty of opening plastic case of the fire shelter with gloves on, so he removed a glove and received first-degree burns on his right hand.

- Inside driver's door and door molding melted, possibly creating toxic fumes.

- Lack of oxygen stalled Engine #2 and the pump. Members of the SAIT started Engine #2 on August 12, and drove it on August 14th.

- Oklahoma Engines were signed on with an Emergency Equipment Rental Agreement with U.S. Forest Service, Region 8.

Recommendations - Equipment

- All firefighters must have correct foot wear, as described in the Fireline Handbook, PMS 410-1.

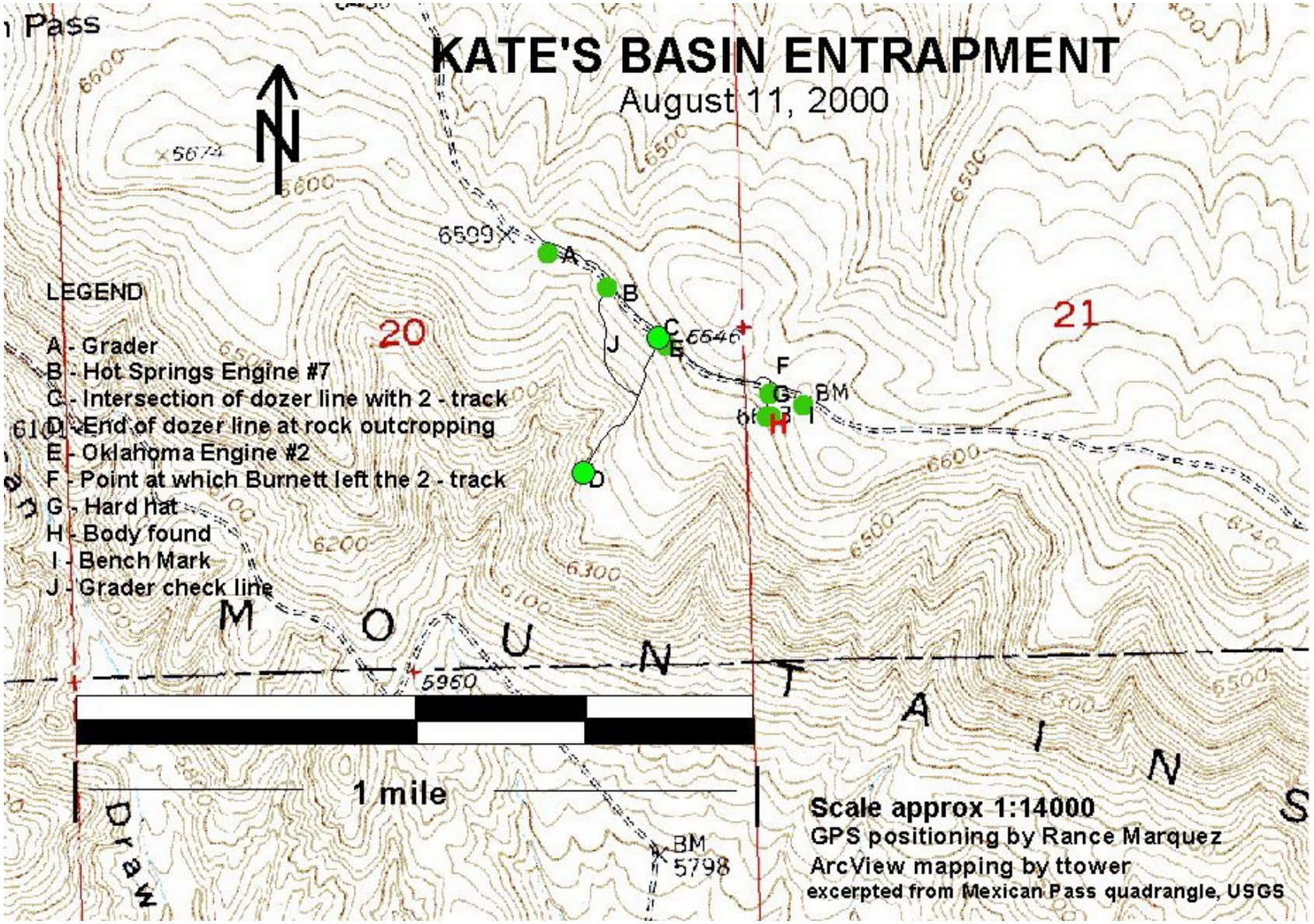
- Oklahoma State should be recognized and commended for building firefighting equipment which meets national mobilization standards, and for making this equipment available through annual agreements.

- BIA National Fire and Aviation Director should request and support MTDC in its studies of fire entrapments where vehicles are concerned, to include newer model engines.

- Annual fire shelter training must include proper pulling of the red release-ring while wearing gloves.

APPENDICES

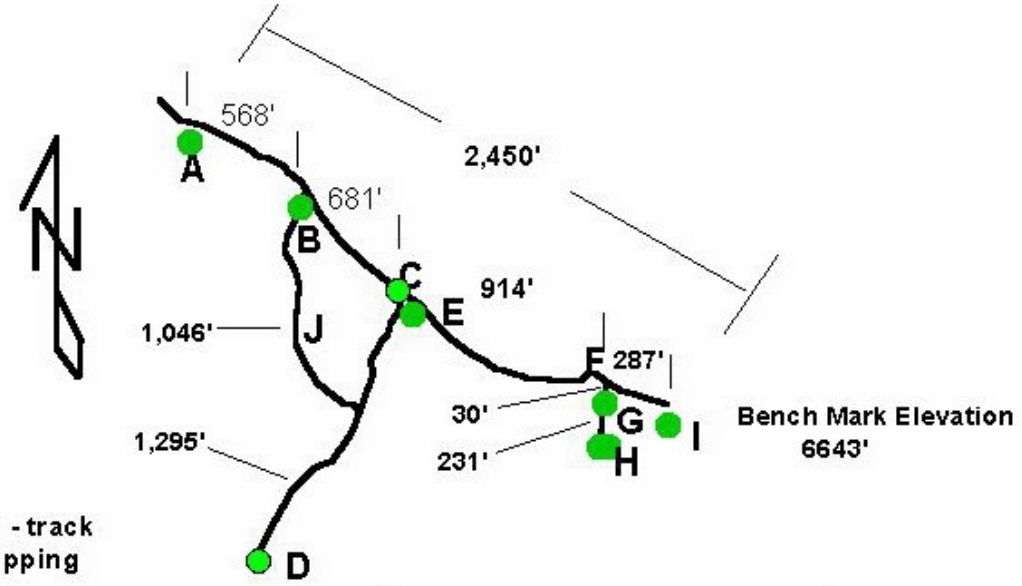
APPENDIX 1 - MAP OF THE IMMEDIATE SCENE (ARCVIEW)


KATE'S BASIN ENTRAPMENT
August 11, 2000
N
LEGEND
A - Grader
B - Hot Springs Engine #7
C - Intersection of dozer line with 2 - track
D - End of dozer line at rock outcropping
E - Oklahoma Engine #2
F - Point at which Burnett left the 2 - track
G - Hard hat
H - Body found
I - Bench Mark
J - Grader check line
20
21
6509
6546
6960
5798
BM
MOUNTAINS
1 mile
Scale approx 1:14000
GPS positioning by Rance Marquez
ArcView mapping by ttower
excerpted from Mexican Pass quadrangle, USGS

APPENDIX 2 - SKETCH MAP OF THE ENTRAPMENT AREA (ARCVIEW)

Kate's Basin Entrapment

August 11, 2000



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APPENDIX 3 - FIRE BEHAVIOR ANALYSIS

Kates Basin Fire Behavior Report for August 11, 2000

Fuels (Significantly contributed)

The fuels in the area where the entrapment occurred consisted of mostly grass and scattered sagebrush. Fuel bed depth ranged from .5 to 1.5 feet. The "Aid to Determining Fuel Models for Estimating Fire Behavior" (Anderson, 1982) classifies this vegetation as Fuel Model 2.

The primary carrier of the fire was grass. However, clumps of sagebrush, where present, did increase fire intensities and lengthen duration of the fire. The fuel moisture of the cured grasses ranged from 3%-4% at the time the entrapment occurred. The grass component of the fuelbed was completely cured. These moisture predictions were estimated from the closest Remote Automatic Weather Station (RAWS) site, Grass Creek Divide. The Grass Creek Divide RAWS is located at an elevation of 7100 feet on an exposed ridge 23 miles northwest of the entrapment site. Live woody fuel moisture values from the Grass Greek Divide RAWS site were in the 56% range. Probability of ignition reached 90% during the early afternoon of Friday August 11th.

The fire danger indices for the Grass Creek Divide RAWS site for this time period exceeded the 95 percentile Energy Release Component (ERC), indicating the severity of the fire season.

Weather (Significantly contributed)

The Riverton, Wyoming National Weather Service Office reported on 08/14/00 that their area had received 4.59 inches of precipitation for the year, which is 1.32 inches below normal. The normal precipitation for this date is 5.91 inches. Above normal temperatures have been common this summer.

The week of August 6th experienced Red Flag Warnings for many of the Fire Weather Forecast zones managed by the National Weather Service (NWS) at Riverton, Wyoming. Haines Index of 6 was forecasted for all days of the week for most zones, including zone 287, the area of the Kates Basin Fire.

On Thursday August 10, 2000, 0600 hours, another Red Flag Warning was issued for that day and evening for many zones in the area, including zone 287. The discussion forecasted an upper level disturbance passing over the western fire zones that day. Specifically for zone 287, including the Owl Creek Mountains, the Red Flag Warning for August 10th through the evening called for temperatures to the mid 80's, minimum relative humidity of 10% to 15%. Twenty-foot winds on the ridges were to be southwest 10-15 mph in the morning and southwest 12-18 mph with gusts 20 to 25 mph in the afternoon. The August 10th, 0600 hours forecast for Friday the 11th, called for temperatures again into the high 80's and relative humidity from 10%-15%. Twenty-foot winds near ridges were to be southwest at 5 to 10 mph in the morning and west at

10- 15 mph in the afternoon. Haines Index again was forecasted to be 6.

The updated, Thursday August 10th, 1500 hours forecast discussion included an upper level disturbance moving across the area that evening. The disturbance, in combination with mid and upper level moisture, would continue to fuel thunderstorms. The low levels of the atmosphere would remain dry. Wind gusts of 35 to 50 mph.

The Friday, August 11, 2000, 0623 hours forecast issued Red Flag Warnings for many zones including zone 287, for dry fuels, very warm temperatures, low relative humidity, and gusty winds. The Red Flag included forecast for gradient wind increases in advance of an approaching cold front due to cross the forecast area Friday evening and into the night. The Friday, August 11th, 0623 hours forecast specifically for zone 287, forecasted Red Flag Warning for that afternoon through sunset, temperatures into the mid 80's, and relative humidity of 15% to 20%. Twenty-foot winds near ridges were to be southwest 7 to 13 mph in the morning, and west northwest 15-25 mph and gusty in the afternoon. Transport winds from the west-southwest at 32 mph, with a Haines Index 6, and the air mass becoming unstable by 10 am.

At 1200 hours Friday August 11th, the NWS Riverton, Wyoming office had their regular scheduled noon update. This update removed showers from zone 140 and isolated afternoon thunderstorms from zone 279. The remainder of the discussion was similar to the morning forecast. Specifically for zone 287, there was little or no change from the morning forecast except for the mention of gusty winds with the 20-foot winds near ridges of 15 to 25 mph.

The Friday August 11th, 1500 hours forecast continued Red Flag Warning through sunset and again Saturday for many zones, including zone 287. Gusty winds, very warm temperatures, very low humidity again were the concern. The discussion of the Red Flag Warning included information that a jet stream maximum, moving to the north of the area, would increase winds once again.

Line personnel reported winds relatively calm at 0900 hours on the 11th, then picking up to 3-5 mph out of the southwest with occasional gusts, later in the morning. After 1300 hours, the winds were reported to pick up in speed. By around 1400 hours, winds were much stronger, reported by fire ground personnel to be southwest 25-30 mph, with higher gusts. During the entrapment period, the winds speeds were reported high enough to rock a Ford Expedition, just west of the entrapment site, continuously for a period of a few minutes. The Grass Creek Divide RAWS reported 20 foot winds between 1315 hours and 1515 hours on August 11th ranging from 10-17 mph and gusting from 26-37 mph, southwesterly. The Grass Creek Divide RAWS is at an elevation of 7100 feet, exposed. Elevation at the site of the entrapment is approximately 6600 feet.

All firefighters interviewed during the investigation were asked if any on-site belt weather kit observations were made and recorded. There is no record of any on-site belt weather kit observations made. The only requested, recorded, and received spot weather forecast to the

NWS Riverton Office was for the Blondie 2 Fire on August 9th, 1215 hours.

Haines Index

The Haines Index for August 11, 2000 was 6, the same given for everyday of that week. Based on atmospheric conditions over the fire, the Haines Index value of 6 (the highest possible), indicated a high potential for extreme fire behavior and large fire growth. These conditions contributed to the extreme fire conditions experienced on the afternoon of August 11th on the Kates Basin Fire.

The Grass Creek Divide RAWS located in zone 287 recorded the following weather conditions for August 11, 2000.

Time	Temperature F	Relative Humidity	Average Wind Speed mph	Direction	Peak Gust
1015	81	24	9	124	17
1115	80	15	21	241	35
1215	82	16	13	235	34
1315	85	16	10	242	26
1415	86	11	14	206	37
1515	86	10	17	253	31
1615	86	10	13	251	27
1715	85	9	15	222	29
1815	82	10	15	228	25

Topography (Significantly contributed)

The topography of the Kates Basin fire was in mountainous terrain of the Owl Creek Mountain range running west to east. Elevation relief from Buffalo Basin on the flat due south of Mexican Pass to entrapment area was from 5000 feet to 6646 feet. The slopes in the accident area ranged from 20 to 25%. There were steeper slopes of 40 to 45% below entrapment site in a southwest facing draw. Primary aspects in the vicinity were southwest to south-southwest. The area where the critical fire run occurred averaged 25% slope and a southwest aspect. The exposed aspect,

chutes, and saddles of the entrapment area to the forecasted and experienced winds are all contributing factors to the fatality. The fire burned on all aspects.

Predicted Fire Behavior

Fire behavior predictions were not made on the Kates Basin Fire during the week of August 6th, including August 11th. The fire during this period had progressed from an initial attack to an extended attack stage. Acquiring RAWS outputs, weather forecasts, and using information from interviews, witness statements, and on-site visits, fire behavior predictions were calculated to determine rate of spread and fire intensities just prior to and during the entrapment of the engine and firefighter.

The environmental inputs and data for the potential fire behavior calculations are listed below:

Fuel Model	2	NFFL Fuel Model 2 was used to model fire behavior in grass with scattered sage overstory and litter. (Note: Fuel Model 1, continuous cured grass fuels, was reported by firefighters near the ridges and exposed areas. Fire behavior calculations were made with similar weather inputs, however, the outputs from these calculations exceeded the wind limit for the model. Therefore, only Fuel Model 2 will be reported).
1 hour fuel	3-4%	1 hour fuel moisture was calculated using the Grass Creek Divide RAWS temperature and relative humidity.
10 hour fuel	4%	Value from Grass Creek Divide RAWS.
100 hour fuel	4%	Value from Grass Creek Divide RAWS.
Herbaceous	4%	Value from Grass Creek Divide RAWS.
Live Woody FM	56%	Value from Grass Creek Divide RAWS.
Mid-flame	8-23	Recorded winds (mph) from Grass Creek Divide RAWS station at 1415 hours (approximate time of entrapment) averaged 14 mph and peaked at 37 mph, south-southwesterly direction.
Slope	25	Slope averaged 20- 25% on the southwest-south aspects in the proximity of the entrapment site.

The calculated rate of spread (ROS) prior to and during the entrapment ranged from 135 chains/hour to 879 chains/hour at peak wind speeds, or from 148 feet/minute to 967 feet/minute, (ranging approximately 2 to 11 miles/hour).

Flame lengths (FL) during this period are calculated between 12-30 feet. Visual observations of flame lengths during the blowup period were reported from 25 to 30 feet. Fireline intensity was calculated to range between 1396 and 9084 BTU/foot/second. The predicted rate of spread and flame length are in a range that far exceed control options.

Observed Fire Behavior

The Kates Basin Fire was reported on Monday August 7, 2000 at 1430 hours. The reported lightning-caused fire had grown to 590 acres by the end of the day. On August 8th, at 1800 hours, the fire had covered 15,000 acres. The August 9th, 1800 hours report estimated the fire size at 18,000 acres. By August 10th at 1800 hours the fire had reached 31,000 acres and was over control lines in many areas.

During the mid to late morning hours of Friday August 11th, fire behavior was reported to be creeping spread rates with flame lengths 1-4 feet high. Between 1000-1100 hours, an observation of fire behavior near the area of entrapment on a southwest aspect, described flame lengths of 1-2 feet. At approximately 1300, winds started to pick up and fire behavior increased in intensity. Support from a helicopter assisted in controlling this area near the entrapment site.

Observed fire behavior during the entrapment period of 1430 hours on the 11th included flame lengths between 25 -30 feet and estimated winds on site of 40 mph. These winds, coupled with extremely low 1 hour fuel moisture and the effect of 25-45% slopes, chimney and saddle effect, with an exposed southwest aspect directly in-line to the prevailing winds, presented extreme fire behavior conditions in this fuel type.

APPENDIX 4 - OKLAHOMA ENGINE #2 FINDINGS

Oklahoma State Engine Two (Tag #1-20006) attempted to escape the on-coming flaming front by backing up a two-track road. The driver of the vehicle, Presley Byington, stated that after backing approximately 60 feet Engine #2 began to bog down and would not climb the hill behind it. Jim Burnett, Engine Boss, exited the vehicle and attempted to use the engine's pump to provide protection for the vehicle and themselves. Byington stated the pump's engine operated only for a few seconds before quitting. Engine #2 was backed a few more feet up the two-track road before its engine stalled. The vehicle was hit by the flaming front moments later.
On August 12, 2000, the vehicle's condition was inspected by members of the Serious Accident Investigation Team(SAIT). The vehicle was heavily damaged by direct flame impingement to the front and driver's side of the vehicle. Equipment and personal gear packs on the top of the engine's water tank had caught fire and were heavily damaged or destroyed. The right rear duel wheels had caught fire and burned. All other wheels were charred, but did not lose pressure. The pump's control panel was heavily damaged but the Hobbs meter was still recording time, the voltage meter was registering twelve volts, and the "on" light and panel light were still functional. The vehicle's transmission was in reverse, the transfer case was in 2H and the emergency brake was in the off position. The engine was started and functioned normally. The engine's two-way mobile radio also functioned normally. The driver's door panel and molding melted and charred from intense heat to the outside of the driver's door.

On August 14, 2000, three members of SAIT returned to the accident site for further evaluation of the Engine's operation. The spare tire was installed on the vehicle to allow a test of the engine's backing ability and operational characteristics. The engine was started, and with the transfer case placed in 4H, successfully backed up the hill along Byington's intended escape route. The engine was returned to the entrapment position. Procedure was repeated with the transfer case in the 2H position. Again, the engine successfully retreated along the escape route with no apparent effort.

Byington believed that the engine failed to climb the hill because of the weight of the water carried in the engine's 250 gallon water tank. However, it is likely the engine stalled due to extremely heavy smoke arriving with the flaming front. Witnesses from Hot Springs Engine #7 and Mark Rudkin, HEMG, stated visibility to be 15 feet and less at the time of the blow up.

Oklahoma Engine #2 was released to the BIA's Wind River Agency for removal from the site at 1700 hrs on August 14, 2000. The removal was to occur on August 15, 2000 with subsequent shipment to Oklahoma Department of Agriculture's Forestry Services.

Right side of Oklahoma Engine #2

Left side of Oklahoma Engine #2

APPENDIX 5
FIRE ORDERS AND 18 SITUATIONS THAT SHOUT WATCHOUT

FIRE ORDERS NINE (9) WERE COMPROMISED

***1. Fight fire aggressively, but provide for safety first.**

- PPE used
- Fought fire aggressively
- Engine #2 escape route was compromised.

***2. Initiate all actions based on current and predicted fire behavior.**

- Positioning the Engine #2 in front of the fire, with unburned fuels between it and the fire, placed it at risk.
- Prior to the accident, the calculated rate of spread was 135 chains per hour. At the time of the entrapment, the calculated rate of spread was 879 chains per hour, with flame lengths of 30 feet. The timing of the tactical actions did not take into account the predicted weather and fire behavior.

***3. Recognize current weather condition and obtain forecast.**

- Did recognize condition, but did not apply this recognition to tactics.
- Knew about Red Flag issued at 0623 hours (08/11); did not know about the Red Flags issued at 1200 hours, but this did not contribute to the accident because there was no change in the Red Flag for the local zone (287).

***4. Ensure instructions are given and understood.**

- unclear instructions on burn out in Mexican Pass area
- unclear instructions on who was in charge in Mexican Pass area

***5. Obtain current information on fire status.**

- Lack of incident management organization led to incomplete fire intelligence.

***6. Remain in communication with your crew members, supervisors, and adjoining forces.**

- No radio communications with the Hot Springs engines.

***7. Determine safety zones and escape routes.**

- Knew that safety zone was in the black, and the escape route to it.
- Escape route was compromised because Engine #2 got in front of unburned fuels.

***8. Establish lookout in potentially hazardous situation.**

- Did not have a designated lookout posted.

***9. Maintain control at all times.**

- No one designated as being in charge at the Mexican Pass area

10. Stay alert, keep calm, think clearly, act decisively.

- Did not contribute to the fatality.
- Quick response of the crew of Hot Springs Engine #7 probably prevented more serious injuries to Presley Byington.

18 SITUATIONS THAT SHOUT WATCH OUT SEVEN (7) WERE PRESENT

1. Fire not scouted and sized up

- Oklahoma Engine #2 was in the process of sizing up this portion of the fire when the entrapment occurred.

2. You are in country not seen in daylight.

- This was not a contributing factor.

3. Safety zones and escape routes were not identified.

- Crews understood and demonstrated that the burn area was their safety zone.
- Burned over engine could not get to safety zone because the escape route was compromised..

4. You are unfamiliar with weather and local factors.

- Engine #2 had been working in similar fuels and weather for at least one (1) week.

***5. You are not informed of tactics, strategy and hazards.**

- Unclear direction on tactics in the area
- No overhead assigned to this segment of fire.

***6. Instructions and assignments are not clear.**

- Engine #2 knew they were to support the dozer line, but they were uncertain as to the location of their assignment and the role they would have.

***7. No communication link has been established with the crew members and their supervisor.**

- Communications were established within the Oklahoma crews.
- Handheld radios were set to Agency frequency.
- Communications with supervisors were subject to the availability of the human repeater.

8. You are constructing line without a safe anchor point.

- This was not a contributing factor

9. You are building fire line downhill with fire below.

- This was not a contributing factor

10. You are attempting a frontal assault on the fire.

- This was not a contributing factor

***11. There is unburned fuel between you and the fire.**

- There was unburned fuel between Engine #2 and fire while the crew was scouting out control lines.

12. You cannot see the main fire and are not in contact with someone that can.

- This was not a contributing factor

13. You are on a hillside where rolling material can ignite fuel below you.

- This was not a contributing factor
-

14. The weather is becoming hotter and drier.

- This was not a contributing factor

***15. The wind is increasing or changing direction.**

- Wind speeds suddenly increased as a dry surface cold front passed.

- Engine #2 knew winds were expected to increase but were not fully cognizant of the relationship to their location and the resulting fire behavior.

***16. You are getting frequent spot fires across the line.**

- There had been difficulty in holding the fire to control lines prior to Engine #2's arrival.

***17. The terrain and fuel make escape to safety zone difficult.**

- Narrow road and terrain made turning the engine around difficult.

18. You feel like taking a map near the fire line.

- This was not a contributing factor.

APPENDIX 6
OPERATIONS & CRITICAL DECISION GATES/LCES

Saturday, August 5, 2000 thru Wednesday, August 9, 2000

Lightning on Saturday, August 5th ignited Kates Basin Fire. On Monday the fire was reported and initial-attacked. National and geographic area activity limited availability of suppression resources. Initial attack was not successful. Consequently, the overall strategy was to either monitor fire spread until it reached a point where the limited resources could be successful or, when resources became available, try a more direct attack. Conversations between the incident (Dave Underwood) and Rocky Mountain MAC group indicated with 10 to 15 engines the fire could be contained within 2 operational periods.

From the ignition source the fire spread generally down slopes to the north and east to the large flat basin drained by Red Canyon Creek (T6N & T7N, R4E). At the base of this slope is an unimproved dirt road extending north from Mexican Pass to Dry Cottonwood Creek (a.k.a. Black Rock Draw Road). This potentially provided Incident Commander (Type 4) Mike Brown a point in the fire environment to contain spread to the east. Values at risk from fire spread beyond this road included a power line (4 to 5 miles away) and the Riverton VOR.

Thursday, August 10, 2000

Thursday the tactics were to burn along Black Rock Draw Road (5 to 7 miles). During the afternoon the fire escaped immediately south of Potato Butte and ran as a long finger to the east. This escape ran in light fuels, under the influence of a strong wind, for approximately 1,000 acres. Light fuels and a decrease in the afternoon winds resulted in moderating fire activity and allowed resources to be effective. By midnight fire spread had been checked. Earlier that afternoon the two Oklahoma Engines (Engines #2 and #10) had arrived and assisted in containing this escape.

From Mexican Pass there is another unimproved dirt road heading in a westerly direction that roughly follows the crest of the Owl Creek Mountains. By 1300 hours suppression efforts had contained fire spread to the east and south in the Mexican Pass area. However, the same winds creating the escape near Potato Butte caused the fire to become established on the east aspect of Mexican Draw.

Between 1700 and 1800 hours members of the Rocky Mountain Area MAC Group called Bob Jacob to recommend taking the IMT2 currently headed toward the North Fork Fire in Colorado. The current situation on the North Fork fire was going well with a IMT3 in place. The group members were concerned that the Kates Basin fire and another local fire (Blondie Pass #2) were getting large, especially with that day's wind event, and were beyond the ability of the local unit to handle. Additionally, the group members were concerned with firefighter safety since this was the fourth day initial attack resources had been chasing this fire and suspected they had been

working long hours. Jacob agreed that the complexity analysis indicated an IMT2 complexity level and agreed to take the team.

By 2400 hours IC Brown had pulled all his resources back, for rest, to the ICP/dip tank site (T7N, R3E, Section 26) except for the Hot Springs County engines (Engine #7 and the Quick-Attack). They remained over night at Mexican Pass.

Friday, August 11, 2000

At 0500 hours the suppression resources got up and, since they were running short of fuel, went to fill-up at Duncan Ranch to the northeast of Potato Butte. During this time breakfast was delivered to the ICP. Between 0830 and 0900 hours IC Brown held a briefing for all resources at the ICP. The general weather was discussed. Oklahoma Engines #2 and #10 were assigned to patrol and mop-up the 1arge escape south of Potato Butte. They were also instructed to be available to assist in the suppression efforts in the Mexican Pass area if support was required.

Hot Springs Fire Chief Marvin Andreen (Unit 15), Engine #7, the Quick-Attack, along with a D-6 dozer and road grader, started Friday morning in the Mexican Pass area. See map, Appendix 3. Dozer operator Jeff Larson (Arapahoe Ranch manager) started the east fireline at 1030 hours and completed it to the top of the rock escarpment in 30 minutes. Approximately 1100 hours the dozer started and completed the west fireline to the road accessing Mexican Pass from the south. By 1200 hours the Hot Springs engines had positioned themselves on the road above the west fireline to burn out the road and down the east fireline to the escarpment. Fire Chief Andreen went down the Mexican Pass access road.

Bob Jacob and Mike Brown made a reconnaissance flight at 1100 hours to inform Jacob on the current situation for the IMT2 transition later that day. Although the fire had escaped the pre-planned containment lines the day before, the prospect of containing the escaped fire look good. Brown return to the Mexican Pass area and Jacob continued on to Riverton to prepare for the transition.

Radio coverage from local mountaintop repeaters was inadequate, so Amos Begay served as a human repeater. Additionally, Begay assisted Brown as driver while Brown directed other suppression resources to their work assignments. From 1130 to 1300 hours Brown also monitored the burn-out operation that Chickasaw Nation Engine #602 and Standing Rock Engine #2 were conducting along the Mexican Pass road. This burn-out was a small-scale operation removing unburned fuels along the Mexican Pass road ½ miles south of the Pass. All of those interviewed indicated that this burn-out did not contribute to the fatal fire spread later that day.

The fire becoming more active toward midday began to burn up to the west fireline and around 1200 hours jumped this line in the rock scab (natural barrier). The Hot Springs firefighters momentarily checked the fire spread only to lose the fireline again. This time approximately 1,000 feet of 1-inch hose was lost. The road grader in the meantime had reinforced the east fireline and placed the check line between the fire and the corner of the east fireline and road.

At 1300 hours the fire activity continued to increase; however, Helicopter 43T was somewhat effective in checking fire spread with bucket work. Around this time Oklahoma Engines #2 and #10 were asked to leave their previous assignment north of Mexican Pass and re-position to support suppression actions in the Mexican Pass area. No single individual (e.g., task force leader) was identified for them to report to.

Critical Decision Gates

Past this point in time there were six critical decision gates that were passed through, each with only a few minutes (in some cases only seconds) in which to make the decisions. Once the decisions were made, they could not be reversed because of the timing of the wind event.

1. **The decision to extend Engine #2 beyond the secure black where Hot Springs Engine #7 was stationed**. Upon coming onto the scene, Engine #2 Boss Jim Burnett was told by Engine #7 Boss A.J. Helm of his plans to burn out. This discussion lasted for a few minutes. Engine #2 then pulled ahead on the road toward the east fireline.

2. **The decision to turn Engine #2 around at the east fireline instead of continuing in an easterly along the road.** In route to the corner of the road and the east fireline the winds "suddenly" increased resulting in more intense fire behavior. Burnett observed that they could not hold the fire and the decision was made to turn the engine around at this corner heading the vehicle in a westerly direction back toward the Hot Springs engines and the black - their only safety zone.

3. **The decision to back Engine #2 eastward instead of driving forward through the flaming front.** After turning around Engine #2 continued to back in an easterly direction instead of driving through the on-coming flaming front. Consequences of driving through the front are unsure: becoming disoriented could have led to the vehicle driving off the road with serious injuries to both Byington and Burnett. However, this decision might have kept Burnett in the vehicle.

4. **The decision to leave the engine cab to start the pump.** After turning Engine #2 around they proceeded to back to the east along the road. At some point Burnett left the cab and went to the rear of the engine to start the pump for protection and possibly to help back the engine that was rapidly being engulfed by smoke. The pump ran for 4 to 5 seconds then quit, apparently because of lack of oxygen. Once this occurred the option of returning to the cab was eliminated.

5. **The decision to continue heading east along the road on foot instead of deploying a fire shelter.** Because of the rolling nature of the road Burnett possibly thought he could continue along the road to what may have appeared to be a ridge within a few hundred feet. During Burnett's retreat the Engine #2 Operator Presley Byington radioed Burnett who said he was okay; in fact, Burnett showed concern over Byington's well being.

6. **The decision to out flank the fire instead of continue east on the road.** Sometime around 1430 hours Burnett moved off the road to the south in what appears to be an attempt to out flank the fire. By the time Burnett was overrun he had deployed his shelter, apparently as a heat shield.

Tactical LCES application in this situation.

Kates Basin incident points out important differences in applying LCES in operations involving engines and other vehicles. The primary concerns with LCES in vehicle entrapments are the use of vehicles for escape routes and as a safety zone when the vehicle's occupants are entrapped.

→ **Lookout:** It is highly likely that a lookout, posted in the area of the entrapment would have been able to share concerns with the fire behavior prior to the entrapment. A lookout knowing difficulties with the fire's containment might have prevented Engine #2 from continuing on the two-track road above and down wind of the unburned fuel. However, since there was no task force leader, strike team leader, or division supervisor assigned on this critical segment of fire perimeter, a lookout was not established.

→ **Communications:** Hot Springs engines could not communicate by radio with Engine #2. However, face-to-face communication did occur prior to Engine #2 continuing past the Hot Springs engines. Because of the "suddenness" of the wind event, once Engine #2 left the Hot Springs engines an improvement in communications might have only helped to warn Engine #2 not to turn back to the west.

→ **Escape Routes:** Escape routes are the paths followed from a firefighter's current work location to safety zones. In this entrapment there was only one identifiable safety zone with just one escape route to this safety zone. That safety zone was the black where the Hot Springs engines were parked. The escape route was compromised once the fire made its fatal run.

Vehicles expedite the firefighter in getting to the safety zone. If the vehicle can be operated safely, there is no reason why it shouldn't be used to get there. One potential concern, of course, is that all firefighters depending on vehicle egress are transported and that the vehicle does not leave anyone behind. This was not the case in this situation. Burnett, having left the vehicle, could not get back into the cab.

→ **Safety Zone:** Herein lies one of the most critical concerns - does the cab of a vehicle ever afford a reliable safety zone or deployment site? And, if so, what level of fireline intensity makes the vehicle ineffective for either use? There are a number of case studies demonstrating rationale for both leaving and staying with the vehicle. This topic is in need of further research. Ideally, engine operations would follow the same principles as handcrews, that is, locating areas or zones in a fire environment where the engine could retreat and be able to safely let the fire burn past.

United States Department of the Interior

BUREAU OF INDIAN AFFAIRS
Wind River Agency
P.O. Box 158
Fort Washakie, Wyoming 82514

IN REPLY REFER TO:

Date: August 12, 2000

Memorandum

To: Ed Shepard , Team Leader

From: Director, Office of Fire and Aviation

Subject: Delegation of Authority - Serious Accident Investigation

This memo provides official delegation of authority for the conduct of serious accident investigation for:

Fire name: Kate's Basin
Location: Wind River
Date of occurrence: August 11, 2000

As Team Leader, you are responsible for ongoing (daily) briefings to me. The information you provide will be shared with the Bureau Designated Agency Safety and Health Official and the Bureau Safety Manager. You are also responsible for the following formal briefings/reports in accordance with Departmental Manual 485, Chapter 7.

Preliminary brief (24 hours)
Expanded brief (72 hours)
Final report (45 days)

This investigation shall be conducted objectively to gather facts and evidence related to the accident, in accordance with the guidelines set in Departmental Manual 485, Chapter 7.