New York Peak Fire Burnover
July 25, 2006

Factual Report

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Executive Summary

The New York Peak Fire was started by a lightning strike on July 24, 2006, on land administered by the Bureau of Land Management, northwest of Winnemucca, NV. Members of the Eldorado National Forest Hot Shot Crew (IHC) and a D-8 Catepillar dozer were involved in a burn over incident during fire suppression operations on July 25, 2006. Six crew members received injuries after being hit by a fire whirl. Due to the suddenness of the fire whirl, fire fighters had no time to deploy fire shelters. Their designated escape route had been cut off as the wind shifted and blew flames across the dozer line. Several crew members escaped through the green to avoid further injury. Two crew members were seriously burned and walked out through the hot black and the dozer operator drove out through the fire to the safety of the road. The dozer was not damaged and the dozer operator was not injured due to the protection provided by his environmental cab.

Introduction

The 2006 wet winter throughout the Great Basin has caused tremendous fine fuel growth in native and non native plant species. A Safety Alert was issued by Nevada BLM on May 4, 2006 which identified heavy fine flashy fuel loadings and potential for extreme fire behavior. Observed fire conditions for May were more similar to fire behavior conditions in July.

Nevada was experiencing multiple lightning ignited fires during the time of the New York Peak Fire which started on July 23, 2006. Central Nevada Interagency Dispatch mobilized an ICT3 and numerous engines, dozers, aviation resources and crew resources to take action on this incident. These resources took action on this fire until they were relieved by overhead from the Trident Peak Fire and other resources. The estimated size of the New York Peak Fire around the time of transition was 500 acres, and the final size was 3,004 acres on July, 26 2006.

Specific to the site on the New York Peak Fire where the burnover incident occurred was:

- Date and time – July 25th at 1655
- Location – Winnemuca BLM F.O. – BLM Juridiction
- Legal - T43N R29E Sec. 31 SW of NE ¼
- Fuel Model 2 (grass, sage)
- Elevation 5800 feet
- Slope – 0-10%
- Position on slope – midslope - ridgeline

- Aspect – East
- Acreage of Spot #1 at time of suppression action – approximately 1 acre
- Weather – Temp 90 RH 26% Wind 1-3 E Gust 5 SE

Narrative

On July 25, 2006, the Eldorado Hot Shots were dispatched from the Six Mile II Fire near Virginia City, NV and reported to the BLM Winnemucca Field Office to receive further information on the Trident Fire. En route to the Trident Fire, the crew was diverted to the New York Peak Fire near the Leonard Ranch near Denio Junction, NV by the Operations Chief. The crew arrived at approximately 1400 Briefings were provided by the ICT3. Crew leaders provided a briefing to crew members. The crew began to conduct burn out activities along a road using indirect attack. An Air Attack Platform, Single Engine Air Tankers and a Type I Helitanker provided air support to the operation. At approximately 1700, spot fires began to occur across the road as a result of dust devils that were forming in a burned out drainage area and blowing embers across the line. Three spot fires occurred within minutes of each other and the Eldorado and PatRick crews began to fight those three fires using direct attack. A flanking operation was used to fight the first spot fire, with T-6 engines Cateland 1 and Cateland 4 on the south and north flanks, respectively. A hand crew of seven fire fighters and the DeLong D8 dozer worked a west-to-east dozer line along the left flank of spot fire #1. Cateland 1 engine foreman noted that the spot fire was difficult to suppress on the right flank as the engine began to run low on water. The wind shifted and the fire grew quickly so Cateland 1 engine crew began to pull out and withdraw to the road. As this retreat was occurring (approximately 1700), the wind shifted and the order was given by the squad boss to retreat. A fire whirl developed near the hand crew and dozer. Due to the suddenness of the appearance of the fire whirl, firefighters did not have time to deploy fire shelters. The escape route previously identified (dozer line) was compromised by the flaming front. Several firefighters on the hand crew were struck by the fire whirl and took refuge near the dozer momentarily. The dozer operator realized that fire fighters were taking refuge near his dozer, so he remained in place for a short time as the fire burned over his dozer. Other members of the hand crew were able to escape through the green/unburned area and they outran the flaming front. The dozer operator then backed out of the area towards the road. Two fire fighters who had been struck by the fire whirl escaped through the hot black back to the road. While walking to the road, they were met by Cateland 1 engine foreman while he conducted a quick search of the hot black for additional victims when he learned of the situation. These two firefighters received serious burn injuries. Four of the five other firefighters who were able to escape through the green/unburned area received less serious injuries. The Eldorado Hot Shots began to account for their personnel along the road as firefighters reached it. As injuries were discovered, immediate medical treatment was provided by Emergency Medical Technicians (EMT) from the Eldorado IHC and a medical emergency was declared. An air medevac was requested. Approximately 1 ½ hours later, an initial medevac helicopter picked up the two most seriously injured fire fighters and transported them to Humbolt General

Hospital in Winnemucca. The third most seriously injured fire fighter was also taken to Humbolt General Hospital by a Careflight helicopter approximately 3 ½ hours after the medical emergency was declared. After a medical evaluation, it was determined that the first two firefighters were to be transported to University Medical Center in Las Vegas for further treatment. The remaining Eldorado IHC members departed from the fire to return to Winnemucca. Three additional firefighters were taken to Humboldt General Hospital in Winnemucca for treatment for minor burn injuries and smoke inhalation and released. The Bureau of Land Management activated a Serious Accident Investigation Team (SAIT) to investigate the burnover. The SAIT consisted of BLM and Forest Service members. The team arrived in Winnemucca on Wednesday, July 26 and began to investigate the incident.

Chronology of Events

July 25, 2006: (times are approximate)

0600: Eldorado IHC is dispatched to Trident Fire Nevada from Six Mile II fire near Virginia City, NV

0900: FMO Winnemucca has dialog with Trident IC requesting IMT resume command of NY Peak Fire at 1300

1030: Eldorado IHC arrives in Winnemucca and meets with the FMO and AFMO for a briefing and clarification of their assignment.

1130: Eldordo IHC departs from Winnemucca.
Eldorado IHC is diverted from Trident Fire to New York Peak, via radio conversation with OSC2.

1430: After a lunch stop, Eldorado IHC arrives on NYP fire and is briefed by the new ICT3.

1500: Eldorado IHC is assigned positions and locations on fire

1530-1600: Burn out operation continues with Eldorado IHC assigned to Division C.

1530 – Formal transition occurs to the new ICT3.

1540: Burn out begins to the corner on the dozer line adjacent to Chicken Creek. Weather info at this time: temp = 90, RH= 29%, SE winds 3-5 mph

1640-1655: A dust devil in the black causes spot fires across the road to the east.

1650: The crew boss and crew member #1 complete burn out operations on the south side of the burnout area, working around crew buggies and to the north.

1655: Spot fire #1 is detected by DeLong dozer, air attack, and members of the Eldorado IHC.
DeLong dozer moves to start direct dozer line on spot fire #1 which is backing into the wind (east).
Crew member #1 is directed by the crew boss to light the dozer line from the area near the crew buggies to north of the dozer line (Chicken Creek).
Crew member #1 and the crew boss recognize a wind shift at this time

coming from the west.

1705: A dust devil is spotted by ATGS in the big bowl within the burned perimeter (bowl is west and above spot fire #1)
Cateland Engines 1 & 4 move to the flanks of spot fire #1; Engine 1 lays hose 200 feet down the right flank; Engine 4 is on the left flank.
Dozer boss and squad of six crew members begin support of the dozer line.

1705-1722: Lookout moves along the ridge near Chicken Creek, south towards a vantage point overlooking spot fire #1.
Spot fire #2 appears 200 yards south of spot fire #1.
Crew boss and crew members #2 and #3 work on spot fire #2.
Spot fire #3 appears and Patrick 15 crew moves to the spot.
Wind shifts from the west.
Dust devils and fire whirls appear on spot fire #1.
Cateland 1 right flank hose crew retreats.
Div C orders disengagement.
Dozer boss calls for retreat. He and his squad of six move towards the road and are hit with a fire whirl and strong flame front.
The escape route (dozer line) is cut off by flames.
Dozer boss yells to retreat and to follow him through the green. Crew members #4, #5, and #6 immediately exit thru the green north of the dozer line, yelling for the remaining three crew members to follow.
Crew member #7 hesitates behind the dozer blade and then follows the dozer boss.
Crew members #8 and #9 are struck by the fire whirl and crew member #8 is thrown to the ground.
Crew boss and crew members #4, #5, #6, and #7 arrive at the road.
DeLong D8 dozer is burned over with flame heights over the environmental cab.
DeLong dozer hesitates 20+ seconds due to concerns for firefighters possibly taking refuge near the dozer and then backs out through flames to the road.
Engine boss (Cateland 1) responds to calls for help and runs thru the hot black. He meets and directs crew members #8 and #9 back to the road. Crew member #8 believes six crew members are still unaccounted for at this time. Engine boss (Cateland 1) continues to search thru the hot black to the end of dozer line; finding no one he retreats back to the road.
Eldorado IHC account for all personnel and medical care is started on three patients (crew members #7, #8, and #9). Div C calls/requests medevac ATGS to Dispatch.

1724: Air Attack (5AR) calls Central Nevada Dispatch Center for medevac helicopter (2SA) to re-route from Winters fire to NY Peak Fire; 2SA returns to Winnemucca for fuel.

1727: Careflight duty officer is notified by CNDC Center Manager.

1742: 2SA departs Winnemucca en route to NY Peak Fire.

1813: 2SA contacts Careflight to transport 3rd patient.

1816: 2SA arrives at NY Peak Fire.

1835: 2SA departs NY Peak Fire with two patients (crew members #8, #9).

1921: 2SA is on the ground at Humboldt General Hospital, Winnemucca.

1948: Careflight departs Winnemucca for 3rd patient.

2029: Careflight departs NY Peak Fire with 3rd patient (crew member #7)

2106: Careflight is on the ground in Winnemucca (Humboldt General Hospital).

2127: Fixed wing aircraft leaves Winnemucca for Las Vegas with crew members #8, #9.

2134: Eldorado IHC leaves NY Peak Fire.

2140: Crew member #7 is released from the hospital.

2300: Majority of the crew arrived at motel in Winnemucca.

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0130: Dozer boss and crew members #4, #5 are treated for minor injuries at Humboldt General Hospital and released.

Investigation Process

The SAIT was activated on the evening of July 25th by a delegation of authority from the Acting Director, BLM Office of Fire and Aviation. The team arrived at the BLM Winnemucca Field Office on July 26th to begin the investigation. Team members began to investigate the incident by conducting on-site and off-site interviews, collecting witness statements and data to support the investigation. The team visited the site of the incident on the New York Peak fire with members of the Eldorado IHC on July 27th. The team reviewed the sequence of events leading up to and including the burn over incident and the medevac. Personal interviews were conducted. Recorded witness statements were sent to the team by two injured crew members on August 21stsince the crew members remained hospitalized due to their injuries. The team used guidance for investigating an entrapment to fully consider all elements relating to this burn over incident. Human, materiel, and environmental factors were considered. Environmental factors were the most significant contributors to this accident.

Entrapment Investigation Elements

FIRE BEHAVIOR

- Fuels –significant contributing factor NFDRS fuel model T and FBPS 2 (sagebrush, bitterbrush, and grass). Winnemucca BLM Fire Management typically uses this fuel model for fire behavior prediction. Statewide fine fuel carryover is estimated around 70% to 90% above normal adding to the continuity of the fuel bed. Fuel loadings in fine fuels are heavy averaging 1500 to 2000 pounds dry weight.
  - Dead fuel moisture was 5%. Moisture determined by using observed weather reading taken on site by weather observer.
  - Live fuel moisture readings taken from the closest fuel sampling sites on 7/17/2006 ranged from 106% to 113%.
  - 1000 Hr Fuels Moisture reading taken from the closest reading site measured 6%.
- Weather - significant contributing factor
  - The wind shifting in direction caused the fire to change direction throughout the day. However, the velocity of the wind did not change significantly during the wind shifts.
  - The fire whirls that developed inside the spot and moved through the flames striking the squad members likely were created by heating from the spot fire and atmospheric instability.
- Topography – influencing factor
  - Atmospheric instability along with high temperatures, low relative humidity and topographical influence created high fire behavior activity.
  - The instability along with surface heating from the fire and topographic influence contributed to the formation of the fire whirl(s) in the area of the burnover incident.
- Predicted v. Observed – significant contributing factor
  - The Trident Fire IAP weather information was not reflective of the actual conditions on the New York Peak Fire during the events surrounding the burnover incident. A low potential for spotting was predicted, however mulitple spotting occurred. Little variability in the winds was noted however, a significant wind shift contributed to the burnover incident.

ENVIRONMENTAL FACTORS

- Smoke – did not contribute
- Temperature – influencing factor
  - Atmospheric instability along with high temperatures, low relative humidity and topographical influence created high fire behavior activity.
- Visibility – did not contribute
- Slope – influencing factor
  - Orographic and topographic influences added to localized convection and instability which contributed to dust devils/fire whirls.

INCIDENT MANAGEMENT

- Incident Objectives – influencing factor
  - Utilize the IAP from Trident Incident for operational period July 25, 2006
    - For all IA – Full suppression and minimize fire size.
- Strategy – influencing factor
  - Use direct/indirect tactics to contain fire –
    - East of Ridgeline between Snow Creek and Chicken Creek
    - West of road that parallels Leonard Creek
    - North of Snow Creek
    - South of Chicken Creek
- Division C Tactics – influencing factor
  - Burn out from Chicken Creek Drainage south to cold black along the north/south road that parallels Leonard Creek.
  - Division C Assignments (July 25, 2006)
    - Division C to assume the role of Division Group Supervisor (DIVS) assigned by ICT3.
    - Assumption of Crew Boss (CRWB) role for the Eldorado Hot Shots.
    - Lookout, crew member #2, and another crew member assume roles as Squad Bosses for IHC
    - One Squad boss assumes role of Dozer Boss (DOZB).
    - Other resources assigned were DeLong D-8 Dozer, Cateland 1 and Cateland 4 Type VI engines, PatRick 16 Type II Crew, Miller 13 Type II Crew.
- Safety briefings/major concerns – did not contribute
  - Multiple briefings were conducted.
  - Specific briefings addressed current tasks.
  - During the shift re-evaluation and trigger points were developed.

- Risk Management process was in place and LCES was re-evaluated and adjusted throughout the shift.
- Weather briefings were provided with the weather information in the Trident Fire IAP. ICT3 and Crew boss briefed personnel on fire behavior and weather prior to initiating fire suppression operations.

- Instructions given – influencing factor
  - Specific tasks and instructions were given and reflected incident objectives and strategy.

CONTROL MECHANISMS

- Span of control
  - Was adequate and did not contribute
- Communications
  - Were adequate and did not contribute
- Ongoing evaluations
  - Appeared that assessment and reassessment was continuously taking place with the Risk Management Process, LCES, and Trigger Points. Did not contribute.
- 10 Standard Fire Orders/18 Watch Out Situations – influencing factors
  - The 10 Standard Fire Orders were not compromised.
  - The following 18 Watch Out Situations were present.
    - Watch Out 11 – Unburned fuel between you and the fire.
      - The dozer line along spot fire #1 was direct with isolated pockets of unburned fuel existing near the end of the dozer line. It was estimated that these unburned pockets were approximately 5-15 feet from dozer line.
    - Watch Out 15 – Wind increases and/or changes direction.
      - A wind shift occurred at approximately 1655. The crews, Air Tactical Group Supervisor and Division Group Supervisor recognized and communicated to all about the wind shifts. Shortly after the first wind shift was recognized, dust devils appeared in the burn area near the fireline.
    - Watch Out 16 – Getting frequent spot fires across the line.
      - Multiple spot fires occurred within a ten minute time span.
    - Watch Out 17 – Terrain and fuels make escape to safety zones difficult.
      - Flames over the dozer line (left flank) of spot #1 impeded the escape route to the designated safety zone.

PERSONNEL PROFILES OF THOSE INVOLVED

- Training/Qualifications/ Physical Fitness
  - The Investigation Team reviewed all of the training, qualifications, and physical fitness of the crew involved in this incident and concluded that none of these items were a factor that influenced or contributed to the burnover incident.
  - The Investigation Team looked at the incident qualifications of the crew and found that all crew members had the proper training and qualifications needed for the positions they filled on this assignment per Interagency Standards for Fire and Fire Aviation Operations, Incident Qualifications Handbook 310-1, The Interagency Hot Shot Operations Guide, and FS Handbook 5109.17.
- Length of Operational period/fatigue
  - The Investigation Team concluded that the length of the operational period and fatigue were not a factor that influenced or contributed to the burnover incident.
  - The day of the burnover was the first day that the crew was assigned to the fire and they had 12 days left on their current work cycle. The crew traveled from Virginia City and arrived on the New York Peak Fire at approximately 1400 on the day of the burnover incident.
  - Crew showed great cooperation with other units assigned to the operation by checking on the IA fatigue level and limiting exposure of resources during burn out operations.
- Attitudes
  - The Investigation Team concluded that attitudes were not a factor that influenced or contributed to the burnover incident. The crew acted professionally on the fire.
- Leadership
  - The Investigation Team concluded that leadership was not a factor that influenced or contributed to the burnover incident.
  - The crew arrived on the fire and took a very proactive approach to carry on the assignment. They immediately recognized the fatigue factor of the initial attack resources and staged them to provide them some rest. As soon as possible, Div C assumed command and Eldorado IHC engaged in burnout operation.
- Experience Levels
  - The team concluded that experience levels were not a factor that influenced or contributed to the burnover incident. The crew met the experience level of having 80% or more of the members with more than one year experience.

EQUIPMENT

- Availability
  - Sufficient resource support was on scene (crews, equipment, air support, etc.).
  - Helicopter 2SA (Aerostar) was designated by the IMT as the medevac platform. This platform was Winnemucca BLM's designated Initial Attack helicopter. Winnemucca BLM was using this helicopter on the Winters Fire which was approximately 30 minutes out from Winnemucca. BLM Fire Management was unaware that the IMT had designated this helicopter as a medevac platform. Duty time used for suppression became an issue during the second flight of medevac in that the pilot would exceed his daily duty time.
- Performance/nonperformance
  - The environmental cab on the DeLong D-8 Dozer protected the operator and allowed him to remain in place to provide protection to firefighters impacted by the direct flames during burnover incident. Absent the presence of the dozer and its shielding effect, injuries sustained by firefighters could have been more serious.
- Clothing and equipment
  - PPE was provided and available to all firefighters.
  - MTDC Reported that it appears that the clothing performed as designed. Reference Appendix C.
  - One individual was not wearing gloves and suffered burns on his hands.
- Used for intended purpose?
  - The dozer remained on site long enough to afford protection to fire fighters caught in the burn over. Fire fighters were able to shield themselves behind/beside the dozer from direct flame impingement. The dozer operator's choice to remain in place momentarily is commendable.

Causes of the Accident

Direct cause:

A direct cause is the contact with energy or hazardous material which resulted in injury or other damage. In this incident, heat exposure from fire caused the burn injuries to 6 individuals on the Eldorado Interagency Hotshot Crew (IHC). A fire whirl developed suddenly and blew through the area where some members of the Eldorado IHC were constructing line. Some members of the crew were struck by the whirl. Fire shelters were not deployed. Other than normally worn PPE, crew members did not have other protection from the heat and flames.

Indirect causes:

Indirect causes are those unsafe (substandard) practices or conditions which allowed or contributed to the contact.

1) Fuel source existed between the line and the burned area. A strip of unburned fuels, estimated at 15' – 30' wide, became engulfed in the flame front that blew across the dozer line that had been cut to flank the spot fire. This compromised the established escape route. An escape route was established and known, but became inadequate due to sudden and unpredicted wind change.

2) The atmospheric instability along with surface heating from the fire and topographic influences contributed to the formation of the fire whirl(s) in the area of the burnover incident. The presence of cumulus clouds may have contributed to variability of the wind shift.

3) Dust devils blew spot fires into the green (across the line). Dust devils also contributed to the development of fire whirls on this incident. Dust devils are very common occurrences in the Great Basin during summer months and create Watch Out Situations for wildland fire suppression activities.

4) PPE was available but not used by all personnel. Not wearing gloves resulted in hand burns for at least one crew member.

Other (not contributing):

5) Medevac for burn victims was delayed due to Winnemucca BLM using this helicopter on the Winters Fire and other missions. The Winters fire was approximately 30 minutes out from Winnemucca. BLM Fire Management was unaware that the IMT had designated this helicopter as a medevac ship. Duty

time used for suppression became an issue during the second flight of medevac in that the pilot would exceed his daily duty time. Had the injuries been more serious, or if more crew members had been injured, results could have been fatal.

Appendices

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Appendix A

Overview and Detail Maps

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Appendix B

Fire Behavior Analysis

On July 25th, 2006 the Eldorado Hotshot Crew was conducting a burn out operation on the New York Peak Fire in northern Nevada. The burn out operations started at approximately 1530. The burn out was almost complete when the crew noticed the wind starting to shift in direction. Up until this point the wind had been in a favorable direction, mainly easterly and upslope. A decision was made to continue with the burn out due to almost being completed and having adequate resources on site. At or about the time the firing was completed a dust devil developed inside the burn area and moved across the control line creating three spot fires. The spot fires begin to grow quickly due to the receptive fuel bed of dead grass and shrub that had critically low live fuel moistures. The wind continued to shift back and forth in direction while the spots were being sized up and during suppression efforts. As spot 1 began to grow and move to the east out a small ridge, a squad from Eldorado Hotshot Crew along with one Dozer and two engines took suppression action on the spot. The dozer started constructing direct line along the left flank of the spot moving to the east. After the dozer had gone approximately 150yrds the DOZB decided to stop line construction with the dozer and start handline with the Eldorado squad. The squad's mission was to cut line around the east and south of the spot fire back toward the Cateland 1 Engine Crew. The sawyer had just started cutting when the wind shifted from easterly to westerly, the squad leader made a decision to disengage and move the squad back up the dozerline towards the road, which was also their predetermined escape route. The dozer had been staged on the line about 30 yrds from the end of the dozerline. When the squad had made it back to the dozer a fire whirl came from inside the spot fire and directly hit three members of the squad resulting in two of them getting overtaken by the flames. The third crewmember was burned but was able to continue on through the green out to safety. The two squad members that were overtaken by the flames retreated through the hot black to the road. The dozer was also burned over during this time, but no injuries were sustained to the dozer operator due to being in an enclosed environmental cab. The dozer operator stated that the flames were over the top of the cab during the burnover incident.

Weather taken on site by crew:

Temp 88 RH 29% Wind 1-3 E,SE @1540
Temp 90 RH 28% Wind 1-3 E,SE @1600
Temp 90 RH 26% Wind 1-3 E Gust 5 SE @ 1700

Forecasted Weather:
Partly to mostly cloudy, maximum temperatures 88-98 valleys to 80-90 midslope, minimum relative humidity 15-20% valleys to 19-27% midslope. 20 foot wind speeds – valleys/slopes – upslope 3 to 7 mph with ridge top northwest 6 to 12 mph.
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Observed fire behavior on New York Fire

Typical fire behavior when wind shifted creating a head fire. Fire moving towards road to the east.

10 to 20 ft flame lengths

Typical fire behavior when fire was backing towards road. Wind blowing uphill to the west. Fire backing towards road.

4-6 ft flame lengths

The area to the left of personnel is where spot fire #1 occurred. This photo shows the actual fuel that was consumed in spot fire #1.

Dead fuel moisture was 5%. Moisture determined by using observed weather reading taken on site by weather observer. Readings were entered into the BeHave Plus 3.0.2 Fine Dead Fuel Moisture Tool.

Live fuel moisture readings taken from the closest fuel sampling sites on 7/17/2006 ranged from 106% to 113%.

1000 Hr Fuels Moisture reading taken from the closest reading site measured 6%.

Picture taken of spot fire #1. The Eldorado IHC squad was preparing to start handline back towards road from end of dozerline. Fire was backing due to wind being from the east, southeast.

Photo taken after wind shift and fire whirl occurred. Head fire due to westerly wind.

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Wind Shift and Dust Devil casual factors:

It is not clear to what causes the wind to shift throughout the burning period or at the time the burn over took place. There were presents of cumulus buildup in the area which could have contributed to the shifts in wind. Atmospheric instability along with local topography influence could also have been a contributor to the wind shifts. The closest RAWS station was over 10 miles away and the readings from the stations recorded wind shifts during this same time. There was not a frontal passage forecasted and a frontal passage did not occur over the fire.

The dust devil that caused the three spot fires was created by surface heating and unstable atmospheric conditions which is very typical in the Great Basin. The fire whirls that developed inside the spot and moved through the flames striking the squad members likely was created by heating from the spot fire and atmospheric instability.

16:21:40
This image was taken roughly half way (distance wise) through the burn operation. The first spot occurred near the ridge on the far right of the image.

16:19:09
This image shows the typical cloud cover during the burn operation, as the crew holds the line. The same cloud cover was present during and after the spot occurred.

Photo taken looking to the west before the burnout took place. Notice the clouds in the back ground. Chicken Creek is to the right and the area to be burned out is to the left.

Fuels – Significant Contributor

The wet winter throughout the Great Basin has caused tremendous fine fuel growth of native, non-native species. Specifically, the non-native and invasive species including cheat grass (Bromus tectorum) and Red Brome (Bromus rubens L) have increased the amount of fine flashy fuels. In addition, statewide fine fuel carryover is estimated around

70% to 90% above normal adding to the continuity of the fuel bed. Fuel loadings in fine fuels are heavy averaging 1500 to 2000 pounds dry weight. This has been reported in most Great Basin ecosystems.

The fine dead fuel moisture was critically low due to the high temperatures and low relative humidity. The "Fire Behavior and Tactics" insert from the "Great Basin Live Fuel Moisture Projects" states that when live fuel moistures range from 101% to 125% that fire will exhibit high fire behavior. See appendix xxx

High Fire Behavior is defined as: Fires will exhibit HIGH FIRE BEHAVIOR leaving no material unburned. Head attack with fire engines and dozers will be nearly impossible on large fires, but still may be possible on smaller, developing fires. Retardant aircraft will be necessary on all these fires. Flanking attack by engines and indirect attack of the fire must be used. Spotting should be anticipated. Fires will begin to burn through the night, calming down several hours before sunrise.

Weather – Significant Contributor

Atmospheric instability along with high temperatures, low relative humidity and topographical influence created high fire behavior activity. The fine dead fuel moisture was calculated to be 5% when the spot fire occurred. The wind shifting in direction caused the fire to change direction throughout the day. However, the velocity of the wind did not change significantly during the wind shifts. Typically the fuel type in this area does not contain a 1000 hr fuel component (larger woody material 3 to 8 inches in diameter) but the reading of 6% at Winnemucca indicates that seasonal drying had been severe. The instability along with surface heating from the fire and topographic influence contributed to the formation of the fire whirl(s) in the area of the burnover incident.

Appendix C

Incident Action Plan (IAP) for Trident Fire

IAP for the Trident Fire is used for July 25, 2006 since the New York Peak Fire IAP was not developed until July 26.

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Appendix D

Equipment Analysis

Equipment Report – New York Peak Fire
This report is based on inspection of the personal protective equipment used by three firefighters working the New York Peak Fire on July 25, 2006. Inspection of the aramid clothing and hard hats worn by the firefighters occurred at Missoula Technology and Development Center (MTDC) on August 22 and 23, 2006. No injury reports were received and no personal interviews were conducted for this report.

Crew Member #8:
Pants – GSA, Manufacturer: Lamar International
Date of mg. – October 2001
Size: 32-36 X 30
Heavy dye sublimation of the pant material is present in the lower leg areas from cuff up to 9 inches above the cuff. Moderate to light dye sublimation was present up to 24 inches from the cuff. Folded edges of material on the cargo pockets and exposed thread ends also show dye sublimation.

Shirt – GSA, Manufacturer – Terry Manufacturing
Date of Manufacture: Illegible label
Size: Large
Light dye sublimation of fold lines of right arm (as if the shirt received heat while the firefighter had his arm bent). Thread ends of a small hole in the sleeve show dye sublimation. The nylon Velcro pile located on the cuff of both sleeves is slightly singed.

Undershirt – Manufacturer – Fruit of the Loom
Contents: 90 % cotton, 10 % polyester.
No sign of heat is present.

Crew Member #7:
Pants – Manufacturer: Western Shelter Systems
Date of mfg: April 2004
Size: L-34
Many small (less than 1 inch) spots of dye sublimation near the cuff of the pant legs are present. Folded edges of material on the cuff adjustment strap, the cargo pockets and exposed thread ends also show dye sublimation.

Shirt – GSA, Manufacturer: Workrite Uniforms
Date of mfg: October 2002
Size: XL

The nylon Velcro pile located on the cuff of both sleeves is slightly singed.

Crew Member #9:
Pants – Manufacturer: Western Shelter Systems
Date of mfg: June 2004
Size: M-30
Four small (less than ½ inch) spots of char within 4 ½ inches of the cuff on the right front were present along with dye sublimation (less than 1 ½ inches) surrounding the char areas. On the back of the right leg, lines of dye sublimation are present on creases of the material within 5 inches of the cuff. Both cargo pockets show dye sublimation on the folds of material as well as the cuff adjusters. Many (more than 30) small (less than ¼ inch) spots of dye sublimation are present on the right leg while there are fewer (less than 20) on the left.

Shirt – Manufacturer: Label missing. Appears to be aramid poplin weave; most likely the shirt was manufactured for GSA in the 1980's.
Date of mfg: Label missing.
Size: Large
The nylon Velcro pile located on the cuff of both sleeves is slightly singed.

Hard Hats – Several hard hats were examined. The hard hats varied between little or no heat damage to molten blob.

Note:

- Dye sublimation occurs when the temperature of the aramid material reaches 400 degrees Fahrenheit. The dye added to the material is "cooked" out leaving an orange color with the green material and a gray color with the yellow material.
- Char of the aramid material occurs at 824 degrees Fahrenheit.
- Nylon of the Velcro pile melts at 410 degrees Fahrenheit.
- Skin starts to blister when the skin temperature reaches 131 degrees Fahrenheit.
- Polycarbonate of hard hats begins to melt at 325 degrees Fahrenheit.

Discussion:
All three pants are made from DuPont's Nomex IIIA fibers. The materials used for each style of pant, although slight differences exist, have similar protective performance. Most likely the difference in the signs of heat on the material is because of different heat exposure. Field testing within fire fronts shows marked differences in temperatures and flame exposure from one area to another while even just a few feet apart.

The aramid cloth used in the flame resistant clothing is designed to withstand high temperatures. Like most fabrics, aramid will burn if exposed to flame. Unlike most others, it stops burning when the flame is removed so it does not contribute to injury.

When it chars, aramid thickens and forms a protective char that resists breaking so it continues to provide a limited barrier to flames.

It appears that the firefighters were appropriately equipped with clothing and hard hat and that the equipment performed as designed.

/s/ Tony Petrilli *September 12, 2006*

Tony Petrilli
Fire Equipment Specialist
MTDC

Date

Nomex pants worn by crew member; discoloration from heat damage.

Helmet dropped by crew member; heat damage.

Fuel container dropped by crew member.

Shovel dropped by crew member; heat damage.

Appendix E

Additional Photographs

Typical dust devil forming in the draw on July 26, 2006.

These photos were taken by crew member #1 and indicate approximate times of the fire's progression. Captions were provided by crew member #1.

17:21:38
The personnel on the first spot have already disengaged and are heading back up the dozer line. This photo shows the column standing up, prior to the fire whirl which carried the spot further. Also, the dozer has pulled back from its furthest progression.

17:22:13
This image shows the remnants of the fire whirl, which can be seen at right. The flaming front has already passed the dozer and has progressed at least 150 feet. Note the flying debris in the foreground, which shows a dust devil in the location in which the photo was taken. This image was taken further up the road towards the spot from the first image.

17:22:26
This image shows the spots' progression well past the dozer line and into the green. All constructed line has been overrun at this point. This image was taken approximately 30 feet further up the road towards the spot in relation to the second image.

Appendix F

Crew List and Dispatch Log

Appendix G

Incident Status Summary