



NIOSH
Fire Fighter Fatality Investigation
and Prevention Program

Death in the line of duty...

A summary of a NIOSH fire fighter fatality investigation

December 3, 2004

Career Federal Fire Fighter Dies from Injuries Sustained at Prescribed Burn - Arizona

SUMMARY

On May 14, 2003, a career federal fire fighter (the victim) was severely burned while working at a prescribed burn operation. The prescribed burn operation was conducted utilizing ground crews supported by a helicopter. The victim arrived on the scene at approximately 1100 hours and was assigned to provide reconnaissance and to assist two hand crews. At approximately 1425 hours, the lookout radioed the victim reporting that he could see a large column of smoke on the southeast end of the burn area. The victim headed down the drainage to investigate the flare-up while the crews remained on the ridge. At approximately 1435 hours, the victim, who was now in the drainage, ordered the crews to "Get out, get back into the black." At approximately 1445 hours, the victim radioed for help stating that he had been burned and was in need of medical assistance. The victim was flown to the local hospital where he received treatment before being transported by helicopter to the State Burn Center. On June 19, 2003, the victim died as a result of his burn injuries.

NIOSH investigators concluded that, to minimize the risk of similar occurrences, fire management agencies and fire departments should:

- ***ensure that prescribed burn plans are established and approved prior to ignition***
- ***ensure that the "Go-No-Go" decision checklist accurately evaluates the factors to be considered and is signed by the Burn Boss***
- ***ensure that fire fighters properly don and wear their personal protective clothing at all times while working in a hazardous environment***
- ***ensure that a designated lookout is positioned at a location that allows the observation of fire activity on the prescribed burn***
- ***ensure that fire fighters utilize all available resources (lookouts, helicopters, or lead planes, etc.) when investigating fire activity located in an area that does not have an established escape route***
- ***ensure that prior to the operational period all personnel involved in the prescribed burn operation receive and understand their assignment***
- ***ensure that all prescribed burn operations have a designated Incident Commander (IC)***



Incident Site

INTRODUCTION

On May 14, 2003, a 43-year-old male career federal fire fighter (the victim) sustained burn injuries while working on a prescribed burn operation. On June 19, 2003, the victim died as a result of his injuries. The National Institute for Occupational Safety and Health (NIOSH) was notified of this incident by the U.S. Fire Administration (USFA) on June 23, 2003. On July 14, 2003, a Safety and Occupational Health Specialist and the Senior Investigator from the NIOSH Fire Fighter Fatality Investigation and Prevention Program investigated the incident. A meeting was conducted with the Fire Management Officer, department officers, and fire fighters involved in this incident. Interviews were conducted with the department officers and fire fighters. The incident site was visited by the NIOSH investigators and photographs of the scene were taken. The NIOSH investigators reviewed a copy of the prescribed fire burnover fatality factual report provided by the Bureau of Indian Affairs. A phone interview was conducted with the Bureau of Indian Affairs Regional Safety Officer.

Agency Involved in the Incident

The department involved in this incident is a wildfire agency that has 57 permanent employees and approximately 250 seasonal employees. The agency serves an Indian Reservation with a population of approximately 15,000 in an area of approximately 1.6 million acres.

The primary objectives of the prescribed burn were to improve up to 2,000 acres of existing decadent livestock and wildlife habitat, in an overall area of approximately 14,800 acres. The prescribed burn plan was not approved by the Bureau's Regional Director.

Training and Experience

The victim was Red Card qualified as a Division Supervisor (DIVS), Incident Commander Type 3 (ICT3), Line Scout (LSCT), and Prescribed Fire Burn Boss Type 2 (RXB2). The victim had 25 years of wildland fire fighting experience.

Equipment and Personnel

Approximately forty personnel, including two burn bosses, were assigned to the prescribed burn initiated on Monday, May 12. A total of 1,200 acres were successfully burned without incident the first two days (May 12 and May 13). On May 14, there were two groups of personnel assigned to ground operations. The first group included Burn Boss #1, Crew Boss #1, Squad Boss #1, and Squad #1 (consisting of three personnel [hand crew]). The second group included Burn Boss #2, Crew Boss #2, Squad Boss #2, and Squad #2 (consisting of three personnel [hand crew]). The victim was not assigned to the prescribed burn. He informally attended the morning briefing and arrived on the scene at approximately 1100 hours to provide assistance as needed. He was directed to provide reconnaissance and assistance to the two hand crews. The ground crews were supported by a helitack crew (Helicopter Manager and pilot) operating a Type III helicopter. The helitack crew provided reconnaissance and suppression efforts. *Note: A Type III helicopter must be able to seat five and carry a drop bucket with a 100 gallon carrying capacity.*

Weather Conditions

The weather forecast for the day of the incident called for temperatures of 65-76 degrees Fahrenheit, a minimum relative humidity (RH) of 12-15%, winds from the south at 10-20 mph increasing to 15-20 mph in the late afternoon, and a chance of thunderstorms.

An on-site weather observation was taken on the ridge top above the incident site at approximately 1400 hours. The lookout recorded a dry bulb reading of 85 degrees Fahrenheit, a wet bulb reading of 55, a RH of 13%, and southwest winds (wind speeds were not recorded). A remote automated weather station (RAWS) located approximately 10 miles northeast from the incident site, at an elevation of approximately 5,400 feet, recorded a RH of 8% at 1411 hours on the day of the incident.

Incident Site Description

Size – The incident site occurred in a portion of the designated 2,000 acre prescribed burn area.

Topography – The prescribed burn area was located in rugged mountainous terrain. The area was very broken and rolling with flat ridge tops grading into steep narrow canyons with slopes up to 60%. Elevations in the area range from 5,200 feet to 6,500 feet.

The incident site was located at the bottom of a canyon that primarily runs from the southeast to the northwest. There are three drainages (running to the northeast, north and northwest) that converge at an elevation of approximately 5,600 feet having slopes of 10% to as steep as 60%.

Vegetation – The primary vegetation in the canyon bottoms was ponderosa pine, intermixed with several brush species that included pinyon, juniper and oak. The upper slopes had pinyon-juniper (with a minor component of chaparral), with very limited grass and herbaceous fuels.

INVESTIGATION

The prescribed burn operation began on May 12 with a total of 1,200 acres of the designated 2,000 acres being successfully burned on the first two days. On May 14, at approximately 0700 hours, a morning briefing was conducted by the two designated burn bosses. Everyone involved in the operation, including the victim (who was not assigned to this operation), attended the briefing. The briefing outlined the objectives for the day, including the prevention of the burn backing down to the Holy Grounds of the Indian Reservation. No ignition was to take place on this day as the fire continued to burn from the first two days.

The reconnaissance flight, conducted at approximately 0900 hours by the two Burn Bosses (Burn Boss #1 and Burn Boss #2), identified two areas that needed attention. One of the two areas identified was located along the east side of the burn where fire was backing down the drainage towards the Holy Grounds. The second area of concern was located approximately ½ mile north of the Holy Grounds. Once on site, the ground crews were briefed on the observations of the reconnaissance flight and assigned to construct hand lines to stop the fire from backing down to the Holy Grounds. Crews would be supported with bucket drops from the helicopter (H-355).

At approximately 1100 hours, the victim arrived at the Holy Grounds where he met with Burn Boss #1. The victim was assigned by Burn Boss #1 to provide reconnaissance in the southeast portion of the burn area and to work with the two crews. Approximately thirty minutes later, the victim caught up with Burn Boss #1 along the southern edge of the fire. The Burn Boss instructed the victim to continue working the lines and to identify areas that needed bucket drops. The Burn Boss then left the area to continue his assessment of the fire while the victim proceeded up the drainage to assess the hot area to the north of his location. Crews continued constructing hand lines on the east and west sides of the drainage while being supported with bucket drops from H-355 ([Photo 1](#)).

At approximately 1145 hours, the two crews took a lunch break at the base of the drainage. The victim radioed the crews and instructed them to follow his flag line to work another hot area of the fire. The crews finished their lunch and then proceeded up the drainage. Squad Boss #2 remained at the base of the drainage to patrol the area and Crew Boss #2 stayed behind as she was experiencing problems with her radio. The hand crews were working on line construction while the victim directed the helicopter on bucket drop locations.

At approximately 1400 hours, the Helicopter Manager advised the victim that he had to shut down helicopter operations for refueling and to allow the pilot to take a lunch break. The victim radioed Crew Boss #1, who was now acting as the lookout on the south side of the burn area, to get an updated weather reading. Crew Boss #1 recorded a dry bulb reading of 85 degrees Fahrenheit, a wet bulb reading of 55 degrees Fahrenheit, a RH of 13%, and southwest winds (wind speeds were not recorded). Crews reported to NIOSH

investigators that fire activity was beginning to increase as the temperature was rising and the relative humidity was dropping.

At approximately 1425 hours, the victim radioed the Helicopter Manager requesting bucket drops as the fire was beginning to “heat up.” The lookout radioed the victim and reported that he had spotted a large column of smoke on the southeast end of the burn area. The victim acknowledged the communication and informed the lookout that he was going to go down the drainage to check out the situation. The lookout took another weather observation and radioed the victim advising him that the RH was low and to watch out. The victim attempted to radio for a bucket drop but was having difficulty transmitting out of the drainage. The victim then radioed Crew Boss #2 to call for the bucket drop. At approximately 1432 hours, the helitack crew received the transmission and launched the helicopter with the bucket. At approximately 1435 hours, the victim ordered the crews, who were still on the ridge, to “Get out, get back into the black.” The hand crews proceeded to the safe area while Squad Boss #2 and Crew Boss #2, who were still at the base of the drainage, headed down the drainage toward the Helibase ([Photo 1](#) and [Map](#)). The victim was now trapped at the bottom of the drainage as the blowup^a occurred. The victim then proceeded down the drainage in an attempt to escape while trying to deploy his shelter. *Note: The incident site experienced an increase in fire activity (from 1400 to 1600 hours) that burned approximately 40 acres of the designated prescribed burn area.*

At approximately 1445 hours, the victim radioed for help stating that he had been burned and was in need of medical assistance. *Note: The victim was wearing fire-resistant clothing at the time of the incident, however he was not wearing his leather work gloves and his shirt sleeves were not rolled down to his wrists.* Squad Boss #2 and Crew Boss #2 heard the radio transmission and headed back up the drainage to assist the victim. After hearing the victim’s call for help, the helicopter pilot returned to the Helibase and had the bucket removed before flying to the incident area.

Squad Boss #2 and Crew Boss #2 located the victim as he was walking down the drainage through the heavy smoke. The victim told the Squad Boss that he had deployed his fire shelter but did not lie on the ground as he feared that if he had he would not have made it ([Photo 2](#)). The victim then stated to the Crew Boss “it got me from behind, don’t know what happened, I tried to deploy my shelter, but the fire took it away from me, I walked through it, it happened so fast, it came from behind me.”

The helicopter pilot radioed Central Dispatch advising them that they had an injured fire fighter and requested an Emergency Medical Technician (EMT). An ambulance was dispatched, however due to the severity of the victim’s injuries and the time required in getting an ambulance on site, it was decided that it would be quicker to transport the victim by helicopter (the Type III helicopter used during the prescribed burn operation). The victim was picked up and driven by pickup truck to the Helibase where he was then flown to the local hospital at approximately 1510 hours. At approximately 1513 hours, the helicopter landed and the victim walked inside and received treatment. Within an hour the victim was transported by air to the State Burn Center. Thirty-six percent of the

victim's body surface area had second and third degree burn injuries and he had a significant inhalation injury. The victim died as a result of his burn injuries on June 19, 2003.

^a *Blowup: Sudden increase in fire intensity or rate of spread sufficient to preclude direct control or to upset existing control plans.*

CAUSE OF DEATH

The medical report listed the cause of death as Adult Respiratory Distress Syndrome secondary to severe inhalation injury with cardiovascular compromise.

RECOMMENDATIONS/DISCUSSIONS

Recommendation #1: Fire management agencies and fire departments should ensure that prescribed burn plans are established and approved prior to ignition.^{1, 2, 3}

Discussion: The federal *Interagency Standards for Fire and Fire Aviation Operations* states that “the safety of fire fighters and the public is the number one priority” and “all prescribed fire projects will have an approved prescribed fire plan prior to ignition.” Prescribed burn plans should include a number of required elements (e.g., burn unit description, ignition plan, proposed schedule, pre-burn considerations, etc.). The burn plan is then approved by a designated official; in this case, the Western Regional Office. The original burn plan was rescinded by the Western Regional Office in May 2001. No approved burn plan existed at the time of ignition in May 2003.

Recommendation #2: Fire management agencies and fire departments should ensure that the “Go-No-Go” decision checklist accurately evaluates the factors to be considered and is signed by the Burn Boss.^{1, 2, 3}

Discussion: The Bureau of Indian Affairs' *Fire Use Handbook's Go-No-Go Checklist* is to be utilized by the Burn Boss to ensure that all factors such as weather, personnel, and equipment are within the parameters of the proposed prescribed burn plan. A negative response to any question on the checklist requires the suspension of burn operations until there is a change in the conditions or the conditions have been mitigated and a positive response can be made to each of the questions.

The “Go-No-Go” checklist did not accurately evaluate the factors to be considered (e.g., no approved burn plan existed and the burn conditions were not within prescription

parameters). The “Go-No-Go” checklist was signed by the fire management officer and the forest manager, rather than the burn boss.

Recommendation #3: Fire management agencies and fire departments should ensure that fire fighters properly don and wear their personal protective clothing at all times while working in a hazardous environment.^{2, 4, 5}

Discussion: Safety is the responsibility of everyone assigned to wildland and prescribed burn operations and must be practiced at all operational levels. The *Fireline Handbook and the Wildland Fire and Aviation Program Management and Operations Guide* both list required clothing and personal protective equipment (PPE) and how they should be used while working in hazardous environments. Flame-resistant clothing, that meets or exceeds the NFPA 1977 standard on protective clothing, should be worn while on the fireline with the sleeves of the shirt rolled down to the wrists. Leather gloves should be worn to protect the hands.

Recommendation #4: Fire management agencies and fire departments should ensure that a designated lookout is positioned at a location that allows the observation of fire activity on the prescribed burn.^{2, 4}

Discussion: In the wildland fire environment, Lookouts, Communications, Escape Routes, and Safety Zones (LCES) are keys to safe procedures for fire fighters and should be a part of the prescribed burn plan. Before fighting a fire, a lookout or lookouts must be selected, a communication system established, escape route(s) identified, and a safety zone or zones selected.

Lookouts assess and reassess the fire environment and communicate any threats to the safety of fire fighters. Fire fighters then use escape routes to access safety zones. Lookouts must have a good working knowledge of crew locations, escape routes and safety locations, and be equipped with a map, weather kit, watch, and incident action plan (IAP).

At this incident, it was unclear who was to serve as the designated lookout and where the individual was to be located in order to observe the activities on the burn. One individual serving as a lookout was unable to see all the areas where the crews and the victim were working.

Recommendation #5: Fire management agencies and fire departments should ensure that fire fighters utilize all available resources (lookouts, helicopters, or lead planes, etc.) when investigating fire activity located in an area that does not have an established escape route.⁶

Discussion: Fire management agencies and fire departments should ensure that fire fighters utilize lookouts, air attack officers and aircraft when investigating areas with increased fire activity before committing themselves to an area that does not have a designated safety zone or escape route(s). Lookouts located along a ridge may have a

better vantage point where they can provide valuable information on current and potential fire behavior. Helicopters and fixed-wing aircraft can provide ground forces with an assessment of the situation as they have a wider view of the burn area. Utilizing available resources for remote investigation will help to ensure that fire service personnel remain in those areas that have designated safety zones and escape routes.

Fire fighters should utilize all available resources (planes, lookouts, etc.), when available, to provide them with remote investigation capabilities. This would reduce or eliminate the need of placing fire fighters in situations where escape routes or safety zones are not available. At this incident, a helicopter and lookouts were available to provide additional information regarding a large column of smoke spotted by one of the lookouts. No additional remote investigation or reports of fire activity occurred prior to the victim proceeding into the drainage where there were no designated escape routes or safety zones.

Recommendation #6: Fire management agencies and fire departments should ensure that prior to the operational period all personnel involved in the prescribed burn operation receive and understand their assignment.^{1, 2, 3}

Discussion: All personnel working on a prescribed burn must receive and understand their assignment prior to the initiation of an operation. To improve safety awareness at a prescribed burn operation, personnel must have an assignment and be briefed on their role in the project. This helps to ensure that personnel know what role each individual is playing, how they are dependent upon each other's actions, and that they fully understand how the project will be carried out to completion. One of the questions listed on the *Go-No-Go Checklist* for prescribed burn operations is "have all personnel been briefed on the prescribed burn plan and their assignments?" A "no" answer to this question would require the suspension of operations until the problem was corrected.

The victim had informally attended part of the morning briefing but was not assigned to this prescribed burn. He arrived on the site just prior to lunch where he met with one of the burn bosses and was assigned to provide reconnaissance for the crews while working in the southeast portion of the burn area. Not all of the personnel assigned to this prescribed burn were aware that the victim was on site and what his assignment or what his function was within that operation.

Recommendation #7: Fire management agencies and fire departments should ensure that all prescribed burn operations have a designated Incident Commander (IC).^{1, 2, 7}

Discussion: All fires, including prescribed burn operations, must have an Incident Commander (IC). A qualified Burn Boss would be designated as the IC at a prescribed burn operation. This allows the Burn Boss to manage and carry out the objectives of the prescribed fire plan. An effective operation requires that all fireground activity center around one incident commander. If there is no command, or if there are multiple commands, fireground operations will quickly breakdown in a number of key areas. The

key areas include the following: command and control, coordination, planning, organization, communications, and safety.

There were two Burn Bosses at this incident with no one person designated as the Lead Burn Boss or IC. Burn Boss #1 was the only authority figure aware of the fact that the victim was on the scene.

REFERENCES

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5. NFPA [1998]. NFPA 1977. Standard on protective clothing and equipment for wildland fire fighting. Quincy, MA: National Fire Protection Association.
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7. Brunacini AV [1985]. Fire command. Quincy, MA: National Fire Protection Association.

INVESTIGATOR INFORMATION

This incident was investigated by Mark McFall, Safety and Occupational Health Specialist, and Richard Braddee, Senior Investigator with the Fire Fighter Fatality Investigation and Prevention Program, Fatality Investigations Team, Surveillance and Field Investigations Branch, Division of Safety Research, NIOSH.

EXPERT REVIEW

Expert review was provided by Dick Mangan, Blackbull Wildfire Services, LLC.

PHOTOGRAPHS AND MAP

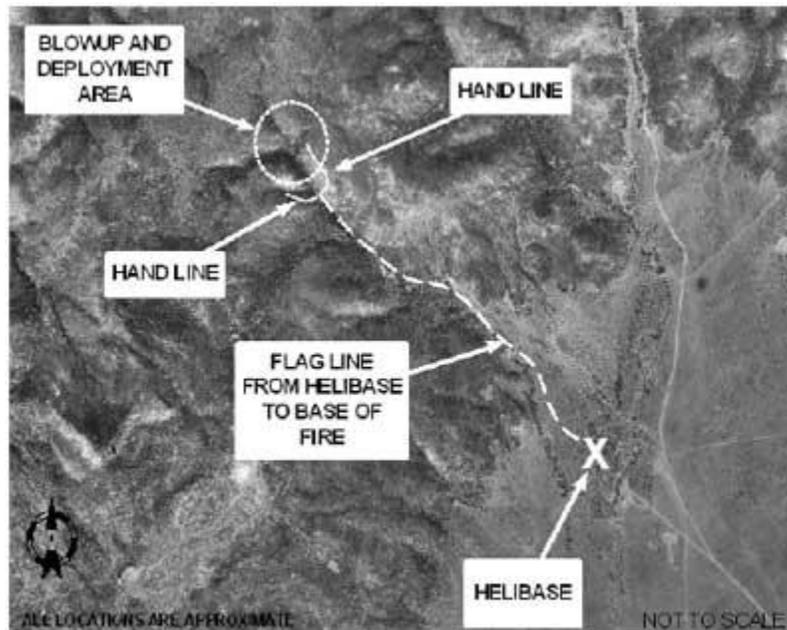
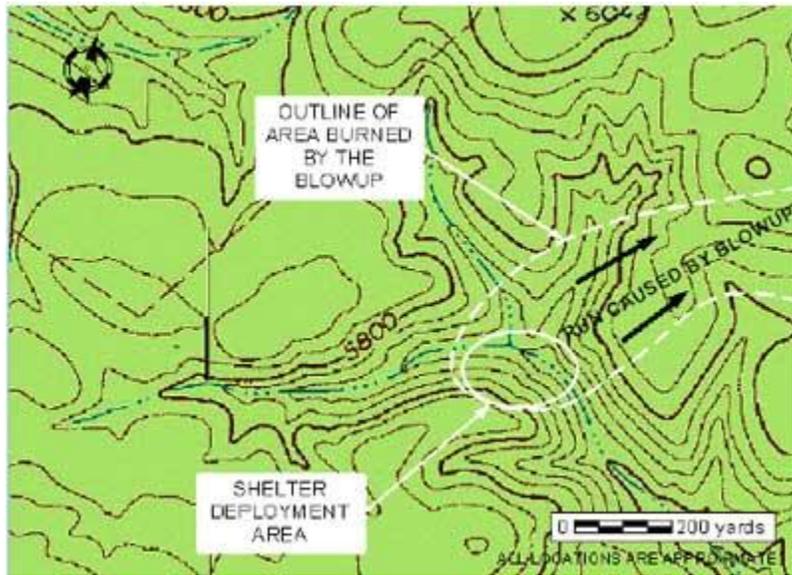


Photo 1. Aerial view of incident site.



Photo 2. View of deployment area looking up drainage.



Map. Topographical map of area where blowup occurred.



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