2007 – 2009 Wildland Fire Fatalities:

Analysis and Observations

Dick Mangan
Blackbull Wildfire Services
Missoula, Montana USA

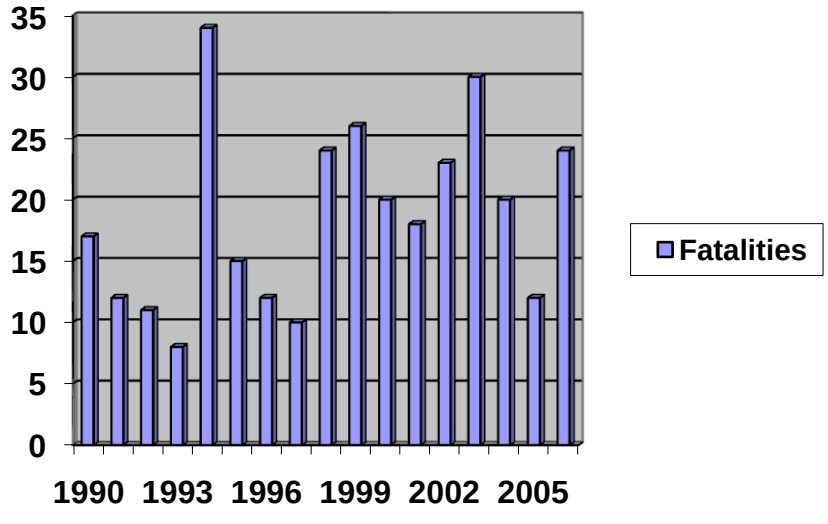
Wildland fire operations have been, and continue to be, a high risk environment for those involved. One hundred years ago, on the "Big Burn" wildfires in northern Idaho and western Montana, more than eighty (80) firefighters lost their lives. Today, one hundred (100) years later, wildland firefighters continue to die in all aspects of the fire operations.

Each year, the NWCG Safety & Health Working Team (SHWT) produces an annual *Safety Gram* that documents wildland firefighter fatalities from all causes during the previous year. The reports for 2007 – 2008 – 2009 show that forty nine (49) firefighters lost their lives in that period.

This paper is an attempt to look beyond the data reported in the *Safety Gram* by using additional information gathered from the U.S. Fire Administration Annual Firefighter Fatalities Reports. My hope is to better identify some of the more subtle trends that may be occurring, and to then offer some ideas for mitigating the risks that are resulting in these fatalities.

A Look Back

In 2007, I authored a Technical Report for the Safety & Health Working Team and the Missoula Technology & Development Center that reviewed all wildland firefighter deaths reported in the Safety Grams from 1990 – 2006. That report showed that three hundred ten (310) firefighters died in that period, an average of 18.2 deaths per year; deaths ranged from a low of 8 to a high of 34 in any one year.



While much of the emphasis in wildland fire safety is placed on LCES and entrapment avoidance, my study showed that the leading causes of death were: 1. Aviation accidents; 2. Vehicle accidents; 3. Heart attacks/Medical causes; and 4. Burnovers.

Volunteer firefighters were most likely to die (34.2%), followed by Federal firefighters (23.5%) and aviation contractors (15.5%).

A copy of that report can be found on the web site www.blackbull-wildfire.com.

The Current Record

As mentioned above, forty nine (49) firefighters have died during the 2007 – 2009 fire seasons, an average of 16.3, which is slightly below the earlier 17 year average of 18.2 deaths. 2008 was the worst year, with 25 deaths; 9 fatalities occurred in 2007, and an additional 15 died in 2009.

Aviation accidents were the leading cause with twenty one (21) deaths, or 42.9% of the total. This number was significantly impacted by a single helicopter crash during the 2008 fire season in northern California where 9 fire personnel were killed in a single event; also included in the aviation accident number is the death of a rappeller who fell from a hovering helicopter during proficiency testing.

Heart attacks and other medical-related events resulted in ten (10) deaths, and vehicle accidents also resulted in ten (10) fatalities.

Only one (1) firefighter died in a burnover event during the 2007 – 2009 period.

Organizationally, Volunteers had the most deaths (12), which can be expected given their large numbers across the US; aviation contractors (pilots and flight crew members) suffered 10 fatalities, a relatively high number given the small total base number of aviators. Contractors lost eight (8) firefighters, 7 of those deaths coming in a single event when an S-61 helicopter transporting them crashed. Federal and State organizations each lost seven (7) firefighters, and County/Rural departments had five (5) fatalities reported.

Organization	2007	2008	2009	Total
Volunteers	2	5	5	12
Federal	2	3	2	7
State	3	2	2	7
County/Rural	1	2	2	5
Contractors	-	8	-	8
Aviation Cont.	1	5	4	10

A Different Look at the Numbers

While the Safety Gram does a thorough job of documenting much of the information relevant to the fatalities that occur, I believe that there may be opportunities to gather and analyze additional data points from these fatal events

that may result in a trend analysis that allows us to make meaningful changes to reduce fatalities.

Some of the information that may help our analysis includes:

1. What was the time of day when the fatality occurred;
2. What was the age(s) of the individual(s);
3. What type of vehicle was involved;
4. What mission was the aircraft involved in;
5. What was the status of the fire relative to the fatality.

What follows is a different look at some of the statistics from the *Safety Gram* and the US Fire Administration Fatality reports for events that occurred in the 2007 – 2009 wildland fire seasons.

AVIATION

Eight (8) separate aircraft accidents resulted in the deaths of twenty (20) firefighting personnel during the 3 year period reviewed:

a. Two (2) of the accidents involved Single Engine Air Tankers (SEATs); both were involved in direct fire suppression activities; the pilots that were killed were 42 and 45 years old. One accident occurred at 1820 hours, the other at 1545 hours.
b. Two (2) fixed wing air tankers (A/T) crashed, killing all 6 pilots and crew members: one A/T was in transit from Montana to the Southwest US when it crashed at 1000 hours; the other was taking off fully loaded on a fire mission at 1810 hours when it crashed, again killing all 3 crew

members. The Chief pilots were 61 and 66 years old, with thousands of hours of flight time each.

c. Three (3) helicopter crashes resulted in the deaths of eleven (11) fire personnel: an S-61 transporting fire fighters crashed on take-off, killing the pilot, a USFS Inspector pilot and seven (7) firefighters. It occurred on the fire ground at 1930 hours; the pilot was 54 years old. A helicopter conducting a logistical support mission on a fire crashed at 1015 hours, killing the 61 year old pilot; and a Medical Evacuation helicopter carrying an injured firefighter to the hospital was involved in a mid-air collision with another Medical helicopter at 1547 hours, killing the firefighter as well as both flight crews. The ages of the pilots is unknown.
d. A State fixed wing observer aircraft crashed while flying over a fire at 1426 hours, killing the 36 year old pilot.
e. In addition to the 20 fatalities shown above, a helicopter rappeller died in a fall from a helicopter during proficiency testing; this is also shown as an aviation-related accident.

The ages of the pilots involved in these accidents ranged from 36 – 66, averaging 52 years old. Without looking at the individual flight logs of the pilots involved, it may be generally inferred that they were well-experienced aviators, but it is unknown if they had extensive mountain or fire flying. The times of these events ranged from 1000 hours until 1930 hours, with 3 of the accidents occurring after 1800 hours, involving a SEAT, A/T and helicopter. Based on the limited number of events in each aircraft type and the reports of mechanical problems on two of the aircraft, pilot fatigue does not appear to be a causal factor, but should always be considered, especially during prolonged fire seasons.

HEART ATTACKS/MEDICAL

Ten (10) individuals died from heart attacks or other medical conditions from 2007 – 2009: their ages ranged from 34 to 74 years old, averaging 54.3 years old (a State inmate who died while exercising did not have an age shown and was not included in the calculations). Five (5) of the deaths occurred on the fire line, one (1) while en route to the fire, two (2) after the fire, and two (2) while taking the "Pack Test" or a fitness hike. Six (6) volunteer firefighters died, ranging from 45 – 63 years of age.

DRIVING/VEHICLE ACCIDENTS

Driving and vehicle accidents killed ten (10) firefighters in seven (7) different events from 2007 – 2009: four (4) of the accidents occurred on the fire scene, while the remaining three (3) occurred while individuals were returning to their stations from training sessions or from a prescribed burn. One accident killed a firefighter and a Deputy Sheriff when they were struck by a semi-truck while directing traffic on the road in heavy smoke at 0530 hours. The individual who was returning from a prescribed burn was killed at 2000 hours; all of the other vehicle accidents occurred between 1251 and 1545 hours. Heavy smoke was a factor in five (5) of those fatalities: two (2) volunteer firefighters died when a bridge burned out and they drove into the ravine it had crossed; another volunteer was killed when he was involved in a head-on crash with another firefighter in heavy smoke; and two (2) County firefighters died when their vehicle went off the road in heavy smoke and down a 800 foot drop. The driver's ages ranged from 35 to 61 years old;

2 were Federal, 2 were County, 1 was State and the remainder were volunteers. The vehicles involved in these fatalities were all pickup-sized vehicles rather than larger engines, water tenders, vans or crew carriers.

Looking at the times these accidents occurred, it can be surmised that darkness may have been a contributing factor in two (2) of the events, but was not relevant in the others; heavy smoke was an important factor in four (4) of the accidents that resulted in seven (7) fatalities. The accident that killed a firefighter at 2000 hours after participating in a prescribed fire may have had fatigue and darkness as contributing factors. The ages of the drivers killed would indicate individuals with multiple years of general driving experience, yet not so old to have reduced response times under normal driving conditions. However, the presence of heavy smoke and reduced visibility appears to have been significant causal factors in the accidents.

State of the Fire

Of the 49 fatalities that occurred in this 3 year period, thirty two (32) occurred on the fire ground; seven (7) while en route to the fire; two (2) returning to the station or soon after returning home; and eight (8) in a non-fire environment. 2 of those fatalities occurred during training, and 2 others as individuals were driving home from training.

Geographic Bias

In the 2007 – 2009 period, wildfire deaths occurred in 15 different states, with California having the most with seventeen (17); this was a result of the helicopter crash that killed nine (9) as well as having the most serious fire situations during those 3 years. The Southern Geographic Area had an additional eleven (11) deaths, and only the Pacific Northwest, Alaska and Northern Rockies Geographic Areas did not suffer any fatalities. When coupled with the 1990-2006 data that showed fatalities in forty one (41) States, the important lesson learned here is that no area of the country is exempt from these tragic events, and so agencies and organizations must always be training their firefighters to be aware of the multiple risks to their lives.

Some Observations and Recommendations

Although this report only looks back at a narrow window of 3 fire seasons, and has less than fifty (50) total fatalities to consider, I believe that there are some important lessons learned and observations that can be made:

First, there was only one (1) burnover fatality in a three (3) year period. The reasons could be better training and awareness, quieter than normal fire seasons (at the National level), or more safety-conscious fire management under critical fire weather/fire behavior conditions. Whatever the cause, this is a significant improvement over the sixty four (64) burnover fatalities that had occurred in the previous seventeen (17) years. Continued emphasis in Entrapment Avoidance in the

Annual Fire Refresher training classes is warranted since fire shelter deployments continue to occur.

The number of aircraft accident involving all classes of aircraft (helicopters, SEATs, single engine observation planes and multi-engine air tankers) gives increased emphasis to the most basic question concerning air operations safety: Is this flight really necessary? We must minimize the risks involved in air operations on wildfires by only using those resources when there are no other feasible alternatives: is a spike camp or coyote camp better than transporting crews morning and night by helicopter; is the risk such that heli-mopping is really necessary; will a load of retardant from a SEAT or multi-engine air tanker really slow the fires spread, or is just a "media drop"; and is medical evacuation by air really necessary given the patient's condition?

Vehicle accidents were one of the top causes of firefighter fatalities in 1990-2006, and continue to be a significant cause in this 3 year period. Heavy smoke conditions contributed to five (5) fatalities: smoke will often be a factor on wildfires, and we must insure that drivers apply the principles of "not over-driving your headlights" in smoke conditions as well. Three (3) individual fatal vehicle accidents killed fire personnel who were returning to their home stations from training or a prescribed burn: one event occurred in mid-afternoon, one occurred at 2000 hours (in darkness), and one did not indicate the time of the accident. Multiple-fatality vehicle accidents in the 1990-2006 period occurred with crews going to or returning from an incident. Continued attention to driving hour limitations, driver fatigue and defensive driving techniques can help reduce these events. The sizes of the vehicles involved in these fatal accidents were light trucks

rather than heavier engines or tenders: this may reflect the fact that no special training or licensing (such as a Commercial Drivers License) was required.

Two (2) heavy equipment rollover fatalities are not included in the vehicle accident numbers, but are reminders of the risks of operating such equipment in rugged terrain and on narrow mountain roads.

Heart attacks and other medical conditions continue as a leading cause of firefighter fatalities: ten (10) fatal events occurred, five (5) of them on the fire ground. Of the 10 fatalities, six (6) were volunteer firefighters ranging in age from 45 – 63 years old. An inmate and a 46 year old prison guard also died of medical conditions. The aging workforce, coupled with the national trend towards increased weight and lower fitness levels, make it imperative that a good health screening process is used by all personnel who may be involved in wildfire suppression efforts, regardless of age or affiliation.

Unexpected falling trees and tree felling activities again took three (3) lives in 2007-2009. With the forest health conditions that exist throughout the western States, and the continued need to remove hazardous trees from the fire scene and in Wildland Urban Interface (WUI) fringe areas, these deaths may be on an upward trend that requires monitoring and increased emphasis. Hazard tree awareness training should be an on-going part of the Annual Refresher classes.

Conclusions

During the past twenty (20) fire seasons, three hundred fifty nine (359) wildland firefighters have died on the job in spite of the 10 SFO, the 18 SSWO, LCES, the WCT, aircraft inspections and certifications, leadership training, task books and job aids, and increasing "command emphasis" on safe practices and procedures.

Our challenge for the coming years is to continue using the tools we have, keep up the emphasis that says "no fire is worth dying over", and to seek new insights into the root causes of the events that are killing our fellow wildland firefighters across the US.

Special Thanks

This report, and the 2 preceding Technical Reports that I authored in 1999 and 2007, would not have been possible without the excellent work of Stan Palmer, BLM Safety Manager at the National Interagency Fire Center in Boise, Idaho. Stan has been responsible for preparing the NWCG *Safety Gram* for more than 20 years, carefully documenting fatalities, serious accidents and close calls. His help in reviewing this report as well as the earlier reports has been invaluable.

Dedication

In January 2010, the wildland fire safety world lost one of our strongest and most outspoken members, Tim Stubbs. He was an Air Attack and an excellent Fire Behavior Analyst, but more importantly, Tim was a strong voice for firefighters and their safety. He will be greatly missed. This report is dedicated to his memory.

About the Author

Dick Mangan is the owner/president of Blackbull Wildfire Services in Missoula, Montana. He retired in 2000 after 30+ years with the US Forest Service; his last assignment was Program Leader for Fire, Aviation & Residues at the Missoula Technology & Development Center. He is a qualified Operations Section Chief 1 and Safety Officer 2. He has authored 2 previous Technical Reports on Wildland Firefighter Fatalities in the United States (1999, 2007). Dick can be contacted at blackbull@bigsky.net.