

## Safety Considerations for Plume Dominated Fires

**From “Bump and Grind” to “Rock and Roll”.** Under the well entrenched high pressure ridge of the last couple weeks, fires have been **grinding** out 800, 900, 1000, 1400 acres on an active day when the inversion lifted without any major plume activity or strong winds. All of that began to change on September 5, 2003, with the introduction of some instability. When the inversion went out in the Hungry Horse Reservoir area in late afternoon, a massive column developed as Blackfoot hit the water’s edge near Kneiff Creek and Ball Fire ran south from Kah to within about a half mile of Soldier Creek. On Saturday, September 6, the combination of an incredibly dry fuel bed, **instability**, humidities in the teens, and temps in the mid to high 80’s will bring a return of Friday’s “rock and roll” conditions observed near the reservoir with **plume dominated** fires (if or when the inversion layer dissipates). To that mix on Sunday we add increasingly stronger pre-frontal winds, setting the stage for wind-driven fires.

Throughout Area Command these sites are especially vulnerable to plume dominated and/or wind driven fires: Divisions C and W on Wedge, the Blackfoot Complex, north side of Robert towards McDonald Creek (with the potential to close Going-to-the Sun Highway again), Middle Fork Complex now that it has moved south near the river (concerns for spots south of the river and movement along the river with stronger southwest winds), and the free-burning fires in the Bob Marshall. The map for Area Command definitely will be re-arranged before the arrival of the cold front Sunday night and Monday.

**Conditions for Plume Dominated Fires.** Observations in the Hungry Horse Reservoir area on Thursday, September 04, 2003, revealed that as the inversion started to clear out about 1500, the response of the Blackfoot Lake Fires and Wounded Animal Fires was almost instantaneous. They made a rapid transition to a plume dominated condition and made substantial increases in size.

**Avoid having people in harm’s way when temperatures are above 85, humidities are below 17, and the Haines is predicted for 5 or 6. But as we learned Friday afternoon, a Haines of 4 can pose a major problem when instability exists.**

As the column quickly develops, there can be spotting in any direction around the perimeter of the column and there can be short distance rapid fire runs.

About 1800 on September 5, 2003, the smoke cleared out on the west side of the Hungry Horse Reservoir and within a short time individual plumes were visible from several fires. By 2000 there was a massive plume visible from Kalispell; and by 2200 the sky above the ridgeline was bathed in a deep orange glow. The weekend could well be characterized by fires that transition between plume dominated and wind driven. Wind driven fires can be expected on Sunday when winds may exceed 20 mph in advance of the cold front.

Brooks Henderson, FBAN on Blackfoot, contributed this additional insight to the extremely active fire behavior observed on the Blackfoot Complex on September 5, 2003:

“By now you probably know that the Blackfoot, and Ball made probably their biggest runs with the B'foot hitting the lake from Kneiff to Colter Crs.,and Ball spreading off Kah and running cross slope south to within 0.5 miles of Soldier Cr. (those locations are approximate). The drivers seem to be the early lift of inversion and the short lived pick-up in southerly winds, and the static fuel availability. **Instability:** the Haines was a 4 but it could have been a 5 except for the moisture side of the equation. When fuels are this dry, and winds are present, instability is all you need.”

A FARSITE run for the Blackfoot Complex on September 5, 2003, spotted the fire across the Reservoir with a 20 mph west wind. The model shows the fire spotting from Goldie Cr. and Kneiff Cr. across the reservoir to Canyon Cr. on the east side. Long Island and just east of Long Island on the mainland also could receive spots with this kind of wind. But since a plume dominated column developed late afternoon and evening, the prevailing winds probably were not that strong. However, a collapsing column from high elevation could cast spots across the Reservoir without much wind. This is what occurred on August 27 at 1700 when Beta-Doris column collapsed and dropped several spots on east side of the Reservoir.

**Lookouts.** When the above conditions exist, knowledgeable lookouts should be posted in appropriate locations to view the entire column development and provide timely warning to people when there is significant vertical development. In the past, people have reported feeling raindrops prior to the collapse of the column.

**Types of Plume Dominated Fires.** There are two general types of plume dominated fires:

1. A plume dominated fire in heavy fuels can make a fast uphill run. This situation occurred on the Butte Fire in the Wallace Creek drainage in 1985 when the fire suddenly ran uphill and trapped 73 firefighters in fire shelters on the ridgeline for one and a half hours. Hotshot crews nearby who had been monitoring falling relative humidities with periodic weather observations retreated to a large clearcut and were entirely safe.
2. When the fire runs into lighter fuels the column can collapse, causing a downward rushing of air in every direction and spreading fire rapidly outward.

Either one of these events is especially threatening to personnel because the escalation of fire behavior is sudden and difficult to predict.

**Additional Threats from a Plume Dominated Fire.** The downward rush of air from a collapsing column can break off large trees and create hazardous turbulence for aircraft. People in Yellowstone in 1988 experienced trees breaking and falling all around them; and an aircraft experienced a descent of several hundred feet. These events were due to a collapsing column.

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