The effects of wildfire retardants on surface water quality

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Abstract. The use of retardants to suppress the spread of wildfires in the United States is increasing as the influence of climate change is increasing the abundance and severity of wildfires. Although regulations are currently in place to apply a 300 foot buffer zone between the aerially applied retardants and water bodies, the retardants are still permitted to be dropped within the buffer zone if it is determined necessary to protect human life or public safety. A recent example of retardants being directly applied on the surface waters (i.e. Poudre River) was during the High Park fire in Fort Collins, CO in late June to early July, 2012. With runoff and wind, the amount of retardant, ash, and burnt plants that reaches the water bodies will increase as the distance between the two areas decreases. Ammonium, phosphates, and iron oxide present in the retardants may have a significant impact on the water quality of the water bodies they reach. Additionally, nutrients, metals, and organics within the burnt soils may contribute to the deteriorated water quality of surface waters. This study is focused on quantifying the levels of organics, nutrients, and metals that may leach from the sediments and retardants into the surface waters. The Royal Gorge Fire in Cañon City, Colorado started on June 11, 2013 and burned 3,218 acres before it was contained on June 16, 2013. Triplicate soil samples from 5 locations within Cañon City (burnt soil with retardant, burnt soil without retardant, unburnt soil with retardant, unburnt soil without retardant, and unburnt soil with high retardant application) were collected from the fire area 10 days after the fire containment. Triplicate samples were dried in a 105 ^{o}C oven, passed through a 0.991 mm size sieve to remove coarse materials and vegetation, and mixed thoroughly before 100 g of sediment from each location was exposed to 1 L of reverse osmosis (RO) water for 6 hrs, 12 hrs, and 24 hrs in glass beakers. The supernatant was analyzed for pH, dissolved oxygen, conductivity, turbidity, total phosphorus (TP), ammonia, total organic carbon (TOC), iron (Fe), and manganese (Mn) using the Hach methods. Ammonia, TP, and Fe measurements in leachate from unburnt sediment with retardant were 6,233% - 36,775%, 427% - 1,373%, and 156% - 253% larger than leachate from unburnt sediment without retardant, but had an insignificant difference between leachate from burnt areas with retardant and leachate from burnet areas without retardant. TOC measurements in leachate from burnt sediment without retardant were 1.3 to 1.7 times higher than leachate from burnt sediment with retardant, while TOC measurements in leachate from burnt sediment were 2.4 to 21 times higher than leachate from unburnt sediment.