

## **Impacts of High Park Fire on Poudre River Water Quality**

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**Abstract.** The High Park Fire, the second largest and second most destructive fire in Colorado history, started on June 9<sup>th</sup>, 2012, after a lightning strike and was contained on June 30<sup>th</sup>. The fire, just west of Fort Collins, grew to 87,284 acres due to the dry fuel including timber, brush, and grass. With runoff and wind, the remains (burnt plants and ash) are carried into the water body, in this case, Cache la Poudre River. Introduction of sediments and ash high in nutrients, metals and incompletely combusted organics can affect water quality and safety. Increases in nitrogen and phosphorus in water bodies cause algae and bacteria to grow, thus producing taste and odor issues as well as the potential for formation of disinfection-by-products. The taste and odor issues are significant to the palatability of drinking water. The earthy, musty odors caused by algae metabolites (e.g. geosmin and 2-methylisoborneol) as well as the smoky flavor after fires are not aesthetically pleasing and cause a perception of unsafe water to the consumers. Since the Poudre is a major drinking water source for the cities of Fort Collins and Greeley the implications of the fire on water quality are important to study to adequately treat the water to satisfactory safety and aesthetic levels. This study focused on: 1) sensory perceptions and treatment of smoky flavors the fire may have imparted in the water; and 2) the levels of nutrients, organics and metals that may leach from the sediments carried into the river. To assess the aesthetic issues in Poudre River water Flavor Profile Analyses (FPA) were performed with two trained panels at Fort Collins Water Treatment Facility (FCWTF) and New Belgium Brewery following the standard method 2170. The FPA results indicated that raw, unsettled samples from just after the fire had a noticeable smoky/charred odor. However, for the water samples obtained several weeks after the fire, a smoky flavor was not perceived. Additional experiments on the smoky flavor and water treatment strategies were conducted in a pilot plant at FCWTF. Water from the Poudre River and Horsetooth Reservoir were fed through a small-scaled version of the conventional treatment process (coagulation, flocculation, and sedimentation) at 8 gal/min and the effluent was analyzed by FPA panels. Additionally, advanced treatment using 5 mg/L powdered activated carbon (PAC) was added to the pilot to compare if any odor was removed. To specifically study the smoky flavor treatment, a solution of 50 µg/L guaiacol (a “smoky” smelling compound) was added to the pilot plant feed water and the conventional and PAC treatment conditions were compared using FPA to determine the efficiency of the treatments. The FPA panel results indicated that neither the conventional treatment nor the PAC treatment removed the smoky smell from the guaiacol spiked samples. The second part of the study is to investigate the amount of nutrients, organics and metals that may leach from the sediments in the river. Triplicate sediment samples from the streambed, the bank and at bankfull were collected from 5 locations within the burn area (Century Park, Stevens Gulch, Young’s Gulch, mile marker 115, and the FCWTF intake) giving a total of 45 samples. The sediment samples were dried and sieved and will be exposed to Poudre River water in 1 L glass beakers for 6 hr, 12 hr, and 24 hr and will be stored in dark at room temperature. The supernatant will be collected and analyzed for conductivity, pH, dissolved oxygen, temperature, and turbidity using Hach probes. Total organic carbon (TOC), total nitrogen (TN), total phosphorus (TP), iron, copper, and manganese will also be tested for each supernatant following Hach methods. The leaching test will indicate the potential issues that may arise from leaching contaminants into the water.