Practical Aspects of Implementing a 5-MGD Treatment System for Removal of PFOA and PFOS from a Public Drinking Water Supply

Paul Hare, C.P.G. (Paul.Hare@obg.com) (OBG, Albany, New York, USA)
George Rest, P.E., and Narayen Venkatesan, P.E. (OBG, Bowie, Maryland, USA)

Background/Objectives. The City of Martinsburg's Big Springs water source is contaminated with PFOA and PFOS at levels exceeding the lifetime health advisory of 70 ng/L. Big Springs is a karst groundwater source, and the PFAA contamination is attributed to the use of fire fighting foams at an Air National Guard Base located approximately 1.6 miles away. Like many karst groundwater sources, Big Springs is classified as "groundwater under the influence of surface water," and therefore requires filtration. The City's 5 MGD water treatment plant includes coagulation, gravity filtration using dual media filters, and chlorine-based disinfection, and was not suitable for the removal of PFOA and PFOS. As a result of the contamination, the West Virginia Bureau of Public Health ordered the City to discontinue use of this water source until treatment could be provided. Given the significance of the Big Springs source to the City, the design and installation of a treatment system was critical.

Approach/Activities. Existing data showed that the raw water exhibits high hardness (over 400 mg/L as $CaCO_3$), pH of 7.5 and low turbidity (generally 1 NTU or less). Total PFOA and PFOS concentrations were approximately 150 ng/L.

Pre-design studies included rapid small-scale column tests (RSSCTs) to confirm the effectiveness of granular activated carbon for the Big Springs source water. Bench testing was also performed to evaluate the use of powdered activated carbon to simulate the addition of PAC to the existing flocculators at the Big Springs water treatment plant. This option was eliminated based on the results, and the design proceeded on an expedited schedule. The basis of design for removal of the PFOA/PFOS includes four pairs of 12-foot diameter GAC contactors. Each pair is piped in series, and each contactor is sized for 10 minutes of empty bed contact time. The GAC contactors are arranged to treat the raw water upstream of the existing conventional water treatment processes, with use of the potable water for backwashing.

The construction was also completed on an expedited schedule, with procurement overlapping some of the design due to lead times for delivery of the GAC units. Construction is substantially complete, and the new treatment system went into partial operation in December, 2017, approximately 10 months after beginning design. With a treatment capacity of 5 MGD, the new system is one of the largest installed to date in the United States for the treatment of PFAAs. More importantly, it allowed the City of Martinsburg to resume use of its primary source of drinking water.

Results/Lessons Learned. This presentation will describe the lessons learned and practical experiences in the expedited evaluation, design, construction and start-up of one of the largest drinking water treatment systems for PFAAs installed to date in the United States, including the challenges associated with obtaining funding. The presentation will summarize the results of the pre-design testing, including the comparison of GAC and PAC for PFAA removal, and key aspects of the design and procurement, including placement of the GAC units within the existing water treatment system, modification of the standard bidding process to consider schedule, and measures to reduce precipitation of $CaCO_3$ in the contactors. Finally, the RSSCT results will be compared with full-scale operating results.