Case Study

FILTRASORB 400 Provides PFAS solution for Air Force Base in Interior Alaska

Eielson Air Force Base, Alaska

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When Eielson Air Force Base, located in the interior of Alaska, found high levels of perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) in their drinking water, they needed a solution that was effective, cost-efficient, and operable in extreme temperatures. Calgon Carbon's Model 10 adsorption system, filled with FILTRASORB 400 granular activated carbon (GAC), was determined to be the best option.

Eielson AFB occupies more than 63,000 acres of land about 26 miles southeast of Fairbanks and about 110 miles south of the Arctic Circle. Eielson Proper has more than 10,000 assigned personnel. The base sources its drinking water from groundwater and uses pressurized greensand filters to remove high levels of iron and manganese.

In 2015, sampling of the base's drinking water revealed levels of PFOA and PFOS that were above the established United States Environmental Protection Agency's (EPA) drinking water health advisory. PFOA and PFOS are fluorinated organic chemicals that have been used to make water, stains, and grease resistant products. Notably for Eielson, PFOA and PFOS are also present in the firefighting foam used at the airfield for accidents and training, which resulted in the compounds migrating into the groundwater.

In May 2016 the EPA reduced its established health advisory levels for PFOA and PFOS from 400 ppt and 200 ppt respectively, to a total of 70 ppt for both, as well as in total between the two compounds. At the time of this change, all of Eielson's wells exceeded the new advisory, said Craig Hollowell, treatment plant operator at Eielson.

With guidance from the EPA to remove PFAS from the water supply, the base began looking for the most effective, cost-efficient technology. After considering different technologies in terms of ease of operation, maintenance, and continued operational costs, Eielson decided to pursue activated carbon.

"(Eielson) really wanted something proven, that was tried and true, and could

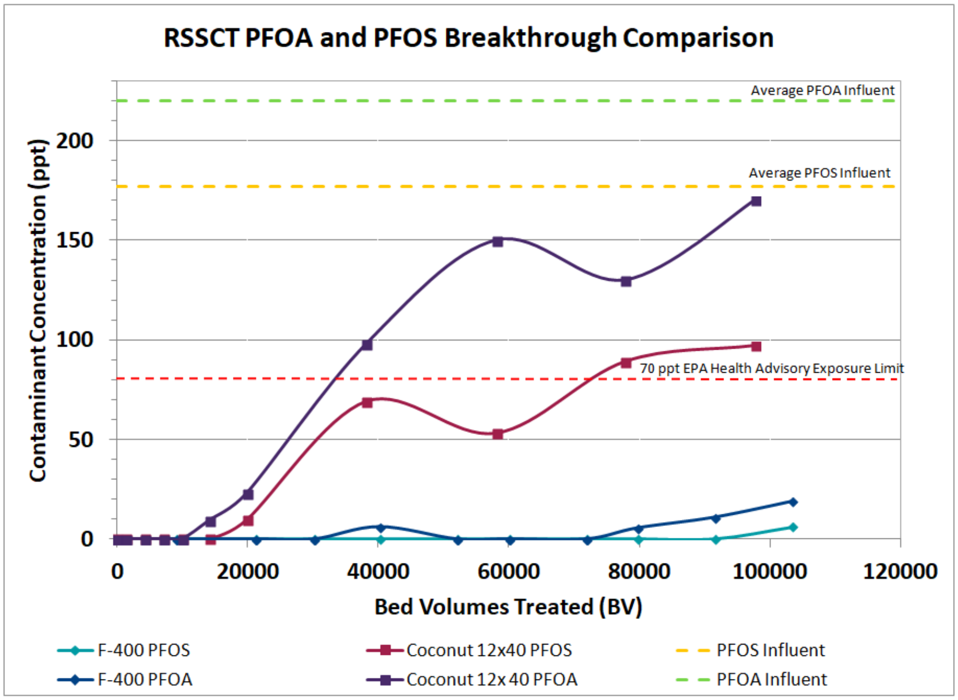

Figure 1 depicts outlet PFOA & PFOS removal using FILTRASORB and coconut shell activated carbons. Outlet PFAS concentrations reported against bed volumes of water treated.

be implemented quickly," said Andrew Nishihara, process engineer at Stantec, a consulting firm brought in to help the Air Force find a solution. "They didn't want to take any chances or risks for their customers or for the people who would be using their water."

TESTING AGAINST COCONUT SHELL-BASED CARBON

After some preliminary testing to roughly determine the efficacy of coconut-based carbon and another coal-based GAC, Eielson decided to install a coconut shell-based carbon for their initial effort to remove the PFOS. However, the coconut-based carbon exhausted quickly after start-up, and had to be replaced every three months. In addition to adding to operating costs, replacing the coconut-based carbon would be "next to impossible to do" during the winter when temperatures on the base reached below minus 30 degrees Fahrenheit, said Vanessa Wike, senior engineer at Bristol Engineering Services, another consulting firm involved in the project.

"Once the coconut started breaking through, it started going fast. It had a pretty steep curve," Wike said.

Stantec originally tested the performance of the coconut-based carbon against another coal-based carbon. However, further testing showed that Calgon Carbon's FILTRASORB 400 would work better than both the coconut-based carbon and the other tested coal-based carbon.

"The FILTRASORB 400 had superior performance compared with the coconut-based carbon," Hollowell said. "Calgon Carbon had the best performance curves I've seen for perfluorinated compound removal, in terms of the ability to last and to remove PFOA and PFOS from water."

Nishihara said Eielson was also considering using ion exchange resins as a solution. For ion exchange, PFAS removal is a single-pass application, meaning once the resin beads are used to remove the contaminants, the exhausted resin is typically disposed of in a landfill. However, Eielson was concerned that contaminants trapped by the resin could be released into the environment if the resin beads were exposed to pH swings, he said.

"(Eielson) wanted a solution that they felt would be both a long-term resolution and limit long-term risk exposure," Nishihara said. GAC used for PFAS removal can be reactivated, thermally destroying the PFAS compounds and eliminating the long-term waste liability.

EQUIPMENT SELECTION

In addition to selecting the optimal GAC for the project, the engineers had to make a decision regarding the design of the adsorption equipment that would contain the GAC. The most important design element to an adsorption system is the underdrain configuration for the vessels. The engineers involved in the project recognized the benefit of the Calgon Carbon Model 10 vessels, which incorporates an internal cone underdrain. The internal cone underdrain is designed to both maximize flow and ensure that the spent carbon is fully removed from the vessels during GAC exchanges, said Ben Goecke, regional sales manager for Calgon Carbon. With one nozzle per square foot of vessel cross section, Calgon Carbon's vessels have superior nozzle distribution and better flow distribution, resulting in optimal utilization of the carbon.

"When you get better utilization, you don't need to change out (the carbon) as much," Goecke said. "Nowhere is that more critical than in a remote place like Eielson. Every additional percentage of bed utilization you can get represents real savings."

INSTALLING IN HARSH CONDITIONS

There were a number of challenges involved with the project. The first was meeting the ambitious delivery schedule after the contract was finalized. Bristol Engineering Services was awarded the contract for the project in early October 2016. Calgon Carbon worked quickly to transport the system so the equipment would arrive in Alaska before temperatures plummeted.

Once on site, the 10,000-gallon vessels needed to be rinsed, disinfected,

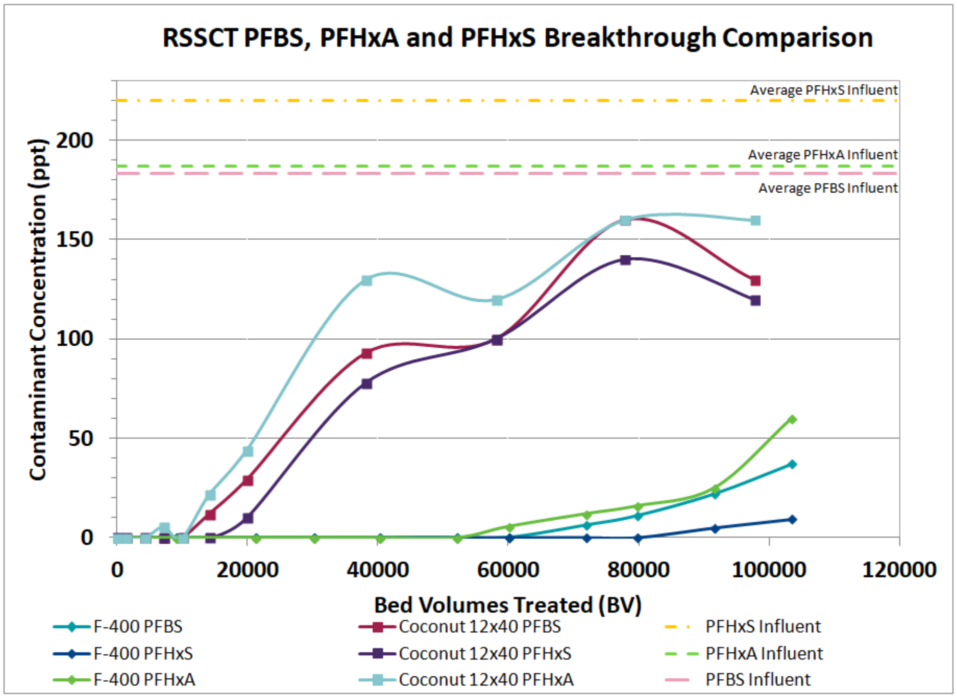

Figure 2 depicts outlet PFHxA, PFHxS, & PFBS removal using FILTRASORB and coconut shell activated carbons. Outlet PFAS concentrations reported against bed volumes of water treated.

and filled. All of these processes require water, which of course freezes at 32 degrees Fahrenheit. However, for this project, these processes had to be completed at a time when the daytime high temperatures were as low as minus 20 degrees Fahrenheit.

"Water is not your friend at 20 below," Wike said. "Water will form glaciers, and you can't leave water in hoses because the hoses will burst. The crew did a lot of surface discharge to rinse the vessels and discharge to areas that were safe." This means preventing icing on roads and walkways, and also preventing ice damage on structures.

In addition to the cold conditions, the limited amount of daylight required crews to use additional lighting on site. "At that time of year, there is maybe four to five hours of daylight, though the sun barely rises above the horizon," Wike said. "It looks like dusk, at best, for four hours, and that's assuming there are no clouds. If it's cloudy, it is even darker."

Finally, the installation site was constrained. "We had a limited available footprint, and Calgon Carbon was able to accommodate that," Wike said. "We couldn't go spatially, and we couldn't go tall because the site is next to an airport runway. We were limited in all three dimensions."

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— Craig Hollowell
Treatment plant operator
at Eielson Air Force Base

One temporary Model 10 system, which includes two vessels in a lead-lag configuration, filled with FILTRASORB 400, was installed in December 2016. In 2017, the final design for the project system was approved, and two additional Model 10 systems were installed. Crews installed new carbon into the temporary system vessels and moved that system from its temporary location to its permanent location, along with the two new Model 10 systems. Installation of the permanent system was completed in January 2018.

RESULTS

Wike said the FILTRASORB 400 has worked well in this application. Since the installation of the permanent system, levels of PFOS have been undetectable on all vessels.

Wike said she was also pleased with the customer service she received from Calgon Carbon.

"I don't think there was one time I called (Ben Goecke) that I didn't get a call back within four hours, including when he was on vacation," Wike said.

Hollowell said his experience working with Calgon Carbon was one of the best in his career.

"In my experience of 19.5 years working as a contractor for the Department of Energy and seven years up here, Calgon Carbon is one of the best, easiest, and most competent companies to work with on a contract," Hollowell said.

This was especially so as Calgon Carbon worked in minus 30 degree temperatures, he said.

"They're not used to working in those kinds of conditions," Hollowell said. "They made it happen, even in extremely harsh conditions."