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ATTACKING EMERGING Contaminants at Eielson

The long-term use of per- and polyfluoroalkyl substances in aqueous film forming foam used for fire suppression has resulted in contamination of groundwater supplies near some U.S. Air Force facilities.

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In response to growing health concerns regarding per- and polyfluoroalkyl substances (PFAS), specifically perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS), the Environmental Protection Agency (EPA) first issued Provisional Health Advisories (0.2-ug/L for PFOS and 0.4-ug/L for PFOA) in 2009. In May 2016, EPA followed the advisories by issuing an updated Lifetime Health Advisory with a cumulative maximum value of 0.07-ug/L (for both PFOA and PFOS).

Per- and polyfluoroalkyl substances are found in many household items including food packaging, carpeting, upholstery, clothing, and nonstick products like cooking sprays and pans. Moreover, the long-term use of PFAS substances in aqueous film forming foam used for fire suppression has resulted in the contamination of groundwater supplies near U.S. Air Force facilities.

PROBLEM DISCOVERY

Eielson AFB, Alaska, concerned with the health of personnel and their families after the initial discovery of PFAS contamination in the underlying groundwater at the installation, implemented immediate and long-term treatment solutions. As part of the Installation Restoration Program, Eielson and the Air Force Civil Engineer Center conducted



Construction of a new granular activated carbon treatment system at Eielson AFB, Alaska.

a site investigation at four locations in July 2014. The results of all four locations exceeded the Provisional Health Advisory for PFOS. Due to the proximity of these sites to base drinking water, bioenvironmental and civil engineer personnel sampled



untreated water at water supply wells and post treatment water (after greensand filtration) in February and March of 2015. These results showed that two of the four water supply wells exceeded the advisory and the existing base treatment was not effective at removing the contaminant. The Air Force immediately removed from service the two wells exceeding the advisory; however, due to the configuration of the system and groundwater flow, serious concerns remained as to how long the two other wells would stay below the threshold.

During the course of the next year, Eielson AFB added PFOS and PFOA to the list of analytes for drinking water monitoring, and over time the PFOS levels began to rise in the two water supply wells in service.

During the course of the next year, Eielson AFB added PFOS and PFOA to the list of analytes for drinking water monitoring, and over time the PFOS levels began to rise in the two water supply wells in service. The base had additional concerns when EPA discussed implementing a Lifetime Health Advisory and lowering the target limits. Eielson needed to be proactive to be ahead of and meet the new limits.

PRELIMINARY DESIGN

To provide immediate treatment, in March 2016, the 354th Civil Engineer Squadron acquired two leased granular activated carbon (GAC) units capable of removing PFAS at a sufficient rate to meet base demand and obtained operational approval from the Alaska Department of Environmental Conservation. This provided emergency treatment during the development of a permanent solution.

In October 2015, the Air Force contracted MWH (now Stantec) under an existing contract to conduct a study of available alternative water sources or treatment systems to provide a safe water supply to Eielson. Due to the fluctuating base populations and potential growth due to the possible addition of F35 squadrons, the project team needed to identify a treatment capacity and demand that would allow for operational flexibility, without creating an over-built, stranded asset. This required looking at instantaneous peak water production rates, rather than focusing on average or maximum day demands (24/7 operation scenario). The team ultimately settled on a 1,500-gpm capacity.

Alternative water sources were evaluated, with using and treating the existing water sources as the most appropriate solution. The team determined PFOS and PFOA adsorption on GAC filter beds as the current best available technology being used for treatment.

The system was designed to be placed in a new structure adjacent to the water treatment plant to allow for a short construction window and quick tie-in to existing piping so that uninterrupted service to the base could be achieved. The Air Force procurement model allowed for the preliminary treatment design to be approved by the state drinking water regulators early on, while keeping the building and filter vessels in a fast-tracked design-build contract.

DESIGN-BUILD CONSTRUCTION

In October 2016, the Air Force contracted with Bristol through a direct award to design and construct the long-term permanent treatment facility, to include installing the GAC filter vessels and piping, tying in the system to the existing treatment plant, training plant operators, and obtaining needed approvals from state regulators.

The design-build team assumed the government's preliminary design of the permanent treatment facility at 35 percent, working with an established A-E team to finalize the design to 65 percent, 95 percent, and 100 percent submissions. The structural design was simplified after additional geotechnical analysis—removing the proposed stone columns that were designed to address liquefaction concerns with underlying soils in a seismic event.

The final design for the permanent treatment facility incorporated a 2,900-ft² pre-engineered metal building on a slab on grade concrete foundation adjacent to the existing wastewater treatment plant. The permanent facility was designed to house six GAC contactor vessels.

INTERIM SOLUTIONS

To meet Air Force needs, and a very aggressive project schedule, the design-build team implemented a two-phase approach.

In Phase 1, Bristol worked closely with Eielson AFB personnel to implement an interim solution, providing two GAC vessels within three months of contract award to provide safe drinking water. Units were ordered and shipped to Alaska where they were installed within an insulated temporary structure to supplement the leased GAC vessels that were still in operation (emergency solution) to provide additional capacity. The design-build team selected Calgon F400-M GAC media, based on more recent research and full-scale treatment results indicating that it is a more robust and economical option. This media was used in the interim vessels as well as the permanent system. The interim GAC system was installed, operational, and regulatory approved by the end of December 2016. In Phase 2, these first two vessels would be relocated from the temporary enclosure and incorporated into the final system.

The interim system provided the necessary treatment to meet the more stringent advisory for PFAS, delivering safe drinking water during the winter months and allowing Eielson the time to complete design, procurement, and construction of a permanent system. This two-phased approach also gave the Air Force a cost-effective and flexible method to quickly deal with site contamination.

In addition to installing interim GAC treatment, the Air Force contracted with the design-build team to renovate a remote groundwater supply well to function as an emergency sole source





The presence of per- and polyfluoroalkyl substances in aqueous film forming foam used for fire suppression has resulted in the contamination of groundwater supplies near many U.S. Air Force facilities. PHOTOS COURTESY BRISTOL

supply for the base. This supply well, located up gradient and free from the PFAS contamination, was treated with chlorine and a corrosion inhibitor injection system to mitigate the high levels of naturally occurring iron and manganese. The well renovations, including connection to the base's SCADA system, were regulatory-approved and operational in April 2016.

SAFE DRINKING WATER

In completing Phase 2, four of the six permanent vessels were brought online in the new water treatment plant addition in December 2017, with the final two moved into the building from their temporary location in February 2018.

The final system received interim operational approval from state regulators and was commissioned in December 2017, at which time plant operators were trained in system operations and maintenance. The Air Force submitted a final operational approval from state regulators in June 2018 (six months ahead of schedule) ensuring delivery of high quality drinking water to 3,200 active duty personnel and their families.

The installation of GAC treatment addresses the current PFAS contaminants of concern (PFOA and PFOS) and is proving effective at treating other types of PFAS contaminants that are being considered for additional regulatory oversight.

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