Installation, Operation and Startup of World's First Regenerable Resin System for PFAS Removal

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Background/Objectives. The Air Force Civil Engineering Center (AFCEC) is conducting on-going response activities to remove and remediate groundwater impacted by poly- and perfluoroalkyl substances (PFAS) at the former Pease Air Force Base in New Hampshire. The two primary PFAS compounds found at the Site are perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) at combined concentrations (PFOA+PFOS) above the United States Environmental Protection Agency's (USEPA) Health Advisory Level (HAL) of 0.07 micrograms per liter (µg/L).

AFCEC responded by contracting with Wood Group PLC to conduct a side-by-side pilot test in 2016, comparing the performance of Emerging Compound Treatment Technology's (ECT) regenerable ion exchange (IX) resin and bituminous granular activated carbon (GAC). The regenerable resin system was selected for full-scale application, based on system performance and a lower overall lifecycle cost than GAC.

Approach/Activities. A 200-gpm system was provided to meet the primary project objective of producing treated water with combined PFOS plus PFOA concentrations below the 70 ng/L HAL. The full-scale IX resin system was installed from July 2017 through April 2018. System startup took place in April 2018. The PFAS removal system includes bag filters to remove suspended solids, back-washable GAC pretreatment filtration to remove iron, two parallel trains of lead-lag regenerable IX resin vessels for PFAS removal, an in-vessel regeneration system to strip PFAS from the IX resin, a distillation system to recover and reuse the regenerant solution, a PFAS super-loading system to further reduce PFAS waste volume, and two parallel, single-use IX resin vessels for PFAS polishing. The polish vessels contain a blend of IX resins, tailored to the general water chemistry and PFAS species and their relative concentrations.

Results/Lessons Learned. The PFAS remediation system has treated more than 9 million gallons of groundwater having a total influent average PFAS concentration of 70 µg/L. The effluent quality from the IX resin system has been consistently non-detect for all 13 monitored PFAS compounds, including the short-chain species, readily achieving compliance with the 70 ng/L HAL target.

The system has been operated in the 40- to 70-gpm range since startup, somewhat less than the design flowrate. This has been done to accommodate higher than anticipated influent iron concentrations and a lower than anticipated capacity of the groundwater recharge trench system. The resulting extended empty bed contact times (EBCTs) in both the back-washable GAC pretreatment vessel and the IX resin vessels has resulted in better than projected PFAS removals. Also, the resin regeneration schedule has been modified to accommodate the lower flowrate by removing one of the two parallel trains from service. This has allowed the resin vessels to be loaded closer to design values. Five successful resin regenerations have been performed to date. Operational modifications have been made to address and correct minor challenges with the distillation system, and regenerant recovery and super-loading processes have proven successful. The original super-loading media is still operational, having removed

and concentrated greater than 99.99 percent of the recovered PFAS mass, and therefore no PFAS waste has needed to be hauled off site to date.