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Coupling Technology Approach to Treat High Levels of PFAS in Regenerant Wastes

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Background/Objectives. Filtration technologies including ion exchange resin and reverse osmosis have increased attention on their effectiveness of reducing PFAS concentrations in water. The media used for treating PFASs requires a regeneration process to regenerate the spent media for reuse. The frequency of regeneration cycles varies but each regeneration cycle generates wastes containing high levels of PFASs, brine solution and possibly high organic content. The regenerant waste currently requires off-site disposal or incineration and it increases the treatment cost and creates off-site legacy issues. We proposed an on-site PFAS destructive technology for treatment of a low volume and highly concentrated PFAS waste stream to complete the treatment train with no PFAS waste left behind. Coupling the filtration and destruction technologies allows the treatment of a large volume of PFAS water to achieve part per trillion cleanup requirement and the use of destructive technology can completely destruct PFAS-laden waste on site.

Approach/Activities. An electrochemical oxidation (EO) technology is demonstrated to mineralize perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) in water. As a consequence, EO is used in the study to treat highly concentrated PFAS in regenerant waste. The waste stream used for the study was produced during the regeneration of ion exchange resin within a pilot-scale groundwater treatment system. Two regenerant waste samples were collected and characterized. PFOS and PFOA in the waste stream were up to 68.6 ppm and 100.5 ppm, respectively, suggesting ion exchange resin has successfully removed the PFOS and PFOA from the groundwater. The waste stream also contained up to 7861 ppm of total organic carbon (TOC), showing that groundwater was extracted from a former fire training area (FTA). This former FTA had been actively remediated with in situ biological treatment, as a consequence, elevated TOC was present in the regenerant waste. The samples were treated with the proposed EO technology.

Results/Lessons Learned. The EO treatment achieved TOC removal and removal of PFOS and PFOA. 96.5% of the PFOS and 77.2% of PFOA were removed using a current density of 10 mA/cm^2 after 17 hours of reaction time. The preliminary data confirmed the treatment potential of PFOS and PFOA using EO within 17 hours even with the presence of very high TOC conditions. We anticipate the treatment effectiveness for PFOA can be further improved if TOC is not present to inhibit PFAS treatment. The treatment condition optimization and confirmation of destruction mechanisms are currently ongoing and will be presented at the conference.