Combined In Situ/Ex Situ Treatment of Per- and Polyfluoroalkyl Substance (PFAS)-Contaminated Groundwater

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Background/Objectives. The purpose of this research, funded by the Strategic Environmental Research and Development Program (SERDP), Project ER 18-1306, is to develop a set of combined in situ/ex situ treatment approaches for efficient and effective treatment of per- and polyfluoroalkyl substance (PFAS)-contaminated groundwater. This study will evaluate the feasibility and effectiveness of a range of treatment train approaches, and estimate and compare the scaled-up cost and design challenges for implementation. The general treatment train approach includes (A) pre-treatment of PFASs and their precursors in situ to eliminate or reduce perfluoroalkyl acid (PFAS) source zones, and (B) pumping pre-treated groundwater for follow-on ex situ treatment including ion exchange (IX) and plasma treatment.

Approach/Activities. In situ oxidation experiments will vary oxidation approaches, including aggressive chemical oxidation- heat activated persulfate, oxygen sparging, and slow-release oxidant infusion for pre-treatment of PFAS and their precursors. IX has been proven effective for removing PFAS from water sources. This research will focus on IX resin regeneration, optimization of the regenerant solution for maximum treatment, recovery, and reuse. The broad range of PFAS-containing untreated and pre-treated groundwater along with spent regenerant solution residue will be treated in the enhanced contact (EC) electrical discharge plasma reactor which is highly effective in degrading PFAS.

Results/Lessons Learned. Each major component of the treatment train will be investigated in terms of effectiveness, rate, and efficiency under a range of treatment conditions including the presence of common PFAS site co-contaminants. Research results will be integrated to determine viable combinations of these approaches and develop a cost effective remediation technique that can be implemented fully on-site. Results will also be used to guide a demonstration of the IX and plasma components of the treatment train for Environmental Security Technology Certification Program (ESTCP) Project ER-18-5015.

Based on results, feasible combinations of in situ and ex situ treatment trains will be determined for design. Conceptual designs will be prepared for up to three representative sites. The conceptual designs will consider implementation challenges, anticipated treatment effectiveness, safety considerations, sustainability, and cost for each alternative. The conceptual designs produced will be used to develop a cost analysis to compare costs associated with the proposed treatment train with currently employed treatment approaches. This is a 3-year project beginning during Summer of 2018. This presentation will focus on early results for each stage of the treatment train.