SON Number: ERSON-22-C4 **4 November 2020**

Strategic Environmental Research and Development Program (SERDP)

FY 2022 STATEMENT OF NEED

Environmental Restoration (ER) Program Area

TREATMENT OF PER- AND POLYFLUOROALKYL SUBSTANCE-IMPACTED MATRICES

1. Objective of Proposed Work

The objective of this Statement of Need (SON) is to seek innovative research to develop cost effective remedial technologies for matrices impacted by per- and polyfluoroalkyl substances (PFAS) resulting from the use of Aqueous Film Forming Foam (AFFF) formulations. Preference is for small-scale, proof-of-concept efforts, but larger research efforts will be considered with supporting rationale and demonstrated proof-of-concept. Proposed efforts should focus on the following objectives:

- Develop cost effective treatment approaches for PFAS-impacted matrices, including but not limited to groundwater, soils, aquatic sediments, spent media, and AFFF concentrate. Proposed approaches can be in situ or ex situ, and can be intended for small-scale, mobile treatment or large-scale efforts.
- Develop cost effective approaches for complete destruction of PFAS bound onto spent media (e.g., granular activated carbon [GAC] and single-use ion exchange resins), regeneration of spent media, and treatment of associated ancillary waste streams.
- Evaluate treatment technologies using field-impacted media containing PFAS mixtures and common environmental treatment complications (e.g., water quality parameters, co-occurring contaminants, etc.).
- Develop treatment train approaches that cost-effectively treat PFAS and facilitate treatment of co-contaminants.
- Partner with pre-existing, commercial incineration facilities to conduct field monitoring events to document thermal destruction of PFAS within PFAS-laden soil, PFAS-impacted investigation-derived waste (IDW), spent GAC, and/or spent single-use ion exchange resins. Results must be of sufficient quality to allow for a complete fluorine mass balance on all solids, liquids, and gaseous materials entering and exiting the thermal treatment system during each monitoring event.

A minimum of the 29 PFAS that can currently be measured by U.S. EPA Methods 533 and 537.1 should be qualitatively assessed. Preference will be given to proposals that include quantitative assessment of the PFAS listed in Tables C44 and C45 in the Department of Defense (DoD)/Department of Energy (DOE) Consolidated Quality Systems Manual (QSM) Version 5.3 and qualitative assessment of total fluorine mass balance. Proposers should provide the rationale for any deviation from this list. Treatment of matrices impacted by PFAS at environmentally

relevant concentrations is of particular concern, and proposed efforts should include such an assessment or provide the rationale if different concentrations are proposed.

Research and development activities at laboratory-, bench-, and field-scale will be considered, although work does not necessarily have to culminate in a field-scale effort. In situ technologies and approaches should be applicable to a variety of hydrogeologic settings, including in complex geology such as fractured bedrock aquifers.

Proposers should be cognizant of previous SERDP- and Environmental Security Technology Certification Program (ESTCP)-funded efforts that focused on developing treatment approaches for PFAS-impacted matrices.

2. Expected Benefits of Proposed Work

Research should lead to improved management of PFAS sites by facilitating the establishment of more cost-effective and efficient remedial action plans that are protective of human health and the environment. The remediation approaches that will be developed through this SON will improve the reliability of treatment processes and expedite the cleanup and closure of DoD impacted sites.

3. Background

AFFF formulations have been used by DoD since the 1970s to suppress liquid fuel fires and there are thousands of sites impacted by PFAS. Although the DoD's legacy use of AFFF included various fluorotelomer-based formulations, the vast majority of DoD's environmental liability likely results from the use of perfluorooctanesulfonic acid (PFOS)-based AFFF.

Due to their chemical structure, PFAS are very stable in the environment and are relatively resistant to biodegradation, photo-oxidation, direct photolysis, and hydrolysis. The perfluoroalkyl carboxylic acids and sulfonic acids have very low volatility due to their ionic nature and can leach from vadose zone sources into groundwater despite many operative soil retention processes. GAC is being used at several sites to specifically remove PFOS and perfluorooctanoic acid (PFOA) from contaminated water in ex situ systems; however, the cost-effectiveness over time of GAC systems remain questionable, specifically with regard to regeneration. Use of some types of technologies results in generation of ancillary waste streams (e.g., brines are generated during regeneration of ion exchange resins). Solutions are needed that include provisions for regeneration of spent media, and treatment and disposal of ancillary waste streams.

Further complicating the issue, many of the PFAS found in AFFF formulations are highly soluble and migrate rapidly, while others are far less mobile. The more soluble PFASs are likely to become depleted through flushing from source zones over time. However, other PFAS may be retained in the source zone, with varying degrees of potential for mass transfer into the aqueous phase, infiltration to groundwater (for vadose zone source areas), and/or groundwater migration, particularly after several years in the subsurface. PFOS and PFOA are relatively mobile, though their fates are complicated by the presence of potential precursors for these compounds in complex PFAS mixtures. Effective treatment options are needed that address the variety of matrices that may be impacted by PFAS.

4. Cost and Duration of Proposed Work

The cost and time to meet the requirements of this SON are at the discretion of the proposer; however, the preference is for small-scale, proof-of-concept efforts. Proposers submitting a Standard Proposal must provide the rationale for this scale. The two options are as follows:

Standard Proposals: These proposals describe a complete research effort. The proposer should incorporate the appropriate time, schedule, and cost requirements to accomplish the scope of work proposed. SERDP projects normally run from two to five years in length and vary considerably in cost consistent with the scope of the effort. It is expected that most proposals will fall into this category.

Limited Scope Proposals: Proposers with innovative approaches to the SON that entail high technical risk or have minimal supporting data may submit a Limited Scope Proposal for funding up to $250,000 and approximately one year in duration. Such proposals may be eligible for follow-on funding if they result in a successful initial project. The objective of these proposals should be to acquire the data necessary to demonstrate proof-of-concept or reduction of risk that will lead to development of a future Standard Proposal. Proposers should submit Limited Scope Proposals in accordance with the SERDP Core Solicitation instructions and deadlines.

5. Point of Contact

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For Core proposal submission due dates, instructions, and additional solicitation information, visit the SERDP website.