Chemical Oxidation of PFAS: Insight into Applying Demonstrated Technology for Recalcitrant and Persistent Compound Class

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Background/Objectives. Per- and polyfluoroalkyl Substances (PFASs) are a class of stable compounds widely used in diverse applications. These emerging contaminants have unique properties due to carbon-fluorine bonds, which are one of the strongest bonds in nature. High energy is required to break carbon-fluorine bonds, and as a result, this class of compounds is recalcitrant to many degradation processes. Chemical oxidation is a demonstrated remediation technology for treatment of a wide range of organic environmental contaminants. Relevant literature includes several studies evaluating the use of chemical oxidants or their combinations that offer insight into oxidation-reduction chemistries potentially capable of PFAS treatment. In addition, despite PFAS comprising of thousands of different substances and their precursors, much of the available data related to chemical oxidation has only tested the more commonly discussed PFAS: perfluorooctane sulfonic acid (PFOS) and/or perfluorooctanoic acid (PFOA). The purpose of this study was to evaluate and refine the most promising oxidant and combined remedy approaches in a rigorous testing scenario to address a number of PFASs and precursors.

Approach/Activities. The bench-scale tests utilized field-collected samples from a site historically used for firefighter training. The tests were selected based on the identification and review of more than a dozen different combinations of oxidants presented in published articles, conference presentations, and earlier bench-scale testing performed at the ISOTEC Treatability Laboratory. Oxidation tests were designed to establish conditions that maximized formation of particular radical species, including hydroxyl, superoxide and sulfate radicals, via combination of oxidants, catalysts, pH buffers, and heat. The tests also included the assessment of chemical oxidation on a diverse list of PFAS analytes, including destruction and formation of oxidation by-products.

Results/Lessons Learned. The presentation will provide an overview of published chemical oxidation tests for PFAS and how these were used to design the current bench-scale study. Results of the bench-scale study, being performed late Summer/early Fall 2017, will be presented. This study is believed to be unique because it evaluates oxidation of a diverse list of PFAS analytes along with environmental co-contaminants. The presentation will offer considerations for implementing in situ chemical oxidation for PFAS, as a stand-alone option or combined with other treatment technologies.