A Containerized Thermal Treatment System for the Destruction of PFAS in Contaminated Soils

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1 Purpose of Study

Per- and polyfluoroalkyl substances (PFAS) represent a significant environmental and health challenge due to their chemical and thermal stability, making them resistant to conventional remediation methods. This study focuses on developing and validating a containerized thermal treatment system (Patent pending) capable of not only extracting PFAS from contaminated soils but also destroying them entirely. The objective is to provide a sustainable, scalable, and efficient solution that eliminates the need for secondary waste treatment and reduces environmental risks. The project is done by Arkil AS and Haemers Technologies SA, with support of Eurofins, University of Copenhagen, and is financed by Danish Regions, under coordination by the Capital Region of Copenhagen.

2 Methodology

The containerized system employs **Thermal Conductive Heating (TCH)** to heat contaminated soil to temperatures between 350°C and 450°C, volatilizing PFAS into the vapor phase. These vapors are directed to individual high-temperature combustion chambers capable of exceeding 1,400°C, ensuring near-complete destruction of PFAS molecules through optimized residence time and turbulence. The energy released by those combustion chambers is used to heat the container itself through conductive heating. Circulating combustion gases transfer heat uniformly to the soil while minimizing energy losses. Integrated catalytic oxidation at the exhaust ensures emission compliance. This demonstration project at the Korsor site in Denmark follows a methodology to validate all said claims, through both targeted and non targeted PFAS analyses, at all stages of the process. This is the closest possible way to insure actual PFAS destruction by breaking all C-F bonds.

3 Summary of Findings/Results

Experimental validation will be presented, regarding the system's capability to achieve greater than 99% destruction of PFAS, with rigorous gas-phase and post-treatment soil analysis. The demonstration will start in January 2025 and is scheduled to be completed by May 2025.

4 Conclusion/Take-Home Message

This containerized thermal treatment system offers the potential for a complete solution for PFAS remediation in soils, combining advanced thermal desorption with in-situ destruction (thermal oxidation at very high temperatures) of PFAS molecules. The system eliminates secondary waste streams, reduces operational costs, and minimizes environmental impact. This system provides a practical and sustainable alternative to conventional methods, offering effective and comprehensive PFAS remediation for soils.

5 Significance/Contributions of Study

By integrating extraction **and** destruction within a compact and portable design, this innovation addresses the limitations of traditional approaches. Its ability to adapt to various site conditions and contaminants, coupled with its energy efficiency, makes it a transformative solution for managing PFAS contamination in soil globally. This innovation contributes to cleaner environments and reduces the long-term risks associated with PFAS pollution.