

Perfluoroalkyl and polyfluoroalkyl substances (PFAS) are a family of toxic, carcinogenic, and bioaccumulating chemicals that are ubiquitous in consumer products, from cleaning chemicals to flame- and stain-retardant treatments of furniture fabrics and carpet. Thousands of small cleaning businesses in the United States routinely create and release hundreds of gallons of PFAS-contaminated wastewater daily from their cleaning operations into the environment due to cleaning products that contain PFAS and/or PFAS in the materials that they clean. Many of these businesses lack an awareness of PFAS presence in their wastewater. Our state's Department of Environmental Services seeks a low-cost, open-source solution for PFAS filtering and discharge of wastewater created by cleaning operations.

Requirements for this project are defined through review of the scientific literature, which addresses the efficacy of bituminous Granular Activated Carbon (GAC) in PFAS adsorption from water. These requirements inform the GAC volume required, its lifetime, and necessary dwell times of contaminated water in GAC to adsorb greater than 99% of PFAS. Specifications for a multistage, continuous flow GAC filtering system are derived from the requirements. The project scope includes construction of the initial prototype, tuning the system to meet flow rate requirements, testing on PFAS-contaminated water, and iterating the design to increase efficacy and to simplify assembly.

External laboratory test results indicate a linear decrease in PFAS concentration with the number of filter stages in all 13 PFAS compounds tested. These results informed the revised prototype, which adds filter stages to further increase performance. A parts list, assembly instructions, and educational materials to inform small businesses of the importance of filtering PFAS from wastewater before disposal promote adoption. Successful deployment of our prototype of an open-source, inexpensive PFAS filtering system for small cleaning businesses is expected to reduce PFAS in the wastewater stream thus reducing environmental and health consequences of these toxic chemicals.