

Colloidal Activated Carbon for In Situ Remediation of PFAS: A Review of Multiple Case Studies

Kristen Thoreson (kthoreson@regenesi.com) (REGENESIS Bioremediation, San Clemente, CA, USA)

Maureen Dooley (mdooley@regenesi.com) and Paul Erickson (perickson@regenesi.com)

Background/Objectives. With the increasing awareness to the widespread contamination of PFASs coupled with their resistance to degradation, there is a need for new, low cost strategies to address these contaminants. The current accepted remediation method is to use pump and treat systems equipped with activated carbon or a resin, however the costs associated with running these systems and replacing the adsorbent can be exorbitant. Therefore, the ability to implement an in situ barrier of activated carbon to amend the effective f_{oc} of an aquifer and increase the natural retardation factor for these contaminants is an appealing strategy to manage these plumes. This risk-based approach removes PFAS from the mobile phase and eliminates the route of exposure to down-gradient receptors.

This presentation reviews data from multiple field sites where colloidal activated carbon has been utilized to remediate PFAS contamination. Sites discussed include the Solvents Recovery Service of New England superfund site, and a former furniture manufacturing facility in Canada, among others. Further important questions, including the ability to distribute the colloidal activated carbon in the subsurface, the long-term efficacy, and design considerations, will also be addressed.

Approach/Activities. Multiple field sites were treated with a single application of colloidal activated carbon to address PFAS contamination and other commingled contaminants. Depending on any co-contaminants present, additional remedial agents were also applied to degrade those contaminants. In each case the amendments were applied under low pressure (non-fracking) conditions using direct-push technology. At one of the sites, groundwater was impacted by petroleum hydrocarbons at concentrations up to 6 mg/L in addition to PFOS and PFOA which were present at baseline concentrations of 300 to 3,300 ng/L. In this case, an oxygen release agent was co-applied to promote the biodegradation of the TPH. At another site, TCE was present in addition to the PFAS contamination and a sulfidated zero-valent iron was co-applied with the colloidal activated carbon. Monitoring at all sites is ongoing, with current data ranging from 3 months to over two years, and has included analysis of PFOS, PFOA, shorter chain PFASs, and co-contaminant concentrations.

For some of the sites to be discussed, laboratory bench tests were performed as an initial step to aid in the field dosing and design considerations. In these cases, site groundwater was treated with varying doses of the colloidal activated carbon to assess for any potential interferences or competition for sorption sites between species present at the site.

Results/Lessons Learned. Results from field case studies have demonstrated immediate removal of PFAS from the dissolved phase to levels below the US EPA health advisory level when treated with a single application of colloidal activated carbon. The site with the longest monitoring period has maintained its performance with PFOS, PFOA as well as shorter chain species for over two years and counting. The colloidal activated carbon treatments, sometimes in conjunction with another remedial agent, were capable of addressing co-contaminants like TPH and TCE. Bench studies also proved helpful in verifying dosing levels and ruling out the presence of interfering species that would limit performance. Overall, these studies indicate that

the in situ application of colloidal activated carbon offers a new strategy to address the risk associated with PFAS contamination at a low cost.