

## Sampling Protocol for Petroleum Cleanup Projects Using In-Situ Activated Carbon Injections

During the course of evaluating petroleum contaminated sites for closure, there is some question as to how we can ensure that any injected product has completed the remediation of the groundwater contamination and that there is no residual contamination that could result in a rebound in groundwater concentrations after the site is closed. A key component of this assurance is a demonstration that the product has reacted completely or that insufficient contaminant mass remains to cause a rebound. For reactive products, this can be a straightforward demonstration that the reactants are no longer present. For products that work by adsorbing contaminants, whether to permanently immobilize or to provide a substrate for breakdown, it is more difficult to evaluate.

To help ensure that remediation is complete, the following sampling and monitoring protocol should be used on all petroleum/hydrocarbon contaminated sites where when using products that employ adsorption to injected activated carbon as part of the treatment process at a site. This protocol eliminates concerns that residual contamination could cause rebound after the site is closed. This protocol is in addition to the product-specific use and monitoring requirements in the Innovative Technology (IT) acceptance letter. The current list of IT products known to be subject to this protocol follows below.

<b>Cleanup Stage</b>	<b>Comments</b>	<b>Sampling</b>
Prior to Injection for Pilot Test and Active Remediation (Baseline)	This should be the level of contamination in both matrices in equilibrium at that time. Include total organic carbon (TOC) in soil and CO <sub>2</sub> and methane in groundwater for baseline sampling.	3-5 saturated soil and groundwater samples*
When Groundwater reaches Cleanup Target Levels and PARM begins	Not verifying that soils have reached any target but at this new equilibrium, it should show that whatever contamination remains on soil is not contributing to groundwater contamination because the groundwater concentrations are remaining steady or decreasing.	3-5 saturated soil and groundwater samples. Include TOC in soil and CO <sub>2</sub> and methane in groundwater.
When Groundwater Maintains Cleanup Target Levels for 1 Year	Monitor GW for a year, and if it stays at or below cleanup target levels, the site can move forward with Risk Management Option I under 62-780, F.A.C., unless Soil levels exceed those at the beginning of PARM.	3-5 saturated soil and groundwater samples. Include TOC in soil and CO <sub>2</sub> and methane in groundwater

\* Saturated soil and groundwater samples should be collected in area of highest contamination based on pre-injection concentrations. This table only lists the additional sampling, contaminants of concern, Underground Injection Control parameters, and secondary drinking standards are still evaluated as with all other petroleum sites. Sample collection and analysis should follow standard protocols.

### Additional comments

1. The 3-5 soil samples from each campaign are intended to be replicates of the previous sampling events. Each of the 3-5 samples should be collected at roughly the same location and discrete depth within the targeted carbon-treatment saturated zone.
2. Collected samples should also be analyzed for the petroleum contaminants of concern that were present prior to the initial treatment.

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3. Variability in the soil sample results is expected. An estimate of that variability can be derived from the baseline sampling and that estimate can be used to calculate the expected error range for subsequent sample events.
4. Pilot Test Plans and Remedial Action Plans for petroleum sites that include in-situ injection of activated carbon injections should incorporate this sampling protocol.
5. For sites where in-situ injection of activated carbon has occurred but the PARM Plan has not yet been approved, then the additional soil sampling outlined in rows 2 and 3 of the table will be incorporated into the PARM plan.
6. For sites where post in-situ injection of activated carbon PARM has already begun via an approved PARM Plan or an Approved Purchase Order with PARM Sampling scoped, then the additional soil sampling will not be performed.
7. For any questions about this protocol please e-mail [ODBS\\_Review@FloridaDEP.gov](mailto:ODBS_Review@FloridaDEP.gov).

List of Accepted Innovative Technologies Subject to the Sampling Protocol for Petroleum Projects Utilizing In-Situ Activated Carbon Injections (as of July 19, 2022). This list may be amended or expanded as information on these or other technologies becomes available.

#	Technology Name	IT Acceptance # (linked to letter)	IT Acceptance Date
1.	Bioavailable Absorbent Media (BAM-C formulation)	<a href="#">1661</a>	09/13/2019
2.	CarbonOx	<a href="#">1530</a>	04/18/2016
3.	GR-320-IRC	<a href="#">1450</a>	02/24/2014
4.	MetaFix (formulations I-3 and I-7A)	<a href="#">1487</a>	10/20/2020
5.	Nutribind	<a href="#">1534</a>	04/22/2016
6.	PetroFix with Electron Acceptor Blend – Regular and Nitrate Free	<a href="#">1833</a>	05/14/2019
7.	PlumeStop Colloidal Biomatrix	<a href="#">1476</a>	08/31/2015
8.	Trap & Treat BOS 100	<a href="#">1365</a>	04/19/2007
9.	Trap & Treat BOS 200	<a href="#">1366</a>	04/17/2007