

BPSS – 12C – Biosparging Pilot Test Guidance

Biosparging is an in-situ technology primarily used for the remediation of aerobically biodegradable organic contaminants of concern (COCs) within the saturated zone (i.e., COCs dissolved in groundwater, within the capillary fringe or absorbed to saturated soils). Note that biosparging is not applicable to sites with free product. In biosparging, bioremediation is enhanced by inducing air (or oxygen) flow (using air injection wells) and, if necessary, by adding nutrients into the saturated zone. A biosparging system is similar to an in-situ air sparging (IAS) system, except that a lower air flow rate is used. The lower air flow rate enhances the bioremediation process (the primary mechanism of biosparging), while minimizing volatilization (the primary mechanism of IAS) and therefore the air flow rate should be based on the expected metabolism needs of microorganisms to successfully remediate the saturated zone.

Along with an investigation and evaluation of the lithologic profile at a site, a field biosparging treatability pilot test is required to evaluate the feasibility and effectiveness of the technology and to provide data for the design of the final treatment system. This document provides general guidelines developing a biosparging pilot test.

Prior to implementation of the pilot test, a pilot test plan must be submitted to the FDEM or local program for approval. The pilot test plan must include, at a minimum, the following information:

1. A site diagram (indicating the North direction, drawn to scale, and including a graphical representation of the scale) depicting the following:
 - a. The horizontal and vertical delineation of the plumes in each impacted medium and other pertinent information such as utilities, surface seals, and potential receptors (e.g., workers, air intake systems, buildings, sewer systems or other subsurface confined spaces, etc.); and
 - b. The test well network, consisting of dedicated air sparging well(s) (ASWs) and observation wells.
2. Design details for the biosparging pilot test. Dedicated ASWs are required to effectively implement the pilot test. Consider the following during ASW design:
 - a. A minimum of one ASW located within the most contaminated area;
 - b. The screened interval of the ASW(s) should generally be positioned below the delineated vertical extent of the dissolved COC plume. Some discretion may be appropriate if there is a significant vertical plume thickness with gradually decreasing concentrations and a conscientious decision has been made to allow natural attenuation to remediate the lower portion of the plume;

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- c. Consideration should be given to multiple pilot study ASWs and to multiple injection points at various depths within a single ASW, based upon the horizontal and vertical distribution of the COCs and geologic heterogeneity; and
 - d. The pilot test ASW(s) should be utilized, if feasible, in the final design.
3. Dedicated observation wells are required to accurately monitor the system throughout the pilot test. Consider the following during observation well design:
- a. The number of observation wells must be sufficient to properly evaluate the operational conditions;
 - b. The screened interval of the observation wells must be designed to properly monitor the saturated zone and vadose zone and the expected area of influence throughout the aquifer; and
 - c. The observation wells must be located in a radial pattern at appropriate distances (e.g., 5 ft., 10 ft., 20 ft., etc.) from the AIW to properly monitor and evaluate the following: 1) the biosparging test parameters in all directions, 2) anisotropic conditions, and 3) possible migration of COCs during the pressure testing.
4. Construction details of all ASWs and observation wells. The recommendation to limit the period of operation specified for VES/AS pilot studies to 8 hours or less is not applicable to biosparging and bioventing pilot studies. A pilot study period of 24 hours or more is recommended to allow for development and biological response to the biosparging test.
5. A monitoring proposal for the system, including parameters and frequency. At a minimum, the following data must be obtained before, during and after the test:
- a. Pressure reading, measured at the wellheads of the ASW(s) and observation wells;
 - b. Water elevation, measured in the observation wells;
 - c. Visual observations (e.g., bubbles, etc.);
 - d. Dissolved oxygen (O_2) and carbon dioxide (CO_2) measured in the observation wells;
 - e. CO_2 levels in the exhaust vapors;
 - f. Sparging rate, measured at the compressor discharge flow gauge;
 - g. Radius of influence; and
 - h. Sparging vapor concentrations of COCs, measured in the observation wells.

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6. Description of all specific goals and objectives of the pilot test (e.g., minimum radial influence, minimum rate of reduction of oxygen concentrations, etc.).