BPSS–12A - In-Situ Air Sparging Pilot Test Guidance

This document provides general guidelines for the development of in-situ air sparging (IAS) pilot test plans. Additional guidance on IAS System design and operation may be found in BPSS-2 & BPSS-4. IAS is a technology primarily used for the remediation of volatile and semi-volatile contaminants of concern (COCs) in the saturated zone (i.e., COCs dissolved in groundwater, within the capillary fringe or absorbed to soil below the water table). IAS is generally not applicable to sites with significant free product. While the primary remediation mechanism for IAS is volatilization of the volatile compounds, enhancement of the bioremediation process may also be induced as a consequence of the injection of oxygen into the subsurface. In order to control the migration of the contaminated vapors from the saturated zone, IAS is generally required to be used in combination with a soil vapor extraction system, SVES (see BPSS-12B Soil Vapor Extraction Pilot Test Guidance).

Along with an investigation and evaluation of the lithologic profile, a pilot test is generally required to evaluate the suitability of the site for IAS. Data from the pilot test are also used to optimize the efficiency of the IAS system design. Proper technical justification must be provided at the time of the Pre-RAP meeting if a pilot test will not be performed. Prior to implementation of the pilot test, a pilot test plan must be submitted to the FDEP 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 for each impacted medium and any other pertinent features (e.g., underground utilities, nearby surface water bodies, backfill areas, drainage systems, surface seal, aquifer heterogeneity, etc.); and

    b. The location of the test well network, consisting of dedicated vapor extraction well(s) (VEWs), air sparging well(s) (ASWs), and observation wells.

2. Design details for the vapor extraction pilot test wells as outlined in BPSS-12B.

3. Design details for the air sparging pilot test components and orientation. One or more dedicated ASWs are required to effectively implement the pilot test. Consider the following during the ASW design:

    a. 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;

b. The ASWs must be properly sealed and grouted immediately above the screened interval to eliminate shout circuiting of the injected air to the atmosphere;

c. The pilot study ASW(s) must be located within the most contaminated area of the plume (i.e., area of highest COC concentrations);

d. Multiple ASWs and multiple injection points at various depths within a single ASW should be considered, based upon the horizontal and vertical distribution of the COCs and geologic heterogeneity; and

e. The pilot test ASW(s) should be positioned such that they may be utilized, if feasible, in the final design.

4. The location of dedicated observation wells that will be used to monitor the system throughout the test. Consider the following during the observation well design and orientation:

   a. A minimum of four (4) observation wells should be utilized;

   b. The screened interval of the observation wells must be designed to properly monitor the vadose zone and the expected area of influence throughout the aquifer; and

   c. Observation wells must be located in a radial pattern at appropriate distances (e.g., 10 ft., 20 ft., 30 ft., etc.) from the ASWs to evaluate the influence of the IAS in all directions and to evaluate any anisotropic conditions (e.g., backfill, utilities, tank farms, drainage structures, etc.).

5. Construction details and locations for all the VEW(s), ASW(s) and observation wells.

6. A monitoring proposal for the IAS pilot system, including parameters and frequency as follows:

   a. At a minimum, the following data must be obtained before, during and after the test noting the time each measurement was taken:

      i. Pressure/vacuum readings obtained at the wellheads of the VEW(s), ASW(s) and observation wells;

      ii. Water elevation;

      iii. Visual observations (e.g., bubbles, etc.);

      iv. Dissolved oxygen; and

v. Field measured vapor concentrations in VES wells, observation wells and system off-gas concentrations.

b. Collecting groundwater for the COCs before and after the test may be considered but in general does not always provide useful design data.

c. A baseline off-gas sample for the total petroleum hydrocarbons or total hazardous air pollutants must be obtained with only the SVES operating (see BPSS-2).

d. At a minimum, one additional vapor sample for analyses must be obtained at the end of the combined operation of the IAS/SVES.

e. If there is a possibility of the pilot test resulting in vapors accumulating beneath foundations or enclosed spaces, periodic monitoring of vapor concentrations in areas of potential risk (e.g., buildings, etc.) must be implemented during the performance of the test.

7. A provision to provide continuous vapor recovery and an evaluation of the potential for vapor accumulation in near-by structures.

8. Specifications of the equipment. Note that the air compressor must have a sufficient capacity to inject air at pressures that allow overcoming the sum of the hydrostatic pressure and the air-entry pressure of the formation. If pressure greatly exceeding the hydrostatic pressure or air-entry pressure will be proposed, the pressure exerted by the weight of the soil column should be estimated to establish a safe range of operation. Calculations supporting the proposed operating conditions must be included.

9. Off-gas treatment design, as applicable. All supporting technical calculations and manufacturer's specifications must be included. Off-gas treatment must be implemented in accordance with all applicable federal, state and local codes and regulations. Off-gas treatment must be provided if any of the following conditions exist:

   a. The system is operated for more than eight (8) hours (therefore, limiting the pilot test to no more than eight (8) hours is recommended);

   b. The site of the pilot test is in close proximity to inhabited areas such that health nuisance conditions may result from the pilot study; or

   c. Operation of the pilot system is likely to result in adverse health effects or nuisance conditions due to expected high concentrations of recovered vapors even though there are no inhabited areas in close proximity.

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Note that if the intent of the IAS system is solely to supply oxygen for purposes of bioremediation (see BPSS - 12C, Biosparging Pilot Test Guidance), off-gas treatment may not be required. The site-specific oxygen mass loading requirements for bioremediation must be justified within the pilot study technical design. Proposals to bypass off-gas treatment will have to be in the final design supported by off-gas sample analyses obtained during the pilot test.