

## mi BIO-TRAP® *Catch Remediation in the Act... Trap It!*

ADVANCED DIAGNOSTIC SAMPLERS

### What are Bio-Trap® Samplers?

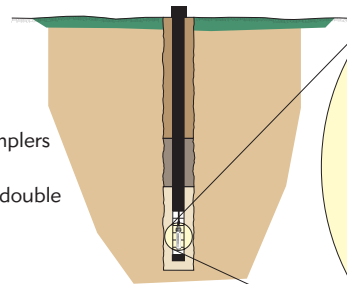
Bio-Trap® Samplers are passive sampling tools that collect microbes over time for the purpose of better understanding biodegradation potential. The key to the Bio-Trap® approach is a unique sampling matrix, Bio-Sep® beads. The beads are 2–3 mm in diameter and are engineered from a composite of Nomex® and powdered activated carbon (PAC). When a Bio-Trap® Sampler is deployed in a monitoring well, the Bio-Sep® beads adsorb contaminants and nutrients present in the aquifer essentially becoming an *in situ* microcosm with an incredibly large surface area (~600 m<sup>2</sup>/g) which is colonized by subsurface microorganisms. Once recovered from a monitoring well (30-60 days after deployment), DNA, RNA, or PLFA can be extracted from the beads for CENSUS® or PLFA assays to evaluate the microbial community.



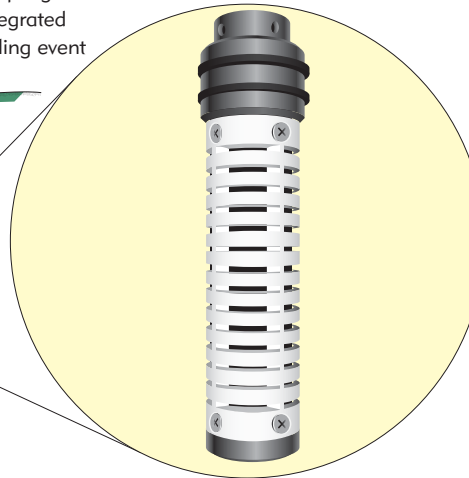
### A modern approach to microbial sampling

Bio-Trap samplers utilize a passive sampling approach allowing the results to be integrated over time rather than from a single sampling event

Multiple Bio-Trap samplers can be isolated from one another using a double seal cap assembly

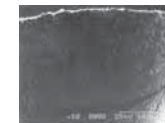


Samplers are suspended in the screened interval for typically 30 days.  
\*study length can vary depending on objectives

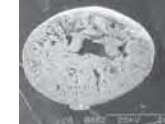


### Sampling Matrix: Bio-Sep® Beads

A key to this sampling approach is the use of Bio-Sep® beads as the sampling matrix. The unique properties of these beads allow them to mimic environmental conditions very well.



Exterior of Bio-Sep bead



Interior of Bio-Sep bead

Bio-Sep® beads provide a large surface area within the bead for microbial attachment. Most microbes prefer to be attached to a surface rather than be free floating.



Lactate amended Bio-Sep® bead

Fishin' for microbes! "Baited" Bio-Trap® samplers can be used to evaluate the microbial response to a wide range of amendments (electron donors and acceptors, etc.).

\*see reverse for more details

Samplers can be analyzed using a wide variety of analyses including:

#### Molecular Biological Tools

- CENSUS® (qPCR)
- PLFA
- DGGE
- SIP

#### Chemical Analysis

Geochemical Parameters  
And more!

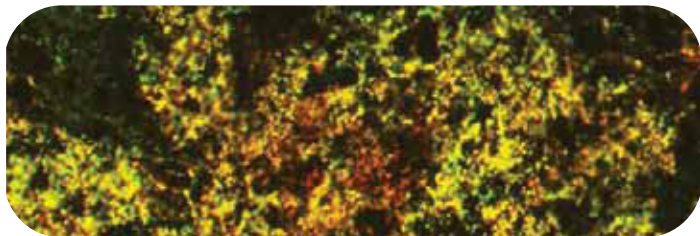
What types of samplers are available?

Bio-Trap samplers are available in a wide variety of configurations that can be tailored to answer your site-specific questions.

Standard: Basic Bio-Trap<sup>®</sup> Samplers in the simplest terms are a replacement for collecting groundwater samples using a conventional approach. Most microbes prefer to be attached to a surface rather than free floating and this passive sampler provides a large surface area for the microbes to colonize. Results generated using this approach have been shown to minimize the variability associated with traditional sampling approaches. Bio-Traps biofilms have also been shown to directly reflect spatial and temporal changes in aquifer microbial community structure plume which could not be determined from groundwater analysis. Standard Bio-Trap<sup>®</sup> Samplers are primarily used during site characterization and routine monitoring activities to:

- Quantify specific microbes or contaminant degrading bacteria (e.g. Dehalococcoides spp.)
- Evaluate monitored natural attenuation (MNA)
- Compare microbial populations from different sampling points
- Monitor shifts within microbial communities following biostimulation

Standard Bio-Trap<sup>®</sup> Samplers are designed for microbial analyses using a variety of molecular biological tools but can also be configured for some chemical and geochemical analyses.



Baited: As the name suggests, Bio-Trap<sup>®</sup> Samplers can be “baited” with various amendments or compounds to answer site-specific questions. In the past, project managers have been forced to turn to laboratory microcosms or small-scale pilot studies to evaluate bioremediation as a treatment alternative. While microcosm experiments with native site materials can show biodegradation in the laboratory, duplication of in situ conditions is difficult and the results may not extrapolate to the field. Pilot studies are performed on site but are often prohibitively expensive as an investigative tool. Baited Bio-Trap<sup>®</sup> Samplers are designed to create discrete in situ microcosms that can be used to:

- Evaluate monitored natural attenuation versus enhanced bioremediation
- Compare effectiveness of different amendments (e.g. HRC<sup>®</sup>, EOS<sup>®</sup>, sodium lactate, molasses, etc.) designed to stimulate bioremediation
- Prove that biodegradation is occurring ( <sup>13</sup>C-labeled compounds - Stable Isotope Probing)
- Estimate relative rates of degradation for a specific contaminant (i.e. MTBE, TBA etc.)
- Address specific questions such as:
  - Is benzene being degraded at my site?
  - Will sulfate amendments stimulate bioremediation?
  - Will sodium lactate increase the concentration of known dechlorinating bacteria?

Baited Bio-Trap<sup>®</sup> Samplers can be amended with a number of compounds including:

- Sodium acetate
- Sodium lactate
- Potassium lactate
- HRC<sup>®</sup>
- Molasses
- Vegetable oil
- EOS<sup>®</sup>
- Sodium phosphate
- Sulfate
- Nitrate
- Ammonium chloride
- Elemental sulfur
- Calcium carbonate
- Iron (III)
- <sup>13</sup>C-labeled contaminants
  - Benzene
  - Toluene
  - Xylene
  - MTBE
  - TBA
  - Chlorobenzene
  - TCE
  - DCE
  - VC
- Fluorinated surrogates for tracing chlorinated compounds
  - TCE
  - DCE
- And more!