

## mi BIO-TRAP®

ADVANCED DIAGNOSTIC SAMPLERS

### Rationale

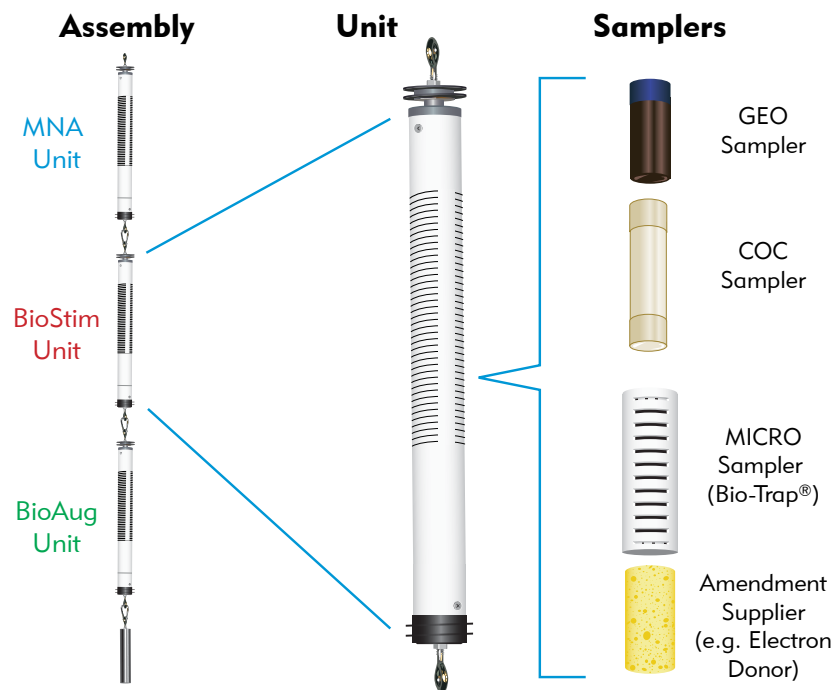
Site managers have frequently turned to laboratory microcosms or small pilot studies to evaluate bioremediation. However, duplication of *in situ* conditions in the laboratory is difficult and the results often do not correlate to the field. Pilot studies are performed in the field but are often prohibitively expensive as an investigative tool. Bio-Trap® *In Situ* Microcosm studies provide microbial, chemical, and geochemical evidence to cost-effectively evaluate biodegradation and screen remedial alternatives.

### Designing an *In Situ* Microcosm Study

Bio-Trap® *In Situ* Microcosms can be tailored to investigate a wide variety of remediation approaches but often consist of three units each corresponding to one of the most common bioremediation options:

### Applications:

- MNA at chlorinated solvent- and petroleum hydrocarbon- impacted sites
- Evaluate the effectiveness of electron acceptor addition (e.g. oxygen, sulfate)
- Assess the feasibility of electron donor addition to stimulate reductive dechlorination
- Assess the need and effectiveness of bioaugmentation
- Can be used in combination with Stable Isotope Probing (SIP) or Compound Specific Isotope Analysis (CSIA)



### Control (MNA Unit)

The Control Unit contains no additional electron donor or amendments and represents MNA or existing site conditions.

### Biostimulation (BioStim Unit)

The BioStim Unit contains a specified electron donor (sodium lactate, EOS®, HRC®, molasses, etc), electron acceptor (e.g. oxygen, nitrate, sulfate), or other amendment.

### Bioaugmentation (BioAug Unit)

The BioAug Unit is pre-inoculated with a commercial culture (e.g. *Dehalococcoides*) and amended with an electron donor.

### Providing Multiple Lines of Evidence

Each *In Situ* Microcosm unit contains passive sampling devices to provide microbial, chemical, and geochemical evidence to quantitatively compare remedial alternatives.

#### Geochemical Fingerprint (GEO)

Quantification of geochemical parameters including electron acceptors (nitrate, sulfate, etc.), dissolved gases (methane, ethene, ethane), and chloride production.

#### Contaminant of Concern (COC)

A passive diffusion sampler designed for analysis of a variety of COCs including chlorinated solvents and petroleum hydrocarbons.

#### Microbial Populations (MICRO)

Bio-Trap<sup>®</sup> sampler containing Bio-Sep<sup>®</sup> beads which provide a large surface area for microbial attachment and were designed for analysis by a variety of molecular biological tools.

### Post-Deployment Analyses

Although in-depth interpretation of results will be different for each study, the general approach involves comparison of chemical, geochemical, and microbiological data between units to quantitatively evaluate treatment options.

#### Microbiology

- CENSUS: Quantify organisms or processes responsible for contaminant biodegradation (e.g. *Dehalococcoides*)
- PLFA: Quantify viable biomass and evaluate microbial community composition
- Stable Isotope Probing: Incorporation of a <sup>13</sup>C labeled contaminant into biomass and dissolved inorganic carbon conclusively demonstrates that biodegradation is occurring

#### Chemistry

- Contaminant loss
- Daughter product formation
- Contaminant destruction/end product formation (e.g. CO<sub>2</sub>, ethene, ethane)

#### Geochemistry

- Anions: Effect of treatment approach on redox conditions/ availability of electron acceptors
- Dissolved Gases: Production of methane, ethene, and ethane
- pH