



Summary Regarding Water Quality Tests for Baseline Markers to measure iSOC[®] Progress

There are quite a few ways to look at performance monitoring in bioremediation and related natural attenuation approaches.

- BOD
- Alkalinity
- Bacteria
- DO
- pH
- Temperature
- ORP (oxidation-reduction potential)
- Changes in contaminant concentration over time.
(Understanding the geochemistry of the site related to the oxidation-reduction potential is important).
- A standard BOD test will help to evaluate overall biological oxygen demand and will indicate if there are other organic compounds present in addition to the contaminants of concern.
- There may also be oxygen demand related to inorganic species present such as reduced iron in particular that should also be measured.

CO₂ generation is key to evaluating progress (increased biological mineralization of contaminants).

- Generally you can expect to see increases in CO₂ and corresponding reductions in target contaminants over time.
- If increased CO₂ does not correspond to reductions in concentrations over the longer term, that may be an indicator that the biological approach is working but a persistent source (eg. soil contamination above water table) is still active.
- In higher pH environments (pH > 7.5), Alkalinity is a good way to evaluate CO₂.

Total inorganic carbon (TIC) may also be used and may be better at lower pH (<7.5) sites.

- For a detailed one-page discussion of CO₂ measurement go to www.microseeps.com click on Technical Resources and then pick CO₂ Measurements for Monitored Natural Attenuation.

Biological monitoring can be accomplished with several approaches:

- The inexpensive analyses such as heterotrophic plate count can be used regularly to track changes but you may also want to see what kind of bacteria you may have before and after the start of treatment.
- For example gram-negative bacteria are known to degrade petroleum hydrocarbons so you would want to look for increases in that type.
- To characterize a site for types of viable bacteria you can use the Phospholipid Fatty Acid Analysis (PLFA).
- PLFA is a method that relies on the characteristic lipids found in the cell membranes of different types of bacteria.
- For a few hundred dollars you can have samples analyzed for PLFA by Microbial Insights (www.microbialinsights.com) and receive an interpreted report.
- One of the issues with bacterial testing is that they will mainly live on the soil/aquifer material, and only a fraction will be found in groundwater, so looking at groundwater alone does not give a full picture.

A good reference for biological and related geochemical monitoring is the ASTM Guide to Remediation of Ground Water by Natural Attenuation at Petroleum Release Sites (E1943-98).

www.isocinfo.com