



Total Inorganic Carbon

Demonstrating Microbial Activity

Microseeps has developed a method for analyzing Total Inorganic Carbon that takes the guess work out of calculating TIC across a site.

Carbon dioxide is one of three forms of inorganic carbon that exist in groundwater. The other two are carbonate, and bicarbonate. These three forms of inorganic carbon exist in groundwater in a pH dependent equilibrium.

Thus if carbonate from soluble carbonate minerals in the soil matrix dissolves in groundwater, there will be concentrations of all three forms of inorganic carbon at equilibrium. Since soluble carbonate minerals are common, there is almost always some background level of TIC, even in uncontaminated aquifers. In contaminated aquifers, there is almost always oxidation, either aerobic or anaerobic, of organic material. Thus there is almost always the generation of inorganic carbon in the form of carbon dioxide in contaminant plumes.

Therefore if one were to measure TIC across a contaminant plume, one would find background concentrations over uncontaminated portions of the aquifer, and



Microseeps has a reporting limit of 1 mg CaCO₃/l for TIC

anomalous concentrations of TIC over contaminated portions of the aquifer.

If TIC is measured before and after a stimulated degradation process is implemented, the difference in TIC is the amount of organic carbon converted to inorganic carbon during the stimulated degradative process.

TIC can be easily determined from a groundwater sample if the sample is acidified before determining the dissolved carbon dioxide. Acidification causes the equilibrium to shift such that most of the inorganic carbon is in the form of carbon dioxide. Thus a dissolved carbon dioxide measurement of an acidified water sample gives an excellent measure of TIC.

Many may feel that TIC is unnecessary, measuring alkalinity is sufficient. That is not true because Inorganic Carbon is present as both alkalinity and as carbon dioxide, and the ratio between the two can vary widely across a site depending upon pH and dissolved solids. The crucial pH is near neutral, and the dissolved solids will increase dramatically as biological activity causes mineral dissolution. Thus there can be wide swings across a site that alkalinity alone or carbon dioxide alone do not point out. Granted, by doing both tests, accounting for the pH and the TDS, and making lots of assumptions, TIC could be calculated. However, the method Microseeps has developed eliminates all of that and provides TIC in one measurement, avoiding multiple analyses and arduous interpretation.

Why Measure TIC?

- TIC is the final product of ALL fuel Oxidation.
- TIC analysis provides the most comprehensive look at inorganic carbon across a site.
- Mapping TIC across a site reveals the background TIC that results from aquifer sediments.
- Mapping TIC across a site also reveals the elevated TIC resulting from biooxidation of contamination from MTBE and other fuel oxygenates.
- TIC combines bicarbonate, carbonate, carbonic acid and dissolved carbon dioxide into one analysis.

