

**COMPARING RELATIVE IN SITU DEGRADATION RATES VIA BIO-TRAP,  
PUSH PULL AND CONVENTIONAL MEANS FOR PETROLEUM COMPOUNDS  
UNDER NATURAL AND BIO-STIMULATED CONDITIONS**

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Significant advancements have been achieved through the development of novel In Situ down-well field tests like Bio-Traps™ samplers and Push Pull tests to assess bio-degradation, both under natural and under stimulated conditions. These tests produce relative degradation rate kinetics for apple to apple comparisons.

In situ degradation rates were generated at a petroleum distribution facility using both Bio-Trap™ samplers and Push Pull tests; the tests were conducted within an existing, gasoline plume. These results, both under natural and bio-stimulated conditions, are compared and contrasted to the in situ degradation rates calculating using traditional means, i.e. decreases in chemical concentrations over time from long term ground water monitoring programs.

The objective of this project was to assess if the protocol of sequential tests (Bio-Traps and Push Pull Tests) were a cost effectively means to screen bio-degradation potential at a site in a relatively short period of time, compared to traditional means which require years of ground water trend data.

The relative bio-degradation rate kinetics from the Bio-Trap™ Study, Push Pull Tests and conventional means were compared and contrasted for similarities and to assess if adjustment constants were necessary to correlate these alternative investigatory techniques.

Bio-traps™ are a novel, in well sampling device often referred to as an in well microcosm. The Bio-Traps™ were augmented with electron acceptors (oxygen, nitrate and sulfate) and were used to determine the target contaminant degradation rates under unamended conditions and when exposed to different electron acceptors (bio-stimulation). The Bio-Traps "baited" with electron acceptors were loaded with <sup>13</sup>C-labeled benzene and passive flux meters to quantify mass reduction of the <sup>13</sup>C-labeled benzene to compare the bio-stimulated degradation rates to un-amended degradation rates.

A series of single-well, "push-pull" tests to determine in situ kinetics and microbial processes in the same wells. "Push-pull" tests consist of the injection of prepared test solutions into existing site wells. The test solution contains the same electron acceptors (oxygen and nitrate) used in the Bio-Trap study in addition to a conservative tracer (bromide) to segregate abiotic and biotic in situ degradation rates of the chemicals of interest over time (short term) when exposed to different bio-stimulation substrates.

Lastly, the bio-degradation rates from the Bio-trap and "push-pull" studies were compared for similarities, and contrasted with the overall site degradation rates generated from years of ground water monitoring at the site.

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