

## **Performance Benchmarks Using Timelines: A Simple Way of Assessing Performance of In Situ Bioremediation Applications**

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**Background/Objectives.** The use of in situ bioremediation (ISB) for the treatment of chlorinated solvents in groundwater has been in practice for over two decades with increasing adoption in the last 10 years. While the concept of ISB is well documented and understood, often evaluating performance can be complex. In evaluating ISB performance, questions such as these arise: How long does it take to fully dechlorinate chlorinated solvents? How fast will each parent and daughter compound degrade? What are the most important factors that influence these degradation rates? How much daughter product formation can we expect and how long will these daughter products persist? When might it be necessary to reapply? Through an aggregate analysis of performance wells from multiple ISB projects, this presentation will focus on patterns and trends in performance data developing benchmarks which can be used to answer these questions.

**Approach/Activities.** This study will use performance data gathered from over 100 monitoring wells at over 20 project sites across the United States where an ISB approach was utilized. By observing some key performance benchmarks and the time required to achieve them, a simple frame of reference for ISB performance can be established. From this frame of reference, one can then delve further, as needed, into cause and effect relationships due to geochemical conditions or other empirical factors affecting performance which in turn, can be used to further guide the remediation activities.

**Results/Lessons Learned.** The results of our aggregate performance analysis will include the average days following injection that the peak concentrations of parent and daughter compounds were observed. In addition, the average days in which 75% and 90% reduction of parent and daughter compounds were observed will be presented. Also, an analysis will be presented of the influencing factors that cause faster or slower-than-normal performance timelines.