

Benefits of a Multiple Lines of Evidence Approach for NSZD

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Background/Objectives. The observation of natural source zone depletion (NSZD) rates on the order of hundreds to thousands of gallons per acre, per year (Garg et al., 2017) has elevated the role of NSZD in LNAPL conceptual site model (LCSM) development and site management decision making. NSZD measurements are more frequently utilized to achieve a variety of objectives, from establishing a baseline for evaluating the relative benefit of active remediation to mapping LNAPL distribution (API, 2017) and demonstrating LNAPL stability (Mahler et al., 2012). The increased reliance on NSZD data reflects the importance for accurate measurements to support informed management decisions.

Processes responsible for NSZD as well as site characteristics and natural background processes that may affect NSZD measurements can be complex. While several methods have been developed to evaluate bulk NSZD rates (API, 2017; ITRC, 2018), each of the methods rely on simplifying assumptions, and are subject to interferences when implemented under non-ideal conditions. The approach presented highlights the value of incorporating multiple lines of evidence for NSZD assessments to identify the effects of non-ideal conditions on different measurement methods and build confidence in the assessment results among stakeholders.

Approach/Activities. NSZD assessments were completed at several sites with variable geologic and ground surface cover conditions using multiple lines of evidence, i.e. multiple measurement methods. Results of co-located measurements in space and time were used to identify site attributes that do not conform to the simplifying assumptions of one or more of the methods utilized in the assessment. Additionally, an evaluation of temporal variability for a subset of sites where NSZD measurements were recorded continuously or on a periodic/seasonal basis will be presented to highlight potential biases that may arise when relying on measurements made at a single point in time.

Results/Lessons Learned. Use of multiple lines of evidence for NSZD assessments can be used to identify effects of non-ideal conditions and mitigate errors in interpretation that may occur when relying on a single measurement technique. Screening approaches such as temperature profiling and soil gas screening using existing wells (Sweeney and Ririe, 2014; Sweeney and Ririe, 2017), and/or carbon dioxide efflux surveys using a dynamic closed chamber (DCC) can often be completed over the course of a few days. When combined with longer-term averaging techniques such as carbon dioxide traps or thermal monitoring, this approach builds confidence in results, decreases the likelihood of remobilization to collect additional data when results of a single NSZD measurement method are suspect, and provides a basis for selecting a method that is best-suited for longer-term NSZD monitoring, where necessary.