Analytics on an NSZD Measurement Database

Tom Palaia (tom.palaia@jacobs.com) (Jacobs, Denver, CO, USA)

Background/Objectives. Large site characterization data sets are a very powerful, and generally untapped, resource in the remediation industry. Hundreds of thousands of carbon dioxide efflux (CO_2) measurements and natural source zone depletion (NSZD) estimates have been collected from sites around the United States and Canada in the past ten years. The estimates have informed remediation professionals of the effectiveness of intrinsic biodegradation on light non-aqueous phase liquid (LNAPL) source zones and facilitated improvements in remedies. However, the magnitude of measured NSZD rates have confounded practitioners at some sites. Why are NSZD rates high at one weathered diesel site while rates are lower at another more recent condensate release site? We have theoretical hypotheses to this question, but empirical evidence is needed to support them.

This project was formed to use data analytics to uncover statistically valid correlations in the data. The primary goal is to provide a defensible basis for screening the magnitude of NSZD based on common elements of the LNAPL conceptual site model. Specifically, the work is being done to:
- Understand the basic range of NSZD rates for various site conditions (e.g., petroleum type, age, geology, depth to LNAPL),
- Evaluate the magnitude and affirmation of the source(s) of variability in the measurements for a given method and site condition, and
- Optimize future measurements due to the predictability of NSZD rates based on certain prescribed site conditions (e.g., NSZD rates range from 100-500 gal/ac/yr at sites with predominantly silt/clay soils).

Approach/Activities. Data use permissions were procured and a database assembled to house validated CO_2 efflux measurements and NSZD rate estimates using the passive flux trap and dynamic closed chamber (DCC) methods at a diverse set of petroleum release sites. A focal point of the data entry is collection of metadata that could be correlated with the NSZD rate estimates. Metadata were assembled from known facility historical and release information and co-located soil borings and monitoring wells, including:
- Product type
- Release age
- Site latitude
- Finest-grained soil type overlying the LNAPL smear zone
- Groundcover
- Depth to groundwater
- Depth to LNAPL and smear zone thickness
- Shallow groundwater temperature

Data analytics are being used to search for statistically valid correlations amongst the NSZD rate estimates and the metadata.

Results/Lessons Learned. The database is built and currently being populated. Data analytics and quality assurance/quality control will be performed by end of 2018. Results will be ready well in advance of the conference. Results will be presented in a way that practitioners find insightful and useful. Because we work in a dynamic field and adaptive site management proven

successful, the goal of this platform will be to present information that will change the way people think about, screen, and measure NSZD rates.