Seasons of Change: NSZD Rates across Nine Sites using New High-data DensityTechnology

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Natural source zone depletion (NSZD) has emerged as a practical alternative for restoration of light non-aqueous phase liquid (LNAPL) sites that are in the later stages of their remediation lifecycle. Site owners and managers are increasingly adopting this as a viable approach towards site closure. This has driven demand for high-density data to better characterise patterns and processes underlying NSZD at daily to seasonal timescales. At EMS we have developed an economical and robust sensor suite ("Soil Sense") that facilitates construction of networks within and surrounding LNAPL plumes. These networks allow high-resolution spatial and temporal quantification of LNAPL plume dynamics (extent and persistence) as well as biological processes associated with natural attenuation (e.g., methanogenesis, methanotrophy). Here we present an analysis of NSZD from nine sites across Saskatchewan and Alberta. The data were collected at 30-minute intervals and include gas flux (CO_2, O_2,CH_4), pressure, air and soil temperatures, relative humidity, and petroleum hydrocarbon vapour concentrations. NSZD rates varied as a function of site and LNAPL plume characteristics. The high-temporal resolution data generated robust estimates of plume areal extent, volume, and mass, NSZD rates, and time to closure. Moreover, while NSZD rates slowed during soil freeze-up, they were non-zero, which affords users a more nuanced and robust picture of natural attenuation at their site over seasons to years.

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Steven is a quantitative ecologist with a focus on edaphology. He has spent the last 20 years studying environmental and ecological change natural and disturbed environments. Using a diverse suite of research approaches from citizen science to machine learning, Steven has developed a deep toolkit for analyzing and visualizing pattern and process along environmental gradients.