Demonstrating the Effectiveness of NSZD Compared to Hydraulic LNAPL Recovery

Steven Gaito & Mark Klemmer – ARCADIS U.S., Inc.
William Parry – CSX Transportation

The presence of light nonaqueous phase liquid (LNAPL) in a monitoring well often results in a regulatory mandate that LNAPL must be remediated, leading to the installation and operation of LNAPL recovery systems that may not always be technically or cost-effective. Recent guidelines from ASTM and Interstate Technology & Regulatory Council (ITRC) have changed the regulatory paradigm that called for the required removal of measurable LNAPL in monitoring wells to one that accommodates risk-based LNAPL remediation and management. New techniques are available to evaluate the mobility, risk, and recoverability of the LNAPL; and determining the rate of natural source zone depletion (NSZD) can guide LNAPL management decisions.

Natural source zone depletion (NSZD) represents a combination of natural processes that reduce the mass of light non-aqueous phase liquid (LNAPL) in a source zone through chemical redistribution of NAPL constituents (i.e., dissolution, volatilization, and sorption) and through biodegradation by microbial and/or enzymatic activity. NSZD is increasingly being considered as an important component of any LNAPL plume management strategy, as measurements of NSZD rates can serve as a benchmark for comparison to the performance and relative benefit of active, engineered remedial alternatives. NSZD, in combination with a demonstration of LNAPL body stability, has particular relevance as a remedial option for those sites which exhibit low risk or where engineered remedial alternatives are impractical.

The selection of NSZD as part of a remedial strategy is illustrated at a former railyard in Massachusetts. NSZD as a viable LNAPL management strategy was demonstrated through an evaluation of risk pathways, LNAPL plume stability, LNAPL recoverability, and quantification of LNAPL mass loss rates through volatilization, dissolution, and biodegradation. NSZD rates can be surprisingly high (thousands of gallons per acre per year), causing doubt as to the validity of the estimate. Rates determined for this site will be shown in context of smear zone thickness, saturation, and compared to standard LNAPL recovery methods. The investigative process and methodologies used to provide a defensible demonstration for NSZD will also be described; along with a comparison of NSZD rates to active LNAPL recovery rates, and an estimate of overall project lifecycle cost savings using NSZD compared to traditional alternatives.