Case Studies of LNAPL Evaluation Process and Applicability for Site Remediation Decision Making

Tom Palaia (tpalaia@ch2m.com) (CH2M HILL, Denver, Colorado, USA), Robert Frank (CH2M HILL, Phoenix, Arizona, USA), Chris Hood (CH2M HILL, Navarre, Florida, USA), Jennifer Whitney (CH2M HILL, Lansing, Michigan, USA)

Site-specific light non-aqueous phase liquid (LNAPL) evaluations were proven to be valuable for site conceptual model (SCM) understanding and site management decision making at three different remediation sites across the country. This presentation describes the LNAPL evaluation process and presents three case study applications. The results of the LNAPL evaluations are presented and their importance with regards to remediation technology selection and improved site management is discussed.

This presentation highlights the importance of understanding the LNAPL "geometry" for derivation of remediation goals and cost-effective technology application. The site-specific LNAPL evaluation process evolved from the wide-spread need for optimization of existing LNAPL remediation systems. For example, many fluid recovery systems are being operated without well-defined endpoints. The LNAPL evaluation process was designed to support operational endpoint definition. However, the LNAPL evaluation process also takes a more forward-looking approach by refining the LNAPL SCM through detailed assessment of the LNAPL characteristics and analytical modeling that can be used to justify future remediation technology selection.

The LNAPL evaluation process consisted of field and laboratory analysis followed by analytical modeling to evaluate various LNAPL remediation alternatives. The focus of this presentation is on the LNAPL evaluation component rather than the technology selection process. The results of the technology selection process are only briefly summarized to illustrate the pertinence of the LNAPL evaluation process in site remediation decision making. Depending on the site complexity, the level of SCM uncertainty, and administrative constraints, the LNAPL evaluation process may begin with the performance of real-time, in-situ measurements such as laser-induced fluorescence (LIF) and/or collection of intact soil cores for various LNAPL analyses. The LNAPL analyses used for the case studies presented herein are commercially available and primarily include pore fluid saturation analysis and capillary pressure testing. The results of the site-specific LNAPL laboratory analyses were then used as input to an LNAPL saturation model and used to predict LNAPL mobility as a function of saturation and gradient. These calculations are based on standard soil and hydrogeologic science using modified forms of the van Genuchten equation, Mualem expression, and Darcy's law. Based on various simulations and other supporting calculations, LNAPL fate and transport was predicted to assist in the selection of a preferred remedial technology.

Results from the application of the site-specific LNAPL evaluation process are summarized for three sites of varying geography, soil type, and LNAPL character. Two industrial sites (New Jersey and Arizona) and one military installation (Eglin Air Force Base, Florida) are discussed. The results at each site are concisely compared and contrasted to evaluate the cost-effectiveness of the LNAPL evaluation process to the overall site remediation efforts.