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Focusing a Mineral Spirit LNAPL Investigation towards Remedial Design Using UVOST Combined with Traditional Sampling to Assess 3-D Distribution

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Background/Objectives. Former operators at an 8.5-acre industrial facility historically used mineral spirits as a prime component in their product manufacturing process. The site geology consists of till overlying mudstone bedrock, which lies at depths ranging from approximately 7 to 20 feet below ground surface. Prior remediation to address underground storage tank (USTs) discharges and spills, associated LNAPL and soil and groundwater impacts at the site were conducted from 1989 through 2000. Subsequently, in 2004, a Classification Exception Area (CEA) was established for monitored natural attenuation of benzene in groundwater with an estimated 10-year duration. The regulatory agency made an entire site no further action (NFA) determination at that time. While conducting groundwater investigations to close the CEA in 2015, free LNAPL (mineral spirits) was again identified in a monitoring well and volatile organic compounds (VOCs) were identified in groundwater at concentrations above Ground Water Quality Standards (GWQS), which triggered the requirement to conduct a Remedial Investigation (RI). Upon evaluating historical data, it was realized that LNAPL was never fully delineated or characterized, and source areas were not remediated below the water table because the groundwater pump and treat system (GWPTS) remedy for the Site collected only approximately 21 gallons of free LNAPL. Total petroleum hydrocarbon storage capacity was approximately 62,000 gallons (21 USTs) prior to the late 1980s/early 1990s, and approximately 51,000 gallons (16 ASTs) after that time.

Approach/Activities. Regulatory requirements necessitate the delineation of free and residual LNAPL as well as soil and groundwater impacts above state standards, the removal or destruction of free and residual LNAPL, and remediation of soil and groundwater to the state standards. To help streamline the progression towards achieving these goals, a laser induced fluoresce (LIF) ultraviolet optical screening tool (UVOST) and a hydraulic profiling tool (HPT) were selected to rapidly investigate the extent of remaining LNAPL in the subsurface and direct investigation and remediation activities. A 3-D LNAPL conceptual site model (LCSM) was developed in Earth Volumetric Studio (EVS) combining 3-D interpolated UVOST response, Site geology, topography, aerial photos, and other Site features. Installation and sampling from groundwater monitoring wells and soil borings were conducted based on the LCSM and the analytical protocol was chosen to meet the RI regulatory requirements and provide Pre-Design Investigation (PDI) data. The LCSM was updated to identify those areas requiring remediation.

Results/Lessons Learned. Soil standard exceedances were found to be very limited and free LNAPL was not found in monitoring wells at the suspected source areas, though UVOST indicated that small amounts of residual LNAPL occurred across much of the Site. Groundwater concentrations exceeded GWQS for VOCs and semi-volatile organic compounds. The LCSM indicated the locations of impacted soil areas requiring remediation to address the groundwater condition. Since the RI and PDI activities were coupled and focused on the areas dictated by the UVOST/HPT results, a large amount of guesswork was eliminated, cost-savings were realized by generating data that serve the dual purpose of complying with regulatory standards and designing the final remedial action, and the efforts to evaluate remedial alternatives and the subsequent design have been streamlined.