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A Simple Assessment Reveals Discrete VOC-Contaminated Groundwater Discharges to a Piedmont Stream

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Background/Objectives. The Hemphill TCE Superfund Site consists of two parcels along Hemphill Road in South Gastonia, North Carolina. During the 1950s, the owner reportedly used the southeast parcel to recycle several thousand chemical drums. Reports indicated that drum residues were dumped onto the ground surface, then the drums were rinsed, burned and flattened for sale as scrap metal. In 1988, a private water supply well was discovered to contain TCE which triggered the first of the environmental investigations for this site. The hydrogeological setting is typical for the Piedmont with residuum, a partially weathered rock zone and fractured bedrock. The release location was near the ridge and the contamination has migrated 800 ft downhill/ downgradient to the unnamed creek. The CERCLA site investigation detected TCE 2,000 feet further downstream from the point of closest discharge. The objective of this phase of the investigation was to identify specific points of groundwater discharge to surface water and characterize the VOC concentrations of those discharge points relative to the stream.

Approach/Activities. Based upon an idea from an EPA technical conference, it was proposed to use a thermal imaging camera and a thermal probe to identify groundwater discharge areas based upon their thermal signature along the bank of a downgradient stream. Surveys were initially performed in August and the locations were identified for later sampling. The stream was resurveyed and resampled the following February. This allowed assessment of the maximum thermal difference between the seeping groundwater and the ambient stream water as well as the VOC concentrations discharging into the creek.

Results/Lessons Learned. Use of thermal imaging equipment identified specific point discharges of groundwater into surface water. In this specific setting, groundwater VOC concentrations were slightly elevated relative to the ambient concentrations in the stream. As expected in the summer, groundwater is cooler than the receiving surface water vice versa in the winter. The difference in the wintertime was on average twice that of the summertime temperature difference. With the slightly elevated results, we were able to use more appropriate VOC concentration values for performing the risk assessment. Hydrogeologically, the VOC detections in the stream improved the conceptual site model and aided in the placement of both residuum and bedrock wells in areas not originally considered. One drawback for thermal imaging cameras is they only work on the surface of the water and do not necessarily represent the temperature more than a couple of inches below the surface. Consequently, these type of studies are best suited for shallow streams. It is recommended that you look for discharges to sample on both sides of the stream. This effort only looked on the obvious ‘downgradient from the release area’ side of the creek. At this site, there are private residential supply wells and septic systems that may have drawn VOCs through the fracture system underneath the creek that may be discharging on the ‘other’ side of the creek. This points to using a more comprehensive approach to the site’s conceptual model.