Changing Long-Standing Conceptual Site Models and Risk Perception with High Resolution Contaminant Distribution (HRCD)

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Background/Objectives. Monitoring well placement and spacing can be arbitrary and is often driven by logistics, feasibility, and/or cost. Data gaps can exist due to the built environment, property issues with neighbors and security issues (industry, military) as well as cost and interference in commerce. Even in open areas, zones of high mass can be missed due to conventional spacing and/or access issues as cited. New technologies have dramatically improved the quality, quantity, and density of data collection in the vertical profile; however, the true nature of conditions in the horizonal plane can be compromised and data gaps can negatively impact conceptual site models (CSMs). This naturally has downstream impacts on cost, risk, and overall success in site management. The simple fact is that with vertical wells alone, a proper CSM is very challenging and often not achievable.

Approach/Activities. Vertebrae™ Well Systems are horizontal nested and segmented well systems capable of producing high resolution contaminant distribution (HRCD) data to complement high resolution site characterization (HRSC) assessments that depend on vertical profiling. The central case study presented illustrates how understanding the contaminant distribution horizontally is critical to site assessment and remediation. A former dry-cleaning site in the Orlando area has been characterized with shallow and intermediate plumes of 400 to 700 feet in length, each with different properties. Vertebrae well systems were installed to aid in defining the magnitude and extent of contamination and added significant information that more precisely defined both plumes. As defined by its nature, the Vertebrae Well Systems were unaffected by obstacles at the site involving a complex-built environment in a strip mall and a four-lane median highway. Our additional efforts at other sites further illustrate how this site is not alone with various assumptions and limitations bringing error to the CSM. These sites are presented as a statistical data set.

Results/Lessons Learned. Vertebrae Well Systems have generated a more intense data density allowing pinpoint accuracy of the source and more complete iso-contours. The added quality and quantity of data have improved the CSM with each use. Basically, three outcomes are plainly observed relative to a gradient of assumptions and characterizations. They are: 1) substandard evaluations which lead to longer than necessary remedial efforts and added cost, 2) highly conservative approaches that lead to unnecessary spending and 3) proper assessments, which unfortunately are rare, as indicated by our data. A key lesson learned is that data gaps, very much as consequence of the status quo, lead to inefficient responses with losses of time and money. Clearly, exploring data gaps and revealing true conditions in a horizontal plane, with HRCD, is an evolutionary step in proper site management. This is especially powerful when HRCD is guided by HRSC for the efficient placement of horizontal wells, so there is synergy in dual use. All of this has ultimate impact on risk to the end users who should be made aware of the ineffectiveness of making mass-based assumptions when the entirely of the plume is not well known and characterized. Then, the other side of the assessment process is treatment. Consequently, the Vertebrae system is the only protocol that allows for treatment without modification bringing in those collateral benefits. The fundamental conclusion, which we will illustrate, is that nested, segmented horizontal wells, for assessment and/or remediation can be critical in reaching site cleanup goals.