Douglas E. Wyatt, URS/EG&G, National Energy Technology Laboratory (formerly Westinghouse Savannah River Company)

Advanced Geophysical Logging in Shallow Unconsolidated Coastal Plain Sediments

Geophysical logging in the shallow boreholes typically drilled into unconsolidated sediments for geotechnical or environmental studies is usually limited to simple gamma ray and resistivity measurements. These measurements are generally well understood and accepted for simple stratigraphic mapping and fluid modeling. However, utilizing state of the art oil and gas exploration geophysical tools allows for a greater understanding of the complexities that effect groundwater flow and contaminant migration. The Savannah River Site, a large DOE facility in South Carolina, lies on unconsolidated Upper Atlantic Coastal Plain sediments. Sediment thicknesses vary between approximately 200 meters updip to approximately 400 meters downdip. These sediments are generally deltaic to near shore marine in character, and consist of alternating sands and clay. The sands are usually aquifers and the clays are usually aquitards. Because of the varying depositional character of the sediments, vertical and lateral variations occur often. The standard bore hole gamma ray and resistivity geophysical logs provide good sand clay signatures and often indicate relative fluid zones, however permeability and facies variations, necessary for detailed modeling cannot be discerned. During geotechnical characterization for a linear accelerator, detailed geophysical logs were obtained in a correlation borehole. High resolution resistivity, spectral gamma ray, and magnetic resonance logs defined compartmentalized fluid flow zones within aquifers that had been originally modeled as uniform. Comparing these data to a grid of bore holes and cone penetrometer tests allowed for a detailed stratigraphy and fluid modeling not possible using conventional logging tools.