High-Resolution Site Characterization in Brazil Using Resistivity Piezocone Test (RCPTu) for Hydrostratigraphic Profile

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Background/Objectives. A suitable decision-making on a contaminated site characterization and remediation program is strongly dependent of the diagnosis process. The correct diagnosis and development of an appropriate conceptual site model (CSM) is very important to develop an accurate remediation project. In Brazil, most of the site investigation campaigns are based on the traditional approach: monitoring wells installation and direct push soil samples (DPT). More specifically, the drilling for monitoring wells installation is the only way to establish the hydrostratigraphic profile and to develop the CSM. These tools cannot detect the hydrogeology heterogeneities in an appropriate scale, which are the most critical and relevant uncertainties on the geo-environmental site characterization. A detailed and suitable diagnosis can be done based on a CSM elaborated using high-resolution site characterization (HRSC) tools. The main goal is to determine the hydrogeological heterogeneities in detail. Several studies argued that one of the best HRSC tools is the cone penetration test with pore pressure (CPTu). This high-resolution tool also allows attaching specific sensors, like the resistivity probe. This hybrid device is called resistivity piezocone (RCPTu). The use of this additional sensor can provide greater accuracy in determining the stratigraphic profile together with the cone tip (qc), sleeve friction (fs) and pore pressure (u).

Approach/Activities. This paper presents four geo-environmental site investigations campaigns in Sao Paulo State, Brazil, where the RCPTu tests were used as a primary tool for high-resolution hydrostratigraphic profile development. The first site is in the city of Bauru, with predominant sandy soils, and the upper aquifer about 4.0 meters. The second is a clay soil site in Sorocaba, with a benzene plume in upper aquifer (about 7.0 meters). The third site is a landfill in Angatuba, with clay organic soil and water level about 5.0 meters possibly contaminated by domestic landfill. The last site is a complex interbed (organic clay, sand, fine sand, gravel and clay) area, contaminated by TCE.

Results/Lessons Learned. Traditional tools were also used with high-resolution tools, like RCPTu tests, pore pressure dissipation tests and Direct Push Slug Tests. All these tools together allowed a low-uncertainties CSM and a "k-map" development. The RCPTu test results showed clearly details of transport and storage zones that were not detected by traditional tools (DPT and monitoring wells installation). The previous CSMs (based only in traditional tools) were very different from the high-resolution CSMs. This paper shows that RCPTu is a tool compatible with HRSC approach, and improves CSM development, therefore, RCPTu test results can reduce mistakes on Brazilian remediation projects.