

## Multiple Remediation Technologies: A Challenging Contaminated Site in Colombia

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**Background/Objectives.** A former chemical plant located in Colombia operated for over 50 years manufacturing chemical additives, plasticizers, stabilizers, and tar distillation. The Colombian environmental market is not well developed and the procedures for investigation and remediation are being learned by the local companies and environmental authority. The plant was deactivated and currently is under redevelopment. Considering the plant's location, inside a very populated neighborhood, with residential receptors living close by, the municipality intends to buy the land and use it for developing local transportation infrastructure.

Initially the company conducted a poor site investigation and identified LNAPL which resulted in a huge excavation process to remove more than 100,000 metric tons in one year. Considering the excavation was still revealing more and more free-phase occurrences, it was decided to identify a company with the necessary expertise to carry out a new investigation to understand the hydrogeological conceptual model and the contamination of the area.

**Approach/Activities.** Based on the initial strategy and the associated results, SGW decided to stop all remediation actions and step back to investigate mixing traditional and high-resolution investigation tools. Centimetric direct and indirect investigations were carried out, hundreds of OIP and HPT (Hydraulic Profiling Tool) were performed and dozens of membrane interface probe (MIP) points and additional drillings were performed to determine an accurate stratigraphic model.

**Results/Lessons Learned.** Despite the use of high-resolution tools, particularities of the site can lead to misinterpretations about the distribution of contaminants, such as the presence of organic clays, calcite, iron oxides and high fluctuations of the water table. An experienced field team was the key to update the conceptual model and also to understand that the presence of several hydrocarbons at the site, with different viscosities, would be an additional challenge for the continuity of the LNAPL removal, where multiple remediation technologies (excavation, MPE, soil flushing, ISCO, soil washing) had to be implemented to obtain the best effectiveness and rehabilitate the area for the intended use. Remediation is ongoing now (excavation, MPE and soil flushing already in place, ISCO and soil washing in the upcoming months).