

Geophysical Characterization of the Shallow Subsurface at a Contaminated Site in Calcasieu Parish, Louisiana

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ABSTRACT

High-resolution surveys of electrical resistivity, total magnetic field gradient, and surface magnetic susceptibility were conducted at the Fredeman Pit (a separate site within the Bollinger Shipyards) in Calcasieu Parish, Louisiana. The main objective was to obtain a 3-D image of the shallow subsurface in an effort to map the exact location of the pit, to determine the extent of the contaminated material, to locate any buried metal objects, and to determine variations in the composition of the surface layer. Shipbuilding and repair as well as barge cleaning operations at the site have been continuous since 1953. The Louisiana Department of Environmental Quality (LDEQ) determined in 1995 that the shallow sediment and ground water beneath the site had been affected by light non-aqueous phase liquids (LNAPL) and dense non-aqueous phase liquids (DNAPL).

The Geometrics OhmMapper resistivity tool was used with transmitter-receiver spacings of 8.2, 16.4, 24.6, and 32.8 ft (2.5, 5, 7.5 and 10 m) to produce virtually-continuous electrical-resistivity depth profiles along 32.8-ft (10-m) spaced survey lines. Inversion of these data produced a 3-D model of the resistivity structure of the shallow (<20 ft) subsurface. Interpretation of the 3-D model revealed the possible locations of the pit boundaries and the approximate depth of the contaminated sludge-filled pit. The magnetic data collected in the same survey area revealed that there are possibly a few small, buried metal objects in the pit. The surface magnetic susceptibility revealed variations in the composition of the surface layer (~1 in). These anomalies are caused by the presence of metal pieces and rust scattered in some areas on the surface of the pit. Our study demonstrates that high-resolution and high-quality data from the shallow subsurface (<20 ft) can be obtained with the OhmMapper in an environment dominated by conductive silts and clays. The results of this integrated geophysical approach can be used to aid in site assessment and remediation programs.