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Use of the Frequency Domain Electromagnetic Method (FDEM) in the analysis of contamination in a small area downstream of the Bauru -SP Controlled Landfill.

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Applied Geophysics has demonstrated significant findings in shallow depth and high-resolution applications, particularly within environmental studies. Integrating geophysical information with direct information, such as that obtained from monitoring wells, has been demonstrated to enhance the conceptual models of contaminated areas. The Bauru Controlled Landfill, located in the state of São Paulo, is 15 kilometers from Bauru downtown and 1 kilometer from pasture areas and a significant drainage in the region. Water quality analyses of monitoring wells near the study area revealed changes in salt values, particularly chloride, suggesting that the sealing system was ineffective. This indicated potential contamination due to the migration of leachate into the subsurface. To assess the contamination plume, the Frequency Domain Electromagnetic method was applied to 4 lines in a small area downstream of the landfill. The equipment used is the Geonics EM34, consisting of a Tx transmitter coil and an Rx receiver coil. The transmitting coil emits a primary magnetic field (Hp), which induces electrical currents in the subsoil, generating a secondary field (Hs). The sum of these two fields is measured by the receiving coil. In this way, the apparent conductivity of the medium can be obtained. A spacing between the coils of 10 meters was used, which allows an investigation to a depth of 7.5 meters in the horizontal dipole, and 15 meters in the vertical dipole. The data was refined using the EM34-2D inversion software by Monteiro Santos (2004), and the profiles were generated using Surfer 10 software. In addition integrating the geophysical data, information from monitoring wells near the study area was used to improve the characterization of the contamination generated. The four profiles obtained express conductivity values (mS/m) by depth (m), arranged in a north-easterly direction. In lines 1J and 2J, conductivity varies from 10 to 30 mS/m across most of the profiles. These low conductivity values indicate a more resistive nature of the subsoil. However, there is an increase in conductivity, ranging from 35 to 60 mS/m, from a depth of 4 meters and in the northeast region of the profile. On line 3J, there is a more resistive character to the northwest of the profile down to a depth of 6 meters, characterized by low conductivities ranging from 5 to 25 mS/m. However, from 6-meter depth and further to the northeast of the profile, there is a gradual increase in conductivity values, ranging from 35 to 60 mS/m. Finally, line 4J, unlike the others, is less resistive. The lowest conductivities are found in the first 4 meters of depth, in the northwestern portion of the profile. From 6-meter depth onwards, conductivity gradually increases, ranging from 35 to 55 mS/m. In the northeastern portion of the profile, there is high conductivity, with values ranging from 50 to 70 mS/m from a depth of 2 meters. Overall, there is a leachate leakage at shallow depths, and the profile generated by line 4 shows the highest conductivity values and consequently the greatest amount of leachate migrated underground. The profiles indicate an advance of the contamination plume to the northeast in this small area downstream of the Bauru Controlled Landfill, indicating inefficient sealing, which corroborates the data from the monitoring wells (high chloride levels) and previous research conducted in the area.