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Land Recycling: Geophysics Applied to Landfill Data Recovery for Urban Reuse

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Introduction

The concept of land recycling has gained prominence as a strategy for the reuse of abandoned or underutilized areas, such as former landfills, enabling their redevelopment or repurposing for urban and social uses. However, the reuse of these sites is often hindered by the lack of information regarding the types of waste deposited and the geometry of the disposal pits, particularly in older landfills. To overcome this limitation, the application of geophysical methodologies has proven to be an effective and promising scientific tool for reconstructing such information and providing the technical basis required for legal authorization and land-use planning. This study presents the results obtained from investigations conducted at two landfills in the Metropolitan Region of Salvador, Bahia: one inert waste site, where geophysical data (magnetometry and electrical resistivity) were crucial for the implementation of a section of Salvador's subway system; and another urban solid waste site, located in the city of Camaçari, where a multiphysics approach combining electrical resistivity, ground-penetrating radar (GPR), and very low frequency (VLF) methods was applied. This approach enabled the identification of zones with leachate and gas generation, as well as clay layers from different capping stages.

Method and/or Theory

Data processing and interpretation allowed for the reconstruction of pit geometries and the differentiation of waste subdomains, even in areas where documentation had been lost. Among the methods employed, notable techniques included resistivity data inversion, forward modeling of magnetic profiles, and interpretive filtering applied to VLF data, such as Fraser, Karous, and Euler filters.

Results and Conclusions

This study demonstrates that geophysics provides a robust technical foundation for the safe and sustainable planning of land reuse in areas previously impacted by environmental liabilities, contributing to the integration of environmental recovery and urban development.