



Integrated geophysical imaging of a solid waste landfill (Greater London, UK)

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In recent years, increased pressure on land use has underscored the need for characterisation of waste composition and distribution in old landfills. In some cases, a lack of information about waste types and potential leachate migration may also pose risks to the environment. Additionally, the emerging potential for retrieving raw materials from old landfills via enhanced landfill mining has further driven the need for developing better informed landfill inventories. Characterising landfills traditionally relies on two main sources of information: historical reports and ground truth data. However, historical reports on old landfills are not always available or are often incomplete, and relying only on ground truth data (drilling or trenching) is costly and requires extrapolation of, and interpolation between, sparse point-data. Geophysical techniques provide an additional, complementary way for characterising landfills, and a means of non-invasively gathering volumetric information on large portions of the surveyed area. Although, in many cases, the complexity and heterogeneity of the internal structure of the landfill makes it difficult to rely on measurements of one single geophysical property alone.

Here, we present an integrated geophysical survey conducted at a landfill site in the Greater London area. The site consists of a former sand, gravel and clay quarry, which was utilised as a solid waste landfill from the 1940s. The landfill was progressively filled with domestic and commercial waste, reaching a peak in activity in the late 1960s and 1970s. Since the landfill has ceased to operate, the site is now relatively flat, covered by grass and used for horse grazing. Our geophysical campaign comprised a combination of several geophysical techniques including rapid mapping (Electromagnetic Induction, EMI; Magnetometry) and profiling techniques (Electrical Resistivity Tomography, ERT; Induced Polarization; IP; Multichannel Analysis of Surface Waves, MASW). The results show a strong contrast in geophysical character between the eastern and the western side of the surveyed area, attributed to a significant change in waste composition. The geophysical results are compared with two intrusive sampling campaigns comprising a series of boreholes, trial pits and Cone Penetration Tests (CPT). Correlating these ground truth data with

the geophysical results allows the identification of different geophysical properties related to distinct waste types, from which it is possible to outline zones of similar waste composition within the landfill site.