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RESISTIVITY-IP TOMOGRAPHY FOR MAPPING OF OLD WASTE DUMPS AND CONTAMINATED GROUND

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Abstract

Buried waste and contaminated ground are widespread in connection with old waste dumps and derelict industrial ground. Several problems are associated with such areas, for example contaminant leakage that can threaten ecosystems and drinking water resources. Buried waste can create severe problems such as subsidence and health hazards when redeveloping areas previously occupied by landfills, due to lack of documentation of the extent and contents. Furthermore it may be desirable to map variation in waste composition for landfill mining purposes. Investigation by drilling and mechanical sounding risks to miss important anomalous zones in the complex 3D structures that are typically encountered in such contexts. Combined DC resistivity and time-domain induced polarization (DCIP) tomography has proved to be a powerful tool for mapping buried waste and contaminated ground in 3D, and can also be used for monitoring (4D) of for example contaminant and gas migration in the ground or inside the waste body. The resistivity typically provides useful information related to the geological setting and contaminant plumes. The IP response (chargeability) generally delineates the extent of the waste, and reflects variations in waste composition. Degradation and precipitation of contaminants can also lead to detectable changes in resistivity-IP responses. Recent technical development within the framework of large research and development projects1 opens new possibilities to extract enhanced information on the subsurface from DCIP tomography. On the data acquisition side hardware development allows IP measurement using 100% waveform, which speeds up surveying and at the same time increases the signal-to-noise ratio. In combination with multi-channel data acquisition equipment and the use of non-traditional electrode arrays this can speed up surveying manifold, and thereby make it more time and cost efficient. A novel signal processing methodology can double the spectral content of time-domain IP data, which in combination with inversion (inverse numerical modelling) algorithms for spectral model interpretation allows creation of more nuanced images of the subsurface. This in turn leads to enhanced models of the subsurface that are expected to open up for refined characterisation of buried waste and contamination status.

[1] MaLaGa: http://malagageophysics.com/; Geoinfra: TRUST 2.1: http://trust-geoinfra.se/; GEOCON: http://www.geocon.env.dtu.dk/

Keywords

Waste, landfill, contaminants, resistivity, induced polarisation, tomography.