Leachate plume mapping by using electrical resistivity tomography

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The leachate plume generated from a solid waste dump site comprises a hazardous mix of heavy metals and salts. The percolation of this leachate into the subsurface, contaminate the groundwater and pose a serious threat to both the nearby human population and the surrounding ecosystem. Therefore, immediate remediation measure required to mitigate its adverse effect. However, determining the exact dimensions of the plume and subsurface characteristics typically requires costly and environmentally unfriendly drilling methods. Therefore, alternative approaches are necessary to achieve effective remediation while minimizing environmental impact and resource expenditure. In this study an Electrical Resistivity Tomography (ERT) was applied to a test site to see its applicability to map the leachate plume. The motivation behind the use of this technique is that as leachate plume contains charge particles (heavy metals and salts), when it interacts with subsurface pore water it enhances the electric charge of soil (conductivity) and facilitates the flow of electric current. These anomalous conductive zones can be mapped through electrical methods. The data was acquired along the two ERT profiles. First profile was acquired adjacent to leachate accumulation point. We deliberately perform the short survey configuration in which each takeout was connected to the electrode and electrode spacing was chosen 1m to get the good resolution data, thereby enhancing our ability to discern the subtle variation in resistivity caused by the presence of the leachate plume. The resistivity value of leachate plume usually considers as (< 25 ohm.m), but it highly depends on leachate mineralization and subsurface geology. By analyzing the resistivity section enables us to confidently identify the leachate plume, characterized by its low resistivity zone (< 10 ohm.m). Second ERT profile was acquired on the top of waste

containing zone. By analysis the inverted section, a varying resistivity stratum with the thickness of 5m was observed. This varying resistivity is due to the heterogeneous nature of waste containing zone. Beneath the waste containing zone a low resistivity anomaly (< 10 ohm. m) was encountered and marked as a leachate plume that was extended up to the depth of 14m. To validate our results, soil samples were collected along each ERT profile. The chemical analysis of soil revealed relatively high level of elemental concentration in zones where ERT indicated the presence of leachate plume at shallow depth of 0.5m. The overall, results suggest that ERT has a potential to detect the leachate plume in the subsurface.