

CHARACTERIZATION OF NORMAN LANDFILL IN OKLAHOMA: AN INTEGRATED GEOPHYSICAL AND GEOCHEMICAL APPROACH TO IMAGE A CONTAMINANT PLUME

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Landfill leachate plumes have been one of the major environmental challenges because of its ability in contaminating ground water aquifers. The toxic materials transported by leachate plumes are highly vulnerable to water resources in shallower depths. Current study site is a closed municipal solid waste landfill, formerly operated by the City of Norman in Oklahoma. The study was conducted to map the edges of the Norman landfill leachate plume and its migration directions over time. We used different geophysical methods including electrical resistivity, electromagnetic (EM34), seismic and spontaneous potential (SP). Previously analyzed total dissolved solids (TDS) data was also incorporated from groundwater samples collected from the wells. The results from EM 34 and resistivity methods show a strong conductive zone across the study area which may have been the measure of higher concentration of contaminants from the leachate plume. Seismic velocity shows a general decrease in velocity across the plume. Although such behavior of velocity across the plume was not understood completely, but the decreasing velocity corresponds to low resistivity area. This may be suggestive of the increasing porous nature of the medium as the leachate precipitates. Results from the SP, also shows changes across the plume. All the results from different geophysical techniques represent a significant correlation. Along with geophysical signatures of the area, high chloride concentration zones were identified from TDS data as well. After integrating all the results from geophysical and geochemical analysis, edges of the leachate plume were located along the central part of all of our survey lines. However, the northeastern edge of the conductive body was also delineated. Our study suggests that an integrated geophysical study can be applied successfully to characterize contaminant leachate plume and can be tied with geochemical results for better mapping of such plumes.