

Prediction of Post-Closure Water Balance for Monolithic Soil Covers at Waste Disposal Sites in the Greater Accra Metropolitan Area of Ghana

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Abstract

The Ghana Landfill Guidelines require the provision of a final cover system during landfill closure as a means of minimizing the harmful environmental effects of uncontrolled leachate discharges. However, this technical manual does not provide explicit guidance on the material types or configurations that would be suitable for the different climatic zones in Ghana. The aim of this study was to simulate and predict post-closure landfill cover water balance for waste disposal sites located in the Greater Accra Metropolitan Area using the USGS Thornthwaite monthly water balance computer program. Five different cover soil types were analyzed under using historical climatic data for the metropolis from 1980 to 2001. The maximum annual percolation and evapotranspiration rates for the native soil type were 337 mm and 974 mm respectively. Monthly percolation rates exhibited a seasonal pattern similar to the bimodal precipitation regime whereas monthly evapotranspiration did not. It was also observed that even though soils with a high clay content would be the most suitable option as landfill cover material in the Accra metropolis the maximum thickness of 600 mm recommended in the Ghana Landfill Guidelines do not seem to provide significant reduction in percolation rates into the buried waste mass when the annual rainfall exceeds 700 mm. The findings from this research should provide additional guidance to landfill managers on the specification of cover designs for waste disposal sites with similar climatic conditions.

Keywords: water balance model, landfill cover, landfill closure, waste disposal site, Ghana

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