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UTILIZATION OF CLAY AND GEOMEMBRANE LINING IN LANDFILLS

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ABSTRACT OF M.SC. THESIS

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ABSTRACT

Landfills are different to dumps or tips, which are what most people think of when they hear about landfills, because they are carefully constructed with special lining and covering systems to contain the waste. The aim is to avoid any hydraulic [water-related] connection between the wastes and the surrounding environment, particularly groundwater. Traditionally, these liner systems are composite of compacted clayey soil and a synthetic membrane. However, In Egypt most of the engineered landfills are having a single liner system consisting from geomembrane (HDPE) sheets. For that purpose, part of this study investigates the effect of imperfections of the HDPE sheets on the overall permeability of the composite liner to emphasize the importance of the secondary liner in the prevention of the ground water table contamination.

Engineering specifications for a compacted clay liner are based mainly in a permeability coefficient less than 10^{-7} cm/s and the need for stability during construction and operation of the landfill.

Sand-bentonite mixtures are often used as a barrier material when there is a lack of naturally occurring clayey soils at the landfill site. The addition of relatively small amounts of bentonite (5-15%) can improve the performance of a granular material providing both a low permeability and an enhanced mechanical stability. In addition, bentonites, obtained in dry,

powdered forms, are much easier to blend with onsite sandy soils and to be compacted than wet, sticky clods of clay.

The central part of the experimental program focused on the detailed investigation of the permeability coefficient of the sand-bentonite mixtures. The factors affecting it such as the bentonite content and the vertical stress are studied. The impact of real municipal solid waste leachate on the liner permeability is also investigated.

Volume change after inundation is also investigated taking into consideration the effect of the bentonite content and the type of the permeating fluid

The results are presented and analyzed. These results are implemented to elaborate a frame work to the liner design procedure. Recommendations for future researches are made.

Keywords: MSW Landfills, Sand-bentonite mixtures, Natural Clay liner, Geomembrane, MSW Leachate, Coefficient of Permeability, Composite Liner.

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STATEMENT

This dissertation is submitted to Ain-Shams University for the degree of Master of Science in Civil Engineering (Structural Engineering).

The work included in this thesis has been carried out by the author in the Department of Structural Engineering, Ain-Shams University, from 2006 to 2008.

No part of this thesis has been submitted for a degree or a qualification at any other university or institution.

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