Reliability Based Approach for Evaluation of MSW Landfill Designs and Site Selection Using GIS

ABSTRACT

Dumping of municipal solid waste (MSW) generated due to anthropogenic activities in any barren land or out fields causes severe hazards to human populations, ecosystems and the environment. In order to avoid this, it is required to design landfills in an engineered and scientific manner. Therefore, it is necessary to understand the behavior of landfills over a period of time, to design landfills for site specific conditions. In this thesis such an attempt is made to evaluate performance of conventional landfill system using a large scale anaerobic reactor in the laboratory. The performance of the containment (bottom liner and final cover) systems is evaluated through numerical modeling and reliability based analysis. Response Surface Methodology (RSM) is used to develop linear regression models. Influence of various parameters and their uncertainty on the reliability of the containment systems are studied for various scenarios and conditions. Reliability assessment of containment systems play a decisive role in taking remedial measures in order to reduce its adverse affects on the environment and human health in the vicinity of landfill sites. On the other hand, pre-assessment of risk guides the engineers, planners and decision makers in achieving the goal of sustainable solid waste management as well as safe landfills. The thesis also includes assessment of vulnerability of groundwater to contamination, identification and ranking of suitable sites for municipal solid waste (MSW) disposal in the Bengaluru district, using remote sensing and
Geographic information system (GIS) integrated with analytical hierarchy process (AHP), a multi criteria decision making tool. The study considers various land use, geological, hydrogeological and environmental factors as criteria. As a result, two most suitable locations are identified around the Bengaluru city and their descriptions are provided. Further, reliability analysis of the suitability of sites is evaluated considering criteria as random variables. The proposed reliability based approach helps the decision makers and planners to choose site locations having low probability of environmental pollution. The provided methods in the thesis can be effectively used for engineered design of landfills.