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LEACHATE PREDICTION FROM A PILOT SCALE LANDFILL LYSIMETER

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Abstract

The leachate management in a landfill is very important in terms of both quantity and quality. The leachate collection and treatment system in a landfill has to be designed carefully keeping the leachate production minimum. The leachate generation depends upon the climatic conditions of specific location and can be controlled by properties of materials of layers used in any landfill and analyses of water balance. This paper presents the outcome of the study on the water balance of landfill in Nepal using a pilot scale landfill lysimeter. The related leachate production (percolation) as an effect of climatological factors has been assessed. The Hydrologic Evaluation of Landfill Performance (HELP), a computer model has been used to compute estimates of water balances and compared with the actual leachate (percolation) measurement.

It was found out that the percolation generally follows the rainfall trend but the evapotranspiration is more or less similar at certain default conditions. With the simulation carried out, it indicates that the evapotranspiration (ET) is nearly constant and do not exactly follow the rainfall and percolation trend. The percolation or leachate production varied in the range of about 78-86% per year whereas evapotranspiration is about 15 to 21% (18% on an average) of the rainfall amount in this research, the leachate production rate being about 2.63 liters/m2/day on an average, the percentage is compared to be high with other research. The response of average percolation and evapotranspiration with change of hydraulic conductivity values of barrier soil liner is very important. With the change of order of 10-6 to 10-7, there is drastic change in the results. This provides an important design consideration of landfill, where hydraulic conductivity values of barrier soil liner is deciding parameter and should be in order of 10-7 or lesser. When less or no percolation is observed, there will be a leachate mound in the layers above barrier soil liner, which needs to be collected from drainage layer and sent to treatment. Another important parameter observed is field capacity of waste, which has been simulated under various conditions. The FC value of 0.292 vol/vol and hydraulic conductivity (HC) of 0.001 cm/s seems to best fit during statistical analyses.

With the present results, we can say that hydraulic conductivities of the soil are influencing parameters, whereas waste parameters (field capacity and hydraulic conductivity values) have significant impact in water balance. Thus the controlling parameters such as hydraulic conductivity of cover and barrier soil and waste hydraulic properties can change the operation of landfills with respect to water management.

Keywords

HELP model, Leachate, Lysimeter, Simulations, Water balance