GUIDANCE DOCUMENT #528

Division of Materials & Waste Management
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Using the HELP Model to Design the Leachate Collection and Management System

Applicable Rules

MSW: OAC 3745-27-08(C)(3)(c)
OAC 3745-27-08(D)(17)
ISW: OAC 3745-29-08(C)(3)(c)
OAC 3745-29-08(D)(17)
RSW: OAC 3745-30-07(C)(3)(b)
OAC 3745-30-07(C)(3)(f)(v)
Tires: OAC 3745-27-72(C)(4)(b)(ii)
OAC 3745-27-72(C)(5)(b)

Purpose

This educational guideline provides information regarding the use of the Hydrogeologic Evaluation of Landfill Performance (HELP) model for the design of leachate collection and management systems (LCMS).

Applicability

This document applies to owners and operators of municipal (MSW), industrial (ISW), and residual (RSW) solid waste landfills and scrap tire monofills.

Detailed Discussion

The rules require that the LCMS be designed to limit the level of leachate to one foot (other than at sumps or lift stations) throughout the operational and post closure periods. The maximum head requirement is applied to each point within the facility and is not averaged across the entire facility. The rules also require that storage structures have a minimum of one week of storage capacity calculated under final cap system conditions. Leachate generation calculations can also be used in estimating post-closure care costs for transport and treatment.

To meet these requirements, it is necessary for the designer to predict the amount of leachate which will be generated and collected by the LCMS. The designer can use any method that provides reasonable results based on professional judgment. The most widely used method is the HELP model which is a computerized water balance analysis.

Although the HELP model was developed primarily to provide landfill designers with a tool for rapid, economical screening of alternative designs, it is typically used to calculate leachate generation rates. When used for this purpose, it is necessary to pay particular attention to selection of the input values used in running the program, whether equilibrium is reached, and the output values used for evaluation.

DATA VALIDATION

Using a computer model, it is important to check the output to confirm that the results are valid.

Average monthly values and their standard deviations can be used to determine whether the precipitation, runoff, and evapotranspiration estimates are reasonable. Records from weather stations near the landfill can be compared to the estimates. Estimates of runoff are evaluated to determine their reasonableness given the general climate for the state where the landfill is located.

The estimates of average annual lateral drainage from each drainage layer can be used to determine whether flow and moisture equilibrium have been reached by the model. If no flow is predicted in a lateral drainage layer, it is likely that flow equilibrium has not been reached during the simulation. This can happen if the model is run for five years or less.

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The change in water storage also is an indication of whether moisture and flow equilibrium has been reached during the simulation. A large positive value indicates that water is still accumulating in the landfill profile. A negative number (typical of arid areas) indicates that water is being lost from the landfill profile. The model should be run at least until moisture equilibrium is reached (e.g., 100 years). The number of years run in the HELP model is not necessarily related to the proposed life of the landfill.

Data on final water storage at the end of the model run can be used to support the determination that moisture and flow equilibrium have been reached. If the final water storage does not change as the length of the model run increases, then equilibrium has been reached. If longer time periods are simulated using multiple sequential model runs, the final water storage values should be used as input for the initial moisture content for each layer in subsequent model runs.

DESIGNING THE LEACHATE COLLECTION SYSTEM

To design the LCMS (i.e., filter layer, protective/drainage layer, collection pipes, pump, conveyance pipes, storage containers, etc.) to limit the level of leachate to one foot, many designers use an "open" landfill consisting of ten feet of waste and daily cover. The Peak Daily output value is typically used to verify that the design standard is met because it reflects the high level of leachate production.

DMWM has observed from landfill data, that applying a multiplier of 2 to the Average Annual output value will result in an LCMS design that will be sufficient to accommodate the annual average volume of leachate collected; and a multiplier of 6 will be sufficient to accommodate the annual peak volume of leachate collected.

SIZING LEACHATE STORAGE STRUCTURES

Sizing of storage structures is based on the landfill under final cap system conditions. Either the Peak Daily output can be used and multiplied by 7 to make a week, or the Peak Average Monthly output value can be used and divided by 4 to make a week.

DMWM recommends, however, that sizing of storage structures be based on operating landfill conditions. Storage structures sized for a landfill under final cap system conditions, when leachate generation rates are much lower, could be woefully inadequate and cause difficulties for the operator scheduling leachate removal and disposal, especially during peak generation.

ESTIMATING POST-CLOSURE CARE COSTS

To estimate the costs of leachate management during the post-closure care period, the Average Annual output value can be used.

Note, however, that the HELP model is a poor predictor of leachate collected immediately after closure.

If the landfill has a final cap that does not include a flexible membrane liner, DMWM has observed from landfill data that multiplying the Average Annual output value by a multiplier of 40 to 75 matched the actual leachate collected. The multiplier of 75 is more appropriate for the first few years after closure.

References

Krantz, Bernard J. and Sharon L. Bailey, P.E. September 19 & 20, 1990. "An Evaluation of Predictive Models Ability to Estimate Leachate Generation, "Thirteenth Annual Madison Waste Conference, University of Wisconsin-Madison.

Schroeder, P.R., C.M. Lloyd, P.A. Zappi, and N.M. Aziz. 1994. "The Hydrogeologic Evaluation of Landfill Performance (HELP) Model: User's Guide for Version 3," EPA/600/R-94/168a, U.S. Environmental Protection Agency Risk Reduction Engineering Laboratory, Cincinnati, Ohio.

U.S. EPA. 1995. "Evaluation of Subtitle D Landfill Designs Using the HELP and MULTIMED Models: Addendum," U.S. Environmental Protection Agency, Office of Solid Waste, Washington DC.

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Contact

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