

Title: The Use of Groundwater Models to Predict Groundwater Mounding Beneath Proposed Groundwater Gradient Control Systems for Sanitary Landfill Designs (Study No. 7)

Investigators: Principal Investigator

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Objectives: To evaluate models for analyzing proposed gradient control landfill designs, study the hydraulics of an existing gradient control site and verify a selected groundwater model with data from the field site.

Background/Need: Two major landfill designs are used to minimize the environmental impacts of leachate in Wisconsin: a clay-lined landfill and a zone-of-saturation landfill. Gradient controls have also been used as remedial action for unlined contamination landfills and as design modifications to sites originally intended as zone of saturation sites.

Methods: Several steady-state analytical models and a numerical model were investigated as a basis for checking proposed gradient control, sanitary landfill designs. The numerical model selected was Modflow, the United States Geological Survey's three-dimensional, finite difference, groundwater flow model. A papermill sludge, ash and bark sanitary landfill with a gradient control design field site was chosen as the site. Field data was collected from November, 1985 through October, 1986. A Modflow test program was developed to conduct sensitivity analyses of various input parameters and to simulate steady-state analytical models for validation of Modflow with simple drainage problems. Application of field data to Modflow included steady-state simulations of the field site before the landfill was constructed and after the cut-off walls and drainage pipes were installed.

Results: Sensitivity analyses of the steady-state analytical models showed that the formulas were very sensitive to the hydraulic conductivity and recharge parameters. The field site selected had a complex geology, an adjacent, older landfill and complications with the gradient control system. The simulated model results indicate the separation distance between the water table and the sub-base of the landfill varied from two to four feet.

Conclusions:

The field site was found to be too complex to fit the simplifying assumptions associated with the analytical models. The numerical model results may not be conclusive because of the limited number of wells available for calibration and verification.

**Recommendations/
Implications:**

The application of models to proposed gradient control designs should include installation of more monitoring wells for proposed gradient control landfills, in-field and lab hydraulic conductivities performed on all wells and well nests to determine vertical gradients. Models should be chosen based on hydrogeologic conditions of the site. Investigation is encouraged of additional analytical models. Other suggestions include an interactive computer program for the models, a method to calculate the flow rate under cut-off walls, and varying conditions for using the Modflow model.

Availability of Report:

This report is available for viewing and loan at:

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