

Title: **Methods for Determining Compliance with Groundwater Quality Regulations at Waste Disposal Facilities (Study No. 16)**

Investigators: Principal Investigator

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August 5, 1987 through December 31, 1988

Period of Contract:

Objectives:

To develop procedures to establish background water quality at waste disposal facilities, discern standard exceedances and significant water quality changes and screen sites in Wisconsin for evidence of contamination.

Background/Need:

This is the culmination of a two-part study which began in 1985. The first portion was entitled "Graphical and Statistical Methods to Assess the Effect of Landfills on Groundwater Quality" and focused on evaluating the statistical nature of developing procedures for evaluating groundwater quality data. The second portion uses the statistical data to detail procedures for establishing background quality standards and determining groundwater quality change.

Methods:

20 sites were chosen for detailed analysis representative of landfill design, size and geologic setting in Wisconsin. Statistical tests of normality and skewness were applied to data at the 20 sites. Statistical tests to determine water quality change recommended by the Environmental Protection Agency were evaluated. A predictor model for groundwater quality change was developed from geology, groundwater flow, site history, waste type and water quality data from 20 sites. A statistical analysis of groundwater quality data collected at monitoring wells at landfill sites was conducted.

Results:

The assumption of normality was frequently found to have been violated. Many of the most powerful statistical tests rely on this assumption. Seasonality and serial correlation were not frequently found in groundwater quality data. Skewness tests for normality required a simple comparison of skewness coefficient to tabulated values and proved to be valid at a small sample size.

Conclusions:

Graphs of water quality data, especially box plots and time versus concentration plots, are powerful analytic tools to detect groundwater contamination. Water quality graphs can be used in combination with geology, groundwater flow data and waste disposal history to build a conclusive case for groundwater contamination.

**Recommendations/
Implications:**

The following procedures are recommended to evaluate contamination at landfills: time versus concentration plots and box plots, tests of trend to support cases of contamination, resampling of wells, comparison of standard exceedances to laboratory accuracy confidence levels and preventive action limits (PALs) and prediction limits for detecting high concentrations thought to be indicative of contamination.

Investigators recommend that the DNR require submittal of annual time series plots with solid waste and wastewater regulations to detect new problems more effectively and in a time-efficient manner. PALs for indicator parameters should be set based on data for each well, rather than a site-wide basis. PALs should not be set for indicator parameters at contaminated sites.

Availability of Report:

This report is available for viewing and loan at:

The Water Resources Center
1975 Willow Drive
Madison, WI 53706
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Publication 050848

Related Publications:

Study No. 15

Key Words:

Landfills, models, statistical methods

Funding:

The Wisconsin Department of Natural Resources provided funding for this project through the Groundwater Management Practice Monitoring Program which receives appropriations from the Groundwater Account.