

# Groundwater Investigation and Management at Landfills: Insights and Best Practices

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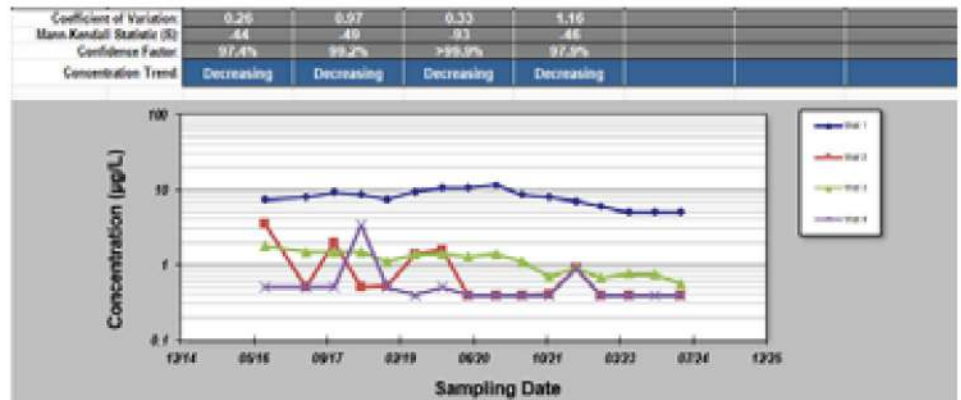
Groundwater management at landfills is a complex yet critical area of environmental engineering. Whether in operation or closed, it is essential to monitor groundwater at landfills to manage leachate, contaminants, and operational issues properly.

Our SCS team analyzed two projects—one involving an active landfill and the other a closed landfill. Active landfills typically exhibit higher leachate levels due to ongoing waste deposition and exposure to precipitation. In contrast, closed landfills with



Field sampling for monochloramines in the groundwater at a Florida landfill.

geomembrane closure systems are designed to minimize water infiltration.



Generated Mann-Kendall statistical analysis graphs using the GSI Mann-Kendall Toolkit.

## Case Study: Active Landfill

In our case study involving an active landfill, we identified specific areas requiring increased monitoring due to elevated leachate indicators. Our team conducted a historical data review to determine background levels for the site compared to current laboratory results, allowing for the identification of migration patterns and areas of focus. Leachate indicators—substances such as ammonia, sodium, and chloride—can signal problems in groundwater. If these compounds, typically absent in the natural groundwater, are detected, it may indicate leaks from the landfill or associated infrastructure. Monitoring these indicators is crucial, particularly when levels exceed state standards or background levels.

Metals also play a significant role when assessing groundwater quality. Florida, for example, has naturally occurring metals such as arsenic and iron. However, if these metals become elevated beyond state standards, they may require prompt attention. By focusing on

flagged areas rather than the entire site, landfill operators can avoid unnecessary extensive sampling and related costs.

## Case Study: Closed Landfill

Our team worked on a closed landfill project and highlighted issues related to gas migration rather than leachate. The landfill had transitioned to a semi-active gas venting system to comply with updated regulations. SCS conducted detailed monitoring and statistical analysis of more than 50 groundwater monitoring wells to assess the extent of gas migration and its impact on groundwater quality.

In addition to chemical sampling, we recognized the importance of biological assessments in understanding groundwater conditions. We conducted microbial sampling to identify bacteria capable of degrading chlorinated compounds, which are of concern in groundwater affected by landfill operations. While the results showed some microbial presence, the populations were insufficient to facilitate effective dechlorination.



*Typical groundwater monitoring well at a Florida landfill.*

This finding underscored the need for a multifaceted approach, combining chemical data with biological analysis to evaluate the site's conditions comprehensively. While enhancing microbial activity in the groundwater could accelerate dechlorination, logistical and cost considerations made this impractical at the time. However, natural microbial degradation of contaminant concentrations is occurring at a slow rate.

### **Communication and Collaboration**

Effective groundwater management hinges on communication between engineers and landfill operators. By engaging operators in discussions about potential sources of contamination—such as damage to the leachate collection system—we can better understand the dynamics at play and take proactive measures.

Regular monitoring is vital so engineers can compare and analyze groundwater samples with historical background levels.

For instance, if a report of contaminant exceedances occurs, reviewing previous records and lab accuracy can provide context and aid in identifying the source of issues. Attributing exceedances solely to landfill operations is a mistake; they may be due to natural influences like changes in rainfall

or seasonal variations, emphasizing the need for comprehensive analysis before jumping to conclusions.

The complexities of groundwater investigation and landfill management demand a thorough understanding of environmental science and regulatory frameworks. We can ensure that landfill operations protect our invaluable groundwater resources by fostering collaboration and employing innovative strategies.

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**Images courtesy of Fauve Herron, EI**

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