

Back to Basics – Environmental Compliance Monitoring

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OUTLINE



GOLDER

- Regulatory Framework
- Hydrogeologic Monitoring Plans
 - Groundwater monitoring
 - Surface water monitoring
 - Leachate collection system monitoring
 - Laboratory & Analytical Requirements
 - Groundwater Statistics & Reporting
- Landfill Gas Monitoring Plans
 - Perimeter landfill gas monitoring
 - Gas Monitoring of Facility Structures

Regulatory Framework

Compliance Monitoring

- FEDERAL REGULATIONS
 - 40 CFR Part 258, Subtitle D
- MICHIGAN REGULATIONS
 - Public Act 451, Part 115
- State regulations are based on Federal regulations

Hydrogeologic Monitoring Plan

Compliance Monitoring

- Based on Hydrogeologic Investigation/Conceptual model
- Includes aspects of landfill compliance monitoring
 - Monitoring locations
 - Site Maps
 - Parameters
 - Various media (groundwater, leachate, surface water)
 - Analysis procedures and types

Groundwater Monitoring

HYDROGEOLOGIC MONITORING PLAN

Well design/location

- Geology
- Topography
- Practical
- Regulatory

Groundwater Monitoring

WELL DESIGN/LOCATION – GEOLOGIC CONSIDERATIONS

- Depth to water
- Confining layers
- Horizontal groundwater flow direction
- Vertical gradients
- Multiple aquifers

Groundwater Monitoring

WELL DESIGN/LOCATION – TOPOGRAPHIC CONSIDERATIONS



- Slope steepness
- Drainage
- Land use (current & previous)

Groundwater Monitoring

WELL DESIGN/LOCATION – PRACTICAL CONSIDERATIONS

- Access for sampling crew
- Protection from traffic
- Installed in areas away from potential contamination



Groundwater Monitoring

MICHIGAN SOLID WASTER (PART 115) REQUIREMENTS

- Upgradient & downgradient locations (600'/300' rule of thumb)
- Casing must maintain integrity of borehole
- Design of screened portion must allow collection of sample (usually 5' length)
- Annular space sealed to prevent surface/shallower contamination
- Wells designed to minimize recharge for sampling
- Wells labeled, locked & visible throughout the year

Groundwater Monitoring

COLLECTING BACKGROUND GROUNDWATER DATA

- Four independent samples during “first sampling event” – what does this mean?
- Background data set must be representative of site groundwater
- Number of background events/data points driven by statistical program
- Best to collect as many as possible prior to waste placement
- Combine with quarterly events when possible

Groundwater Monitoring

GROUNDWATER SAMPLING PROCEDURES

- Decontaminate all equipment prior to use
- Calibrate all meters prior to use (daily)
- Sample wells from upgradient to downgradient
- Collect depth to water measurements
- Follow HMP groundwater purge/sampling methodology
 - Bailer sampling method
 - 3 well volume purging
 - Low flow sampling
- Collect field measurements for stabilization prior to sampling
- Use laboratory provided containers

Groundwater Monitoring

SAMPLE PREPARATION AND DELIVERY OPTIONS

- Fill applicable bottles
- Label each container with parameters requested, time/date of sample, site/ well ID
- Immediately place into chilled coolers
- Pack with ice for delivery to lab
- Include a signed chain-of custody with requested parameters (legal document)
- Seal with custody seal
- Prepare for delivery to lab
 - Drop off at lab
 - Courier service
 - Shipping

Groundwater Monitoring

WELL MAINTENANCE

- Required for life of monitoring plan (i.e., 30 years post-closure)
- Always part of MDEQ inspection
- MDEQ must be notified of decommissioning and/or repairs
- Must stay locked w/ secure cap
- Protection for wells from roads or heavy equipment (i.e., posts, boulders, or brightly painted bollards)
- Labels are readable with correct info
- Accessible to sampling equipment and personnel, free of dense vegetation
- Pads, if present, are intact to hold protective casing in place and not allow surface water infiltration into well

Surface Water Monitoring

HYDROGEOLOGIC MONITORING PLAN

- Required if run-off from site reaches surface water body
- Sampling requirements/parameters included in HMP
- Typically only sampled when flowing water is present
- Number and location of monitoring points vary with each site
- Keep stream channels free of debris, trash, etc.

Surface Water Monitoring

TYPICAL SAMPLING PROCEDURES

- Stand downstream of monitoring location wearing nitrile gloves
- Collect samples directly from stream when possible in laboratory-provided containers
- Record field parameters
- Follow same shipping procedures as groundwater samples

Leachate Monitoring

PART 115 REQUIREMENTS

- Quarterly sampling for 5 Primary Inorganic Indicator Parameters and 36 Primary VOCs
- Annual sampling for quarterly list, plus 12 Secondary Inorganic Indicators, 15 Heavy Metals and 10 Secondary VOCs
- Leachate analytes stay the same regardless of site specific groundwater parameter list

Leachate Monitoring

TYPICAL SAMPLING PROCEDURES

- Sample from site specific location
- Wearing nitrile gloves and safety glasses
- Sample directly into laboratory-provided containers
- Follow same procedures for shipping as groundwater (do not ship in same cooler as groundwater samples)
- Submit Results with Groundwater Reports

Laboratory & Analytical Requirements

HYDROGEOLOGIC MONITORING PLAN

- Laboratory Selection
- Methodology
- Data QA/QC Reviews



Laboratory & Analytical Requirements

SELECTING A LABORATORY

- Certified for all required parameters
- Well acquainted with Part 115 requirements
- Can meet reporting/detection limits required by Part 115
- Turn-around times/responsiveness
- Provide data in appropriate format (EDD)
- Lab has database capability

Laboratory & Analytical Requirements

METHODOLOGY

- Correct methods used – per Michigan regulations
- Correct reporting limits used – per Michigan MDEQ Operational Memo

Laboratory & Analytical Requirements

QUALITY ASSURANCE / QUALITY CONTROL

- Transcription errors
- Holding time exceedances
- Appropriate reporting limits & methods
- Data qualifiers
- Across-the-board dilutions
- Erroneous results
- Blank contamination

Groundwater Statistics & Reporting

TYPICAL MONITORING REPORT

- Data summary
- Groundwater flow map
- Calculate groundwater seepage velocity
- Statistical Analysis
- If statistically significant increase (SSI) is noted, MDEQ must be notified within 14 days of determination of the exceedance
- Resample, complete ASD, or initiate Assessment Monitoring within 90 days
- Generally notification and ASD are included in quarterly report

Groundwater Statistics & Reporting

COMMON STATISTICAL ANALYSIS

- Time Series Plots
- Outlier Analysis
- Trend Analysis
- Prediction Limits
- Control Charts
- Tolerance Limits
- Interwell vs Intrawell
- Comparison to regulatory standards

Landfill Gas Monitoring Plan

Regulatory Requirements

- Less than the lower explosive limit of methane at the property boundary of the facility
- Less than 25 percent of the lower explosive limit within facility structures
- The facility does not create a nuisance

Landfill Gas Monitoring Plan

PERIMETER LANDFILL GAS MONITORING

- Methane monitoring conducted quarterly at a minimum
- The routine program is based on
 - Soil conditions
 - Hydrogeologic conditions
 - Hydraulic conditions
 - Location of facility structures and property boundaries

Landfill Gas Monitoring Plan

LANDFILL GAS MONITORING IN FACILITY STRUCTURES

- Landfill facility structures are equipped with continuous gas meter
- During each monitoring event, the meter is checked visually and tested.

Contact Information

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**Thank you.
Questions?**



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