ALABAMA GROUNDWATER MONITORING REPORTING GUIDANCE

For Solid Waste Facilities

March 2011

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1.0
INTRODUCTION

This guidance is applicable to all facilities which conduct groundwater monitoring under the regulatory requirements contained in Alabama Department of Environmental Management, Land Division, Solid Waste Program, Division 13, revised effective August 3, 2010. This guidance should be used in conjunction with the regulations.

Solid waste facilities which monitor groundwater under the requirements of Division 13 Regulations are required to submit Groundwater Monitoring Reports (GWMRs) summarizing groundwater monitoring activities to the Department. These reports shall at a minimum, demonstrate compliance with the groundwater monitoring requirements for Municipal Solid Waste, Closed Sanitary, Industrial, and/or Construction/Demolition – Inert landfills or propose such actions as may be needed to bring the facility into compliance with applicable portions of Division 335-13.

Groundwater Monitoring Reports are intended to be a stand-alone technical document. While the Department recognizes that some forms of the technical information within the GWMR may have been submitted under separate cover as part of Permit applications or major or minor modifications, a summary of such technical information should still be included in the GWMR.

1.1 APPLICABILITY

The intent of this document is to establish a consistent procedure for preparing a complete Groundwater Monitoring Report for submittal to the Department. Section 2 contains the requested format with brief descriptions of the information to be included.

The Solid Waste regulations are located online at:

http://www.adem.alabama.gov/alEnviroRegLaws/files/Division13.pdf

Additional groundwater monitoring guidance is located in the Alabama Environmental Investigation and Remediation Guidance (AEIRG), and the Alabama Risk-Based Corrective Action (ARBCA) Guidance Manual. These documents are located online at:

http://www.adem.alabama.gov/programs/land/landforms/AEIRGInvestigation.pdf

http://www.adem.alabama.gov/programs/land/landforms/ARBCAManual.pdf

2.0
GROUNDWATER MONITORING REPORTS

2.1 GENERAL

While the Department recognizes that some forms of the technical information within the groundwater monitoring report (GWMR) may have been submitted under separate cover as part of permit applications or major or minor modifications, a summary of such technical information should still be included in the GWMR. A facility may prepare separate GWMRs for constituents in detection monitoring and assessment monitoring.

The GWMR is not intended to contain other facility topics or technical information more properly submitted to the Department under separate cover, such as an Alternate Source Demonstration (ASD), Corrective Action Requirements, a Petition for Variance or any part of a major or minor modification to a facility's Permit. A report outline for an ASD is provided in Appendix A.

2.2 FORMAT AND CONTENT

2.2.1 Cover Page

The cover page should include the period for which the report applies, the landfill name, landfill location (address, city, county), ADEM Permit Number, and report date.

2.2.2 Certification Page

A qualified groundwater scientist as defined in ADEM Admin. Code r. 335-13-1-.03(125) should certify the interpretative activities.

2.2.3 Table of Contents

Specify the order and organization of the report components.

2.2.4 Executive Summary

Provide a brief summary of the purpose and status of the monitoring program, results of the monitoring event, statistical analysis and recommended actions.

2.2.5 Site Location and Description

Describe the site location, use of adjoining properties, main access. Provide the site geographic coordinates, background information, saturated zone and aquifer, groundwater monitoring history, variances and/or other Department approvals, and the monitoring well network. A scaled and detailed site plan map should be included as a figure.

2.2.6 Site Geology and Hydrogeology

2.2.6.1.1 Physical Setting

Provide a description of the site physical setting including geomorphology and topography influencing the hydrologic regime.

2.2.6.1.2 Geology and Hydrogeology

Briefly describe the site-specific geology and hydrogeology including a review of the groundwater elevation and gradient information.

2.2.6.1.3 Uppermost Aquifer

Provide description and characteristics of the uppermost aquifer and/or first zone of saturation at the site.

2.2.6.1.4 Flow Interpretation

A calculation of the groundwater flow rate derived from site-specific data collected during the compliance period should be provided. Provide complete calculations in an Appendix.

2.2.7 Groundwater Monitoring System

Discuss whether or not the monitoring well network functioned as designed during the previous compliance period and had the ability to determine the facility's impact on the quality of groundwater in the first zone of saturation. A monitoring well summary table (see Table 1) should be provided.

2.2.7.1 Monitoring Wells

Identify the following Monitoring Well designations:

2.2.7.1.1 Upgradient Wells

Identify the upgradient background wells and state whether or not they are adequate for the detection of representative background groundwater quality.

2.2.7.1.2 Downgradient Wells

Identify the downgradient monitoring wells confirming the construction and locations for detection of representative groundwater quality.

2.2.7.1.3 Non-Upgradient Background Wells

Identify the non-upgradient background wells and confirm locations for evaluating hydrogeologic conditions adequate to detect representative groundwater quality data.

2.2.7.2 Monitoring Well Replacement and Abandonment

Identify any monitoring wells that have or had damage and need to be or were replaced. Describe abandonment and replacement activities.

2.2.7.3 Monitoring Variances

Identify if the facility monitors groundwater under an approved Variance Petition or well subset which supersedes any regulatory requirement. Provide date of Variance or well subset approval.

2.2.8 Groundwater Monitoring History

2.2.8.1 Available Monitoring Data

Describe the monitoring history of the site including when detection monitoring started, for which parameters, and for how long. Describe any assessment monitoring activities including the duration and outcome. A tabular historical summary of all groundwater data should be included in a table attached to the report. An example partial table is included as Table 2.

2.2.8.2 Historical Groundwater Flow

Describe the historical groundwater flow regime at the site. Provide a tabular summary of all groundwater elevation data collected to date as a table in the report.

2.2.8.3 Historical Special Conditions

Describe any special conditions at the site such as a mounded groundwater table under waste management units, seasonally variable groundwater flow directions, seasonally variable groundwater potentiometric surface, surface water features, production wells, or karst or faulted areas.

2.2.9 Groundwater Sampling and Analysis

Table 3 lists the types of information that should be recorded during a sampling event.

2.2.9.1 Sampling Event Summary

Provide summary of sampling event including the following and any other pertinent information.

2.2.9.2 Sample Collection

Describe sample collection procedures including sample collection order (for all constituents and wells), measurement of static water levels, well evacuation, number of samples, sampling equipment, field measurements, decontamination and calibration procedures, and any other pertinent information.

2.2.9.3 Sample Preservation and Handling

Describe sample preservation methods and container types.

2.2.9.4 Chain of Custody

Include the Chain of Custody in the Appendix with laboratory analytical report(s).

2.2.9.5 Field Records

Include field sampling record sheets in an Appendix.

2.2.9.6 Laboratory Analytical Procedures

Describe the analytical procedures used including method numbers and method detection limits.

2.2.9.7 Quality Assurance/Quality Control

Describe the QA/QC program used in the field and in the laboratory.

2.2.10 Groundwater Data Evaluation

2.2.10.1 Groundwater Elevation Data Evaluation

Discuss determination of the groundwater elevations, groundwater flow rate and direction. Describe actions necessary if one or more of the monitoring wells is determined to no longer function as designed due to a change in the groundwater flow direction.

2.2.10.2 Background Groundwater Quality Data

Describe data used to establish background groundwater quality in hydraulically upgradient wells and wells that are not hydraulically upgradient.

2.2.10.3 Evaluation of Groundwater Quality Data

2.2.10.3.1 Methodology

Describe the procedures used to determine whether or not there has been a statistically significant increase (SSI) over background groundwater quality.

2.2.10.3.2 Statistical Tests

Using graphical and mathematical methods, define the chosen statistical method for detection and assessment monitoring by which the analytical data were statistically compared. Provide the level of significance and confidence level at which the data was evaluated. State how the facility has treated any censored data, outlier data points, and missing data.

2.2.10.3.3 Statistical Exceedances

Describe any SSIs determined from this monitoring event.

2.2.10.3.4 Confirmatory Sampling

Describe the results of confirmatory sampling if conducted.

2.2.10.3.5 Verification Sampling

Describe the verification sampling results if conducted. Table 4 provides Alpha value modifications for use in verification sampling.

2.2.10.3.6 Statistical Analysis of Subsequent Well Data

Describe the actions to be undertaken for any SSIs noted in one or more Appendix I or II constituents. Reference ADEM Admin. Code r. 335-13-4-.27(3)(c).

2.2.10.3.7 Detection Monitoring

Describe any SSIs in any inorganic compound over background groundwater quality. Note that the detection of any organic constituents is considered an SSI. Provide a tabular summary of all SSIs and detections.

2.2.10.3.8 Assessment Monitoring

Provide the status of each Appendix I or II constituent in assessment monitoring when assessment monitoring is required in accordance with ADEM Admin. Code r. 335-13-4-.27(4)(e),(f).

2.2.11 Summary and Conclusions

Provide a summary of findings of the monitoring evaluation results.

2.2.12 Recommendations

Summarize recommended actions based on results of the groundwater monitoring activities. Provide the data interpretation that supports the recommended action(s).

2.2.13 References

Provide a full listing of any published documents, guidance documents, or previous site reports referenced for the monitoring event.

2.2.14 Figures

Figure 1 – Site Location Map (showing streets)
Figure 2 – Site Plan Map (show all site features, well locations, location of landfill cells, etc.)
Figure 3 – Site Topographic Map
Figure 4 – Site Geologic Map
Figure 5 – Geologic Cross-Section(s)
Figure 6 – Groundwater Potentiometric Surface
Figure 7 – Other Figures as necessary to present report data

2.2.15 Tables

Table 1 – Monitoring Well Summary, Status, Construction Details
Table 2 – Historical Well Sampling Summary
Table 3 – Current Groundwater Elevation Data Summary
Table 4 – Historical Groundwater Elevation Data Summary
Table 5 – Historical Groundwater Monitoring Data
Table 6 – Other Tables as necessary to present report data

2.2.16 Appendices

Appendix A – Hydrogeological Calculations/Data
Appendix B – Laboratory Analytical Report
Appendix C – Statistical Evaluation Data
Appendix D – Other Data as Needed to Support Conclusions

3.0
REFERENCES

ADEM, Revised September 2005, *Alabama Environmental Investigation and Remediation Guidance*, Alabama Department of Environmental Management, Montgomery, Alabama.

ADEM, April 2008 – Revision 2, *Alabama Risk-Based Corrective Action Guidance Manual*, Alabama Department of Environmental Management, Montgomery, Alabama.

ADEM, 2010, ADEM Admin. Code r. 335-13-x-.xx, Revised Effective August 3, 2010, Alabama Department of Environmental Management, Montgomery, Alabama.

4.0
TABLES

Table 1

GROUNDWATER ELEVATIONS Facility Name Permit Number									
Well ID	Permit Design	Ground Surface Elevation (ft MSL)	Well Depth (ft BGS)	Top of Screen (ft BGS)	Bottom of Screen (ft BGS)	TOC Elevation (ft MSL)	Date	Depth to Water (ft BTOC)	Groundwater Elevation (ft MSL)
MW-1	BKG	512.00	152.00	140.00	150.00	514.20	mm/dd/yy	62.54	451.66
MW-7	BKG	415.12	115.00	102.00	112.75	417.50	mm/dd/yy	35.47	382.03
SPG-Z	BKG	357.95					mm/dd/yy	DRY	
MW-2	CMP	435.85	125.00			435.85	mm/dd/yy	DRY	
MW-3	CMP	462.85	157.00			465.20	mm/dd/yy	87.65	375.20
SPG-B	CMP	360.48					mm/dd/yy		360.48
SPG-D	CMP	361.69					mm/dd/yy		361.69

SPG: Spring
BKG: Background Groundwater Quality (can be upgradient, cross-gradient, and/or off-site)
CMP: Compliance – downgradient / compliance
MSL: Average Mean Sea Level
BGS: Below Ground Surface
TOC: Top of Casing
GW Elevation = [(TOC Elevation – Ground Surface Elevation) – Depth to Water + Ground Surface Elevation]

Table 2

Sample Spreadsheet for Reporting Groundwater Quality Data
One Spreadsheet per Well

Groundwater Quality Data for MW - X				
Sample Date	**Constituents**			
	Antimony	Arsenic	Barium	etc…
mm/dd/yy	ug/L	ug/L	ug/L	ug/L
03/25/09	3.15	<1.00	476.00	5.00
09/17/09	2.75	<1.00	455.00	<1.00
03/20/10	<5.00	<5.00	360.00	<5.00
etc…				
Percent Non-Detect	33.33%	100%	0	66.67%

Table 3

Information to Record During Groundwater Sampling

- Well identification number
- Well depth
- Static water level depth and measurement technique
- Presence of immiscible layers (yes – no)
- Estimated well yield
- Purge volume and purge pumping rate
- Exact time well purge began and ended
- Well evacuation procedure and equipment
- Field analysis data and methods
- Turbidity
- Dissolved Oxygen
- Oxidation-Reduction Potential
- Groundwater temperature
- Climatic conditions including air temperature
- Field observations on sampling event
- Well location, specified to within 0.5 foot in horizontal plane
- Name of collector
- Date and time of sample collection
- Sampling procedure
- Sampling equipment
- Types of sample containers used and sample identification numbers
- Preservative used
- Sample destination and transport

Table 4

Alpha Value Modifications for Use in Verification Sampling Strategies

a) Select a default value for $\alpha = 0.01$

$$\alpha = 0.01$$

b) Pass the first or one of one verification resamples, adjust alpha

$$\alpha = (1-0.95^{1/k})^{1/2}$$

c) Pass the first or one of two verification resamples, adjust alpha

$$\alpha = (1-0.95^{1/k})^{1/3}$$

d) Pass the first or two of two verification re-samples, adjust alpha

$$\alpha = \sqrt{(1-0.95^{1/k})}\ \sqrt{(1/2)}$$

Where k is the number of comparisons and α is the site-wide false positive rate. Please note that alpha can not be less than 0.01 unless the facility shows that the statistical comparison has at least as much statistical power as published EPA reference power curves.

5.0
APPENDICES

APPENDIX A

ALTERNATE SOURCE DEMONSTRATION REPORT OUTLINE

1.0 Executive Summary
2.0 Introduction
    2.1 Purpose
    2.2 Limitations
    2.3 Definitions
3.0 Exceedance Description
    3.1 Constituent(s)
    3.2 Impacted Monitoring Wells
    3.3 Prior History of Detections
    3.4 Suspected Source
    3.5 Groundwater Protection Standard (if applicable)
4.0 Work Plan Description
    4.1 Soil Borings / "Geoprobe" Sampling
    4.2 Well Installation
    4.3 Wellhead LFG Sampling (if applicable)
    4.4 Groundwater Sampling
5.0 Data Evaluation
6.0 Conclusions
    6.1 Identified Source of the Exceedance
    6.2 Supporting Field Data
    6.3 Future Actions
7.0 Figures
8.0 Appendices
    A. Boring Logs
    B. Well Completion documentation
    C. Field Sheets
    D. Chain of Custody
    E. Laboratory Analytical Results
    F. Miscellaneous