Ash Ponds Closure

# Groundwater Monitoring Plan

Hutsonville Power Station
AmerenEnergy Medina Valley Cogen, L.L.C.
Crawford County, Illinois

September 15, 2014

NATURAL RESOURCE TECHNOLOGY

HANSON
Engineering | Planning | Allied Services

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# 1. Introduction

The following monitoring program is provided for the AmerenEnergy Medina Valley Cogen, L.L.C. Hutsonville Power Station's Ash Ponds (Site) closure for the purpose of evaluating the performance of the ash pond closure activities, including the Ash Pond D groundwater collection trench required by rule at Title 35, Illinois Administrative Code, Part 840, [35 IAC 840], the pond cover system(s) generally conforming to the existing 35 IAC 840 or, where appropriate, the proposed 35 IAC 841 design criteria, and the Groundwater Management Zone (GMZ), proposed for the Site, under 35 IAC 620.250. The program shall monitor groundwater to evaluate closure and post-closure groundwater quality trends and determine compliance with the applicable standards.

# 2. Groundwater Monitoring Program

The groundwater monitoring program design basis includes the geology and hydrogeology information presented in the Hydrogeologic Site Investigation. This Monitoring Plan (Plan) outlines groundwater monitoring and sampling procedures; the parameters to be evaluated and analytical methods; and assessment of groundwater quality data. This Plan does not modify or supplant the existing monitoring program required under the Ash Pond System Operating Permit (Permit No. 2005-EO-3689 or its successors) and will not go into effect until the approval of the Closure and Post-Closure Care Plans that this document supports.

## *2.1 Monitoring Locations*

Groundwater samples will be obtained from a set of previously installed groundwater monitoring wells, plus any additional monitoring wells as described in Section 3. Monitoring wells have a well identification number with a "MW" identifier (monitoring well) followed by a 1-, 2-, or 3-place alpha-numeric designation (e.g., MW2, MW7D, etc.). Monitoring wells that were installed to replace previously installed wells are identified with an "R" in the designation (e.g. MW11R).

The monitoring program follows 35 IAC 620 Subpart E by satisfying the following standards for the monitoring system:

1. The monitoring wells are sufficiently located to represent the quality of groundwater at the compliance point(s).
2. The monitoring wells are located within the stratigraphic unit(s) that may serve as potential contaminant migration pathways.
3. And, the groundwater monitoring wells are secure.

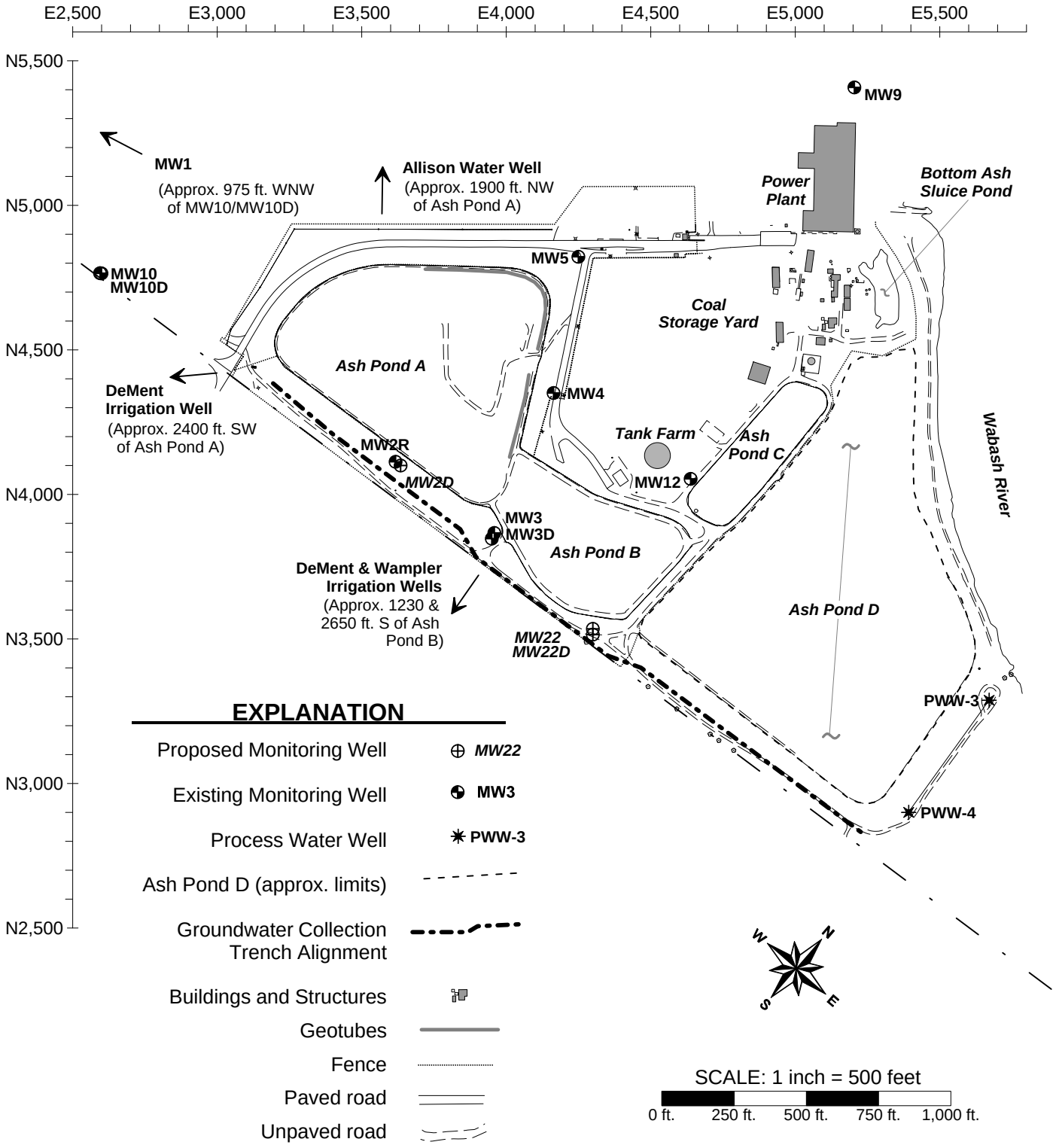
## *2.2 Monitoring Well Installation and Abandonment*

Figure 1 depicts the locations of the current monitoring wells at the Site.

Table 1 lists the monitoring wells, identification numbers, and locations of the wells that will be used for closure and post-closure activities at the Site.

The existing groundwater monitoring wells were generally constructed in accordance with:

1. Illinois Department of Public Health (IDPH) standards as cited in 77 IAC 920.170;
2. Regulatory standards as cited in 35 IAC 620.505(a); and
3. Chapter 6 – Monitoring Well Design and Construction, RCRA Groundwater Monitoring Technical Enforcement Guidance Document, U.S. EPA, November 1992.



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# MONITORING WELL LOCATION MAP

ASH PONDS CLOSURE
HUTSONVILLE POWER STATION
HUTSONVILLE, CRAWFORD CO., ILLINOIS

HANSON NO. 14E0016 FIGURE NO. 1

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As-built diagrams for the groundwater monitoring wells are included in the Technical Source Documents (TSDs)[1]. The monitoring wells were constructed to yield groundwater samples that represent the quality of groundwater within the geologic formation(s) monitored at the site.

Each existing monitoring well shall be maintained so representative groundwater samples may be collected. Items to observe during routine monitoring include; check concrete pad/seal for cracks, integrity of the protective casing, casing lock, seal of well cap, and integrity of the well riser (cracks, bends, etc.). In the event a monitoring well is damaged, the well shall be repaired or replaced in accordance with regulatory requirements.

**Table 1. Hutsonville Ash Pond A Groundwater Monitoring System**

| Monitoring Well ID | Monitoring Well Designation | Monitoring Zone | Install Date | Location[2] | | Screen Interval |
|---|---|---|---|---|---|---|
| | | | | Easting | Northing | |
| MW2R | Downgradient | Shallow | 6 Apr 12 | 3617.43 | 4112.60 | 446.0-435.2 |
| MW2D[3] | Downgradient | Deep | *proposed* | 3612. | 4110. | 435.0-430.0 |
| MW3 | Downgradient | Shallow | 9 Feb 84 | 3952.03 | 3860.23 | 450.9-445.9 |
| MW3D | Downgradient | Deep | 6 Oct 98 | 3952.03 | 3860.23 | 433.6-438.6 |
| MW4 | Downgradient | Shallow | 13 Feb 84 | 4164.06 | 4350.55 | 450.8-443.3 |
| MW5 | Downgradient | Shallow | 13 Feb 84 | 4249.98 | 4821.99 | 453.5-440.5 |
| MW9 | Piezometer | Shallow | 14 Oct 84 | 5202. | 5408. | 448.2-438.2 |
| MW10 | Upgradient | Shallow | 7 Oct 98 | 2559.81 | 4730.48 | 447.2-442.2 |
| MW10D | Upgradient | Deep | 7 Oct 98 | 2564.72 | 4729.43 | 437.6-433.6 |
| MW12 | Downgradient | Shallow | 8 Oct 98 | 4637.98 | 4053.58 | 448.6-438.6 |
| MW22[3] | Downgradient | Shallow | *proposed* | 4300. | 3525. | 450.0-445.0 |
| MW-2D[3] | Downgradient | Deep | *proposed* | 4300. | 3525. | 435.0-430.0 |

[2] Monitoring Well locations based on Plant coordinate system.

[3] Proposed monitoring well to be installed upon approval of this Groundwater Monitoring Plan by Illinois EPA. Deep wells (D suffix) may need to be installed due to shallow zone dewatering from collection trench.

## 3. Modifications to the Monitoring Well Network

Ash Pond A must currently monitor groundwater as part of Permit No. 2005-EO-3689. This monitoring requires the monthly testing of MW1 through MW5, with the annual reporting of results to the Illinois Environmental Protection Agency (EPA). Per the terms of this permit, additional monitoring wells MW6 through MW9 are required to remain operational, although monitoring is not required. A number of additional wells have been installed as part of prior investigations and associated with the site-specific rulemaking authorizing the in-place closure of Ash Pond D (Illinois PCB, 2011). As described below, three of these monitoring wells will be used in conjunction with this Monitoring Plan.

As part of the Site closure activities, the following recommendations to the monitoring well network are being made as part of this application:

[1] Available at: http://www.ipcb.state.il.us/documents/dsweb/Get/Document-65177 in Chapter 6 of the Rulemaking Technical Support Documents.

- MW1 shall be removed upon renewal and/or termination of Permit No. 2005-EO-3689. Closure and post-closure use of this well is unnecessary, because it is too distant (975 ft. from Ash Pond A) for an effective upgradient well and MW10 and MW10D are better positioned for upgradient water quality determination.
- MW9 shall be retained as a piezometer upon completion of the monitoring requirements of Permit No. 2005-EO-3689, and will be used to collect water elevation data only.
- MW10D upgradient deep zone (sandstone) well. This well shall be monitored if the groundwater collection trench causes any of the shallow zone wells (i.e., MW2R, MW3, etc.) to go dry.
- MW2D downgradient deep (sandstone) well. This well shall be installed if the groundwater collection trench causes MW2R to go dry and upon approval of this Plan.
- MW3D downgradient deep (sandstone) well. This well shall be monitored if the groundwater collection trench causes MW3 to go dry.
- MW22 Compliance monitoring well location for GMZ monitoring. This well will be added to the shallow zone monitoring system after approval of this Plan.
- MW22D This monitoring well will be added to the monitoring system only if the groundwater collection trench dewaters the shallow zone and after approval of this Plan.

## 4. Groundwater Quality Characterization

### *4.1 Statistical Evaluation of Background Groundwater Data*

The groundwater quality data for samples, collected from the monitoring wells installed for the Site, collected from upgradient monitoring well MW10 was evaluated using the Electric Power Research Institute (EPRI) computer database and analysis program, MANAGES™ (Version 3.2). Three US EPA documents were principally used as a guide for the statistical evaluation of the groundwater data: Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities – Interim Final Guidance (US EPA, 1989), Statistical Analysis of Ground-Water Monitoring at RCRA Facilities – Addendum to Interim Final Guidance (US EPA, 1992), and Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance, (US EPA, 2009).

Establishing the tolerance interval(s) for the groundwater constituents was accomplished by using either a parametric or non-parametric procedure based on the percentage of non-detects in the data sets and the distribution of the sample population (see Statistical Methodology in Appendix A). If the statistical data for a constituent had less than 50 percent non-detects and was normally or log-normally distributed, a parametric procedure was used. If the data was not normally or log-normally distributed or had more than 50 percent non-detects, a non-parametric procedure was used. Figure A-1 is a flow chart which illustrates the processes followed to determine the appropriate statistical procedure used for each constituent based on its statistical characteristics. The results of the statistical analyses for the groundwater are located in Appendix B.

### *4.2 Statistical Analysis Results*

The results of the statistical analyses for the Site groundwater, completed in accordance with the methodology presented in Appendix A, are presented in Appendix B, and are summarized in Table A-1. For each parameter, the pages of the output file in Appendix B identify the statistical methods used to determine the upper tolerance interval, the percentage of non-detects, the lower tolerance interval (two-tail tests only), and the type of data distribution.

Results of the background water quality evaluation indicate that background groundwater sample results at MW1 (24 monthly or 8 quarterly samples from January 2012 through December 2013) and MW10 (8 quarterly samples from 1st Quarter 2012 through 4th Quarter 2013) contributed to the background water quality values calculated as part of this study and presented in Table 2.

**Table 2. Shallow Zone Background Groundwater Quality Values**

| Parameter | Units | Concentration | Parameter | Units | Concentration |
|---|---|---|---|---|---|
| Antimony, dissolved | mg/L | 0.010 | Lead, dissolved | mg/L | 0.010 |
| Arsenic, dissolved | mg/L | 0.012 | Manganese, dissolved | mg/L | 0.395 |
| Barium, dissolved | mg/L | 0.028 | Mercury, dissolved | mg/L | 0.0007 |
| Beryllium, dissolved | mg/L | 0.010 | Nickel, dissolved | mg/L | 0.009 |
| Boron, dissolved | mg/L | 0.190 | Nitrate (as N), dissolved | mg/L | 3.87 |
| Cadmium, dissolved | mg/L | 0.010 | pH (lower interval) | SU | 6.21 |
| Chloride, dissolved | mg/L | 83.670 | pH (upper interval) | SU | 7.870 |
| Chromium, dissolved | mg/L | 0.012 | Selenium, dissolved | mg/L | 0.011 |
| Cobalt, dissolved | mg/L | 0.010 | Silver, dissolved | mg/L | 0.010 |
| Copper, dissolved | mg/L | 0.009 | Sulfate, dissolved | mg/L | 67.37 |
| Cyanide, total | mg/L | 0.360 | Thallium, dissolved | mg/L | 0.007 |
| Fluoride, dissolved | mg/L | 0.262 | Total Dissolved Solids (TDS) | mg/L | 568.57 |
| Iron, dissolved | mg/L | 1.109 | Zinc, dissolved | mg/L | 0.025 |

## 5. Groundwater Monitoring/Sampling

### *5.1 Sampling Schedule*

Sampling for routine analysis shall be conducted in a manner similar to the existing Hutsonville "site-specific" rules found at 35 IAC 840.114(a) to provide some consistency between the Ash Pond D and Ash Pond A monitoring programs. The schedule for quarterly groundwater monitoring is listed in Table 3, and is based on the quarterly submittal requirements for Illinois EPA Bureau of Water National Pollutant Discharge Elimination System (NPDES) permits:

**Table 3. Quarterly Groundwater Monitoring Schedule**

| Sampling Quarter | Report Due Date | Sampling List |
|---|---|---|
| January - March (1) | May 31 | Field & Routine |
| April - June (2) | August 31 | Field & Routine |
| July - September (3) | November 30 | Field & Routine |
| October - December (4) | February 28 | Field & Routine |

## *5.2 Parameter List*

Routine sample collection will be conducted quarterly on the schedule outlined above, for the constituents listed in Table 4 and Table 5 [per 35 IAC 620.410(a) and 410(e), excluding Radium-226 and Radium-228].

Groundwater monitoring can be concluded upon successful completion of Groundwater Management Zone requirements (35 IAC 620.250) and approval of the Illinois EPA.

**Table 4. Field Monitoring Parameters**

| Parameters[1] |
|---|
| pH[2] |
| Specific Conductance[2] |
| Elevation of GW Surface[2] |
| Depth of Well (bls)[2] |
| Temperature |
| Depth to Water (bmp) |
| Elevation of measuring point |

**Table 5. Routine Monitoring Parameters**

| Parameters[1] | Parameters[1] |
|---|---|
| Antimony, dissolved | Iron[2], dissolved |
| Arsenic, dissolved | Lead, dissolved |
| Barium, dissolved | Manganese[2], dissolved |
| Beryllium, dissolved | Mercury, dissolved |
| Boron[2], dissolved | Nickel, dissolved |
| Cadmium, dissolved | Nitrate (as N), dissolved |
| Chloride, dissolved | Selenium, dissolved |
| Chromium, dissolved | Silver, dissolved |
| Cobalt, dissolved | Sulfate[2], dissolved |
| Copper, dissolved | Total Dissolved Solids (TDS)[2] |
| Cyanide, total | Thallium, dissolved |
| Fluoride, dissolved | *Vanadium, dissolved* |
| | Zinc, dissolved |

## *5.3 Monitoring/Sampling Procedure*

Groundwater samples shall be collected following the procedures presented in Appendix C, or equivalent methods developed by Ameren or its contractors.

[1] Routine parameters are reported as dissolved (filtered) concentrations with the exception of the Field Monitoring Parameters and Cyanide, which are taken from total (unfiltered) samples.
[2] Mandatory monitoring parameter under 35 IAC 840.114(a).

# 6. Analysis of Site Groundwater Monitoring Samples

## *6.1 Laboratory Analysis*

Laboratory analysis and testing methods shall be in general accordance with those listed in the U.S. EPA publication Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA/530/SW-846, 3rd Edition – Update V, amended October 2013 (U.S. EPA, 2013) or as superseded by future editions. The specific testing method used for analysis shall have Practical Quantitation Limit (PQL) values that are capable of determining if regulatory and/or site groundwater standards are exceeded. [For example, 35 IAC Part 724, Appendix I lists three methods and PQLs for Chromium. Methods 7190, Method 6010, and Method 7191 have QPLs of 500 ppb; 70 ppb; and 10 ppb, respectively. Since 35 IAC 620.410 sets the groundwater standard for Chromium at 100 ppb, the method with the highest PQL that can meet or exceed this standard would be Method 6010.] Specific testing methods shall be referenced in the Laboratory Analysis Report.

Other references (unless superseded) for testing methods may include:

1. Test Method: The Determination of Inorganic Anions in Water by Ion Chromatography – Method 300.0, EPA 600/4-84-017, Revision 2.1, August 1993.
2. Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79/020, 3rd Edition, March 1983.
3. Methods for the Determination of Inorganic Substances in Environmental Samples, EPA 600/R-93/100, August 1993.
4. Methods for the Determination of Metals in Environmental Samples, EPA 600/4-91/010, June 1991.
5. Methods for the Determination of Metals in Environmental Samples; Supplement I, EPA 600/R-94/111, May 1994.
6. Standard Methods for Determination of Organic and Inorganic Compounds in Drinking Water: Volume 1; US EPA, EPA 815/R-00/014, August 2000.

Quality Assurance/Quality Control (QA/QC) programs may vary from laboratory to laboratory, but will contain the same general methodologies. The QA/QC programs are implemented: to evaluate the accuracy and precision of analytical data in order to establish the quality of the data; to provide an indication of the need for corrective actions, when comparison with existing regulatory or program criteria or data trends shows that activities must be changed or monitored to a different degree; and to determine the effect of corrective actions (U.S. EPA SW-846, 2013).

Methodologies used by the laboratory to ensure representative analytical results may vary. Some methodologies that may be used are:

1. Calibration checks, used to enhance instrument reliability. Instrumental calibration curves will be generated in a manner consistent with the instrument and method utilized. Calibration verification shall be conducted on a regular basis;
2. Laboratory control samples and/or quality control check standards that have been spiked with analytes may be used to monitor the performance of the method;

3. Matrix spike/matrix spike duplicate analyses are samples in which solutions of specific aliquots are added to a sample matrix prior to sample extraction/digestion and analysis. Samples are split into duplicates, spiked and analyzed. Percent recoveries and relative percent differences are calculated for each of the analyses detected;
4. Replicate samples shall be routinely analyzed to check the precision of the instrumentation and/or methodology employed for all analytical methods; and
5. Where applicable, method blanks are prepared and analyzed each day or sample batch to ensure that the system is free of contamination.

The QA/QC program at the laboratory should generally follow the requirements outlined in the U.S. EPA publication Test Methods for Evaluation Solid Waste, Physical/Chemical Methods, EPA/530/SW-846, 3rd Edition –Update V, amended January 2013 (U.S. EPA, 2013) and which may be periodically revised in the future. However, other published QA/QC methods may be utilized as part of laboratory policy provided the QA/QC methodologies generally follow those numerated above.

# 7. Site Monitoring Program Evaluation

## *7.1 Groundwater Quality Standards*

Pursuant to 35 IAC 620.450(a), the on-site groundwater quality shall be the greater of either the actual monitoring result, or the Class I Potable Resource Groundwater standard [35 IAC 620.410] prior to the completion of the post-closure care period. If upon completion of the post-closure care period the observed concentrations in the site groundwater still exceed a Class I standard, the on-site standard can be adjusted provided criteria are addressed to the satisfaction of the Illinois EPA:

## *7.2 Demonstration of Compliance*

Compliance will be evaluated against the appropriate groundwater standard included in Section 7.1 , above. On-site groundwater shall be considered to be in compliance when no statistically significant increasing trend can be attributable to Ash Pond A at the compliance boundary and with Illinois EPA concurrence.

### *7.2.1 Compliance Determination*

Groundwater Management Zone (GMZ) compliance will be demonstrated by performing an annual trend analysis for each downgradient monitoring well for all of the monitored constituents listed in Table 4 and Table 5. The analysis shall be performed on a minimum of four (4) consecutive samples and use Sen's Estimate of Slope for compliance determination. Generally, if analyses for a parameter show an increasing trend at a down-gradient well, a Mann-Kendall analysis must be performed at a 95% confidence limit to determine whether the increasing trend is statistically significant. If there is a statistically significant increase, then an investigation determining that the statistically significant increasing trend is due to a superseding cause will be performed, and the Illinois EPA will be notified in writing, stating the cause of the increasing trend and the rationale used in its determination.

If a statistically significant increasing trend continues to be observed over two or more consecutive years and there is no superseding cause, a hydrogeologic investigation (and additional site investigation(s), if necessary) must be performed.

Based on the outcome of the additional activities, action must be taken to mitigate the statistically significant increasing trends that are causing, threatening or allowing exceedances of off-site groundwater quality standards. Any actions must be proposed as a modification to the post-closure care plan within 180 days after completion of the additional hydrogeologic and/or additional site investigations.

## 8. References

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# Appendix A

# Statistical Methodology

## A.1 Statistical Methodology

### *A.1.1 Introduction*

The purpose of the statistical calculations documented in this appendix is to determine the maximum background concentrations likely to occur upgradient of the Hutsonville ash ponds. High predicted background concentrations relative to the Class I groundwater quality standards may suggest that downgradient concentrations for those parameters are due to a background source.

The statistical analysis procedures used here are consistent with procedures described in the document: 2009 Unified Guidance. "Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities—Unified Guidance," March 2009, EPA 530/R-09-2007 (USEPA, 2009).

### *A.1.2 Compliance Data Operations - Limit Calculations*

The range of potential background concentrations was statistically determined using parametric and non-parametric tolerance intervals. Tolerance intervals were chosen rather than prediction intervals because a tolerance interval makes no assumption about the future number of samples, while a prediction interval assumes a finite, and known, future number of samples.

The flow diagram (Figure A-1) outlines the logic flow for calculation of limits. Background values were calculated using parametric tolerance intervals for normally distributed data, and non-parametric tolerance intervals for data with no underlying distribution or with non-detect frequencies greater than 50 percent. Parametric tolerance intervals were calculated at a 95 percent coverage rate and a Type I individual comparison error level of 0.01 (i.e., false positive rate). Parameters with 100 percent non-detects were handled with the upper tolerance limit being set to the last Reporting Limit (RL).

### *A.1.3 Statistical Data Evaluation and Results*

The input dataset (Appendix A.1) for background calculations were evaluated for the quarterly data from monitoring wells MW1 and MW10, collected from 2012 through 2013, for the inorganic parameters listed in 35 IAC 620.410(a) and excluding radium-226, radium-228, and perchlorate. All water quality data were stored, prepared, and statistically analyzed using MANAGES$^{TM}$ Version 3.2.39 software (EPRI, November 2010).

A statistical summary of the background water quality data from MW1 and MW10 is provided in Appendix B, and includes the mean, median, minimum, maximum, standard deviation, Sen Slope trend, normality determination, and percent non-detects for the background dataset. The statistical analysis procedure inputs and results are also provided in Appendix B.

Calculated background values for the tested inorganic constituents and pH are listed in Table A-1 along with the percentage of non-detected parameters, normal or lognormal distribution, test methodology, and confidence level.

## Figure A-1. Statistical Analysis Flowchart

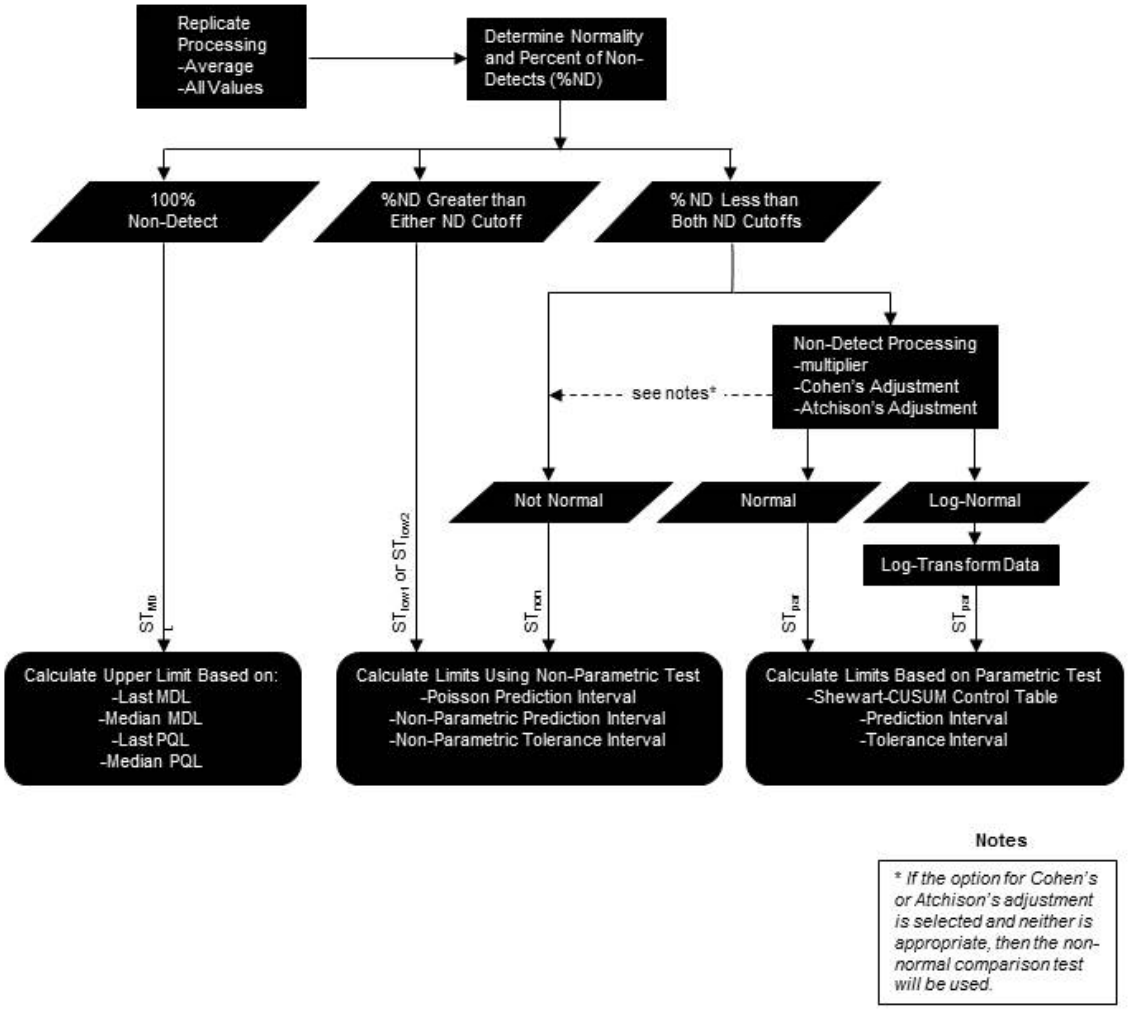

**Table A-1. Tolerance Limits for Background Monitoring Wells MW1 and MW10**

| Parameter (Units) | Count of Background Results | % Non-Detects | Normal/ Lognormal | Test[1] | Confidence Level | Upper Limit | Lower Limit |
|---|---|---|---|---|---|---|---|
| Ag, diss, (mg/L) | 16 | 100.00 | No/No | STmdl | N/A | 0.010 | |
| As, diss, (mg/L) | 16 | 87.50 | No/No | STlow1 | 55.99 | 0.012 | |
| Ba, diss, (mg/L) | 16 | 0.00 | Yes/Yes | STpar | 99.00 | 0.028 | |
| Be, diss, (mg/L) | 16 | 100.00 | No/No | STmdl | N/A | 0.010 | |
| B, diss, (mg/L) | 32 | 6.25 | Yes/No | STpar | 99.00 | 0.190 | |
| Cd, diss, (mg/L) | 16 | 100.00 | No/No | STmdl | N/A | 0.010 | |
| Cl, diss, (mg/L) | 16 | 0.00 | Yes/Yes | STpar | 99.00 | 83.67 | |
| CN, total, (mg/L) | 16 | 62.50 | No/No | STlow1 | 55.99 | 0.360 | |
| Co, diss, (mg/L) | 16 | 100.00 | No/No | STmdl | N/A | 0.010 | |
| Cu, diss, (mg/L) | 16 | 68.75 | No/No | STlow1 | 55.99 | 0.009 | |
| Cr, diss, (mg/L) | 16 | 81.25 | No/Yes | STlow1 | 55.99 | 0.012 | |
| F, diss, (mg/L) | 16 | 12.50 | Yes/Yes | STpar | 99.00 | 0.262 | |
| Hg, diss, (mg/L) | 16 | 81.25 | No/No | STlow1 | 55.99 | 0.0007 | |
| Fe, diss, (mg/L) | 16 | 0.00 | Yes/Yes | STpar | 99.00 | 1.109 | |
| Mn, diss, (mg/L) | 32 | 28.13 | No/No | STnon | 80.63 | 0.395 | |
| Ni, diss, (mg/L) | 16 | 81.25 | Yes/Yes | STlow1 | 55.99 | 0.009 | |
| NO3, diss, (mg/L) | 16 | 37.50 | No/Yes | STpar | 99.00 | 3.870 | |
| Pb, diss, (mg/L) | 16 | 100.00 | No/No | STmdl | N/A | 0.010 | |
| pH (field), (SU) | 32 | 0.00 | No/No | STnon | 80.63 | 7.830 | 6.210 |
| Sb, diss, (mg/L) | 16 | 100.00 | No/No | STmdl | N/A | 0.010 | |
| Se, diss, (mg/L) | 16 | 87.50 | No/No | STlow1 | 55.99 | 0.011 | |
| $SO_4$, diss, (mg/L) | 32 | 0.00 | No/Yes | STpar | 99.00 | 67.37 | |
| TDS, (mg/L) | 32 | 0.00 | Yes/No | STpar | 99.00 | 568.57 | |
| Tl, diss, (mg/L) | 16 | 87.50 | Yes/No | STlow1 | 55.99 | 0.007 | |
| Zn, diss, (mg/L) | 16 | 37.50 | Yes/Yes | STpar | 99.00 | 0.025 | |

[1] Key to Tests
STmdl = Comparison method if all background results are non-detect = Last MDL
STpar = Parametric Tolerance Interval on background
STlow1 = Non-Parametric Tolerance Interval on background (ND Frequency > 50%)
STnon = Non-Parametric Tolerance Interval on background

# Appendix B

# Groundwater Statistical Calculations

# Hutsonville Ash Impoundment
## Analysis Results by Parameter (column), Location (row), and Date (row)

**Date Range: 01/01/2012 to 12/05/2013**

| Well Id | Date Sampled | Lab Id | Ag, diss, mg/L | As, diss, mg/L | B, diss, ug/L | Ba, diss, mg/L | Be, diss, mg/L | Cd, diss, mg/L |
|---|---|---|---|---|---|---|---|---|
| MW1 | 01/30/2012 | AC23054 | <0.0070 | <0.007 | 23.000 | 0.015 | <0.007 | <0.002 |
| | 02/16/2012 | AC23950 | | | 118.000 | | | |
| | 03/15/2012 | AC25361 | | | 106.000 | | | |
| | 04/13/2012 | AC26846 | <0.0070 | <0.007 | 100.000 | 0.020 | <0.007 | <0.002 |
| | 05/10/2012 | AC28222 | | | 101.000 | | | |
| | 06/11/2012 | AC29901 | | | 114.000 | | | |
| | 07/09/2012 | AC31693 | <0.0070 | <0.007 | 131.000 | 0.019 | <0.007 | <0.002 |
| | 08/23/2012 | AC34284 | | | 147.000 | | | |
| | 09/21/2012 | AC35462 | | | 140.000 | | | |
| | 10/18/2012 | AC36007 | <0.0070 | <0.007 | 137.000 | 0.014 | <0.007 | <0.002 |
| | 11/12/2012 | AC36299 | | | 128.000 | | | |
| | 12/17/2012 | 2120463-01 | | | 125.000 | | | |
| | 01/07/2013 | 3010190-01 | <0.0002 | 0.012 | 120.000 | 0.025 | <0.003 | <0.012 |
| | 02/18/2013 | 3020305-01 | | | 87.000 | | | |
| | 03/08/2013 | 3030534-01 | | | 71.000 | | | |
| | 04/29/2013 | 3040851-01 | | | 91.000 | | | |
| | 05/20/2013 | 3040515-01 | <0.0010 | <0.001 | 106.000 | 0.015 | <0.001 | <0.001 |
| | 06/17/2013 | 3060597-01 | | | 74.000 | | | |
| | 07/12/2013 | 3070549-01 | | | <2.000 | | | |
| | 08/26/2013 | 3080791-01 | <0.0010 | 0.001 | 80.000 | 0.011 | <0.001 | <0.001 |
| | 09/20/2013 | 3090526-01 | | | 133.000 | | | |
| | 10/10/2013 | 3100520-01 | <0.0100 | <0.010 | 81.000 | 0.020 | <0.010 | <0.010 |
| | 11/22/2013 | 3110189-01 | | | 85.000 | | | |
| | 12/05/2013 | | | | 71.000 | | | |
| MW10 | 01/30/2012 | AC23055 | <0.0070 | <0.007 | <20.000 | 0.018 | <0.007 | <0.002 |
| | 04/13/2012 | AC26855 | <0.0070 | <0.007 | 143.000 | 0.015 | <0.007 | <0.002 |
| | 07/09/2012 | AC31702 | <0.0070 | <0.007 | 143.000 | 0.018 | <0.007 | <0.002 |
| | 10/18/2012 | AC36016 | <0.0070 | <0.007 | 119.000 | 0.014 | <0.007 | <0.002 |
| | 01/07/2013 | 3010190-10 | <0.0002 | 0.010 | 113.000 | 0.013 | <0.003 | <0.012 |
| | 05/20/2013 | 3040515-10 | <0.0010 | <0.001 | 66.000 | 0.018 | <0.001 | <0.001 |
| | 08/26/2013 | 3080791-10 | <0.0100 | <0.010 | 94.000 | 0.017 | <0.010 | <0.010 |
| | 10/10/2013 | 3100520-10 | <0.0100 | <0.010 | 84.000 | 0.022 | <0.010 | <0.010 |

# Hutsonville Ash Impoundment
## Analysis Results by Parameter (column), Location (row), and Date (row)

**Date Range: 01/01/2012 to 12/05/2013**

| Well Id | Date Sampled | Lab Id | Cl, diss, mg/L | CN, total, mg/L | Co, diss, mg/L | Cr, diss, mg/L | Cu, diss, ug/L | F, diss, mg/L |
|---|---|---|---|---|---|---|---|---|
| MW1 | 01/30/2012 | AC23054 | 2.740 | 0.013 | <0.007 | <0.002 | 2.000 | 0.176 |
| | 04/13/2012 | AC26846 | 3.350 | <0.001 | <0.007 | <0.002 | 2.000 | 0.077 |
| | 07/09/2012 | AC31693 | 5.090 | <0.001 | <0.007 | 0.011 | 9.000 | 0.073 |
| | 10/18/2012 | AC36007 | 8.080 | <0.001 | <0.007 | <0.002 | <1.000 | 0.061 |
| | 01/07/2013 | 3010190-01 | 4.700 | 0.010 | <0.003 | <0.004 | <1.000 | 0.078 |
| | 05/20/2013 | 3040515-01 | 1.840 | 0.360 | <0.001 | <0.001 | <1.000 | 0.083 |
| | 08/26/2013 | 3080791-01 | 1.510 | <0.003 | <0.001 | <0.001 | <1.000 | 0.068 |
| | 10/10/2013 | 3100520-01 | 2.130 | <0.003 | <0.010 | <0.001 | <10.000 | 0.094 |
| MW10 | 01/30/2012 | AC23055 | 66.400 | 0.013 | <0.007 | 0.004 | 2.000 | 0.224 |
| | 04/13/2012 | AC26855 | 33.100 | <0.001 | <0.007 | 0.012 | 1.000 | <0.200 |
| | 07/09/2012 | AC31702 | 22.900 | 0.005 | <0.007 | <0.002 | <1.000 | <0.200 |
| | 10/18/2012 | AC36016 | 22.700 | <0.001 | <0.007 | <0.002 | <1.000 | 0.152 |
| | 01/07/2013 | 3010190-10 | 20.100 | 0.010 | <0.003 | <0.004 | <1.000 | 0.166 |
| | 05/20/2013 | 3040515-10 | 38.900 | <0.003 | <0.001 | <0.001 | <1.000 | 0.154 |
| | 08/26/2013 | 3080791-10 | 49.000 | <0.003 | <0.010 | <0.010 | <10.000 | 0.132 |
| | 10/10/2013 | 3100520-10 | 48.000 | <0.003 | <0.010 | <0.001 | <10.000 | 0.148 |

# Hutsonville Ash Impoundment
## Analysis Results by Parameter (column), Location (row), and Date (row)

**Date Range: 01/01/2012 to 12/05/2013**

| Well Id | Date Sampled | Lab Id | Fe, diss, ug/L | Hg, diss, mg/L | Mn, diss, mg/L | Ni, diss, mg/L | NO3, diss, mg/L | Pb, diss, mg/L |
|---|---|---|---|---|---|---|---|---|
| MW1 | 01/30/2012 | AC23054 | 416.000 | <0.00020 | 0.022 | <0.007 | 0.320 | <0.001 |
| | 02/16/2012 | AC23950 | | | 0.017 | | | |
| | 03/15/2012 | AC25361 | | | 0.054 | | | |
| | 04/13/2012 | AC26846 | 724.000 | 0.00070 | 0.099 | <0.007 | 0.079 | <0.001 |
| | 05/10/2012 | AC28222 | | | 0.045 | | | |
| | 06/11/2012 | AC29901 | | | 0.018 | | | |
| | 07/09/2012 | AC31693 | 342.000 | 0.00040 | <0.007 | <0.007 | 0.583 | <0.001 |
| | 08/23/2012 | AC34284 | | | 0.000 | | | |
| | 09/21/2012 | AC35462 | | | 0.017 | | | |
| | 10/18/2012 | AC36007 | 582.000 | <0.00020 | 0.012 | 0.007 | 1.030 | <0.001 |
| | 11/12/2012 | AC36299 | | | 0.015 | | | |
| | 12/17/2012 | 2120463-01 | | | 0.026 | | | |
| | 01/07/2013 | 3010190-01 | 349.000 | 0.00020 | 0.033 | <0.004 | 1.090 | <0.003 |
| | 02/18/2013 | 3020305-01 | | | <0.005 | | | |
| | 03/08/2013 | 3030534-01 | | | 0.003 | | | |
| | 04/29/2013 | 3040851-01 | | | 0.011 | | | |
| | 05/20/2013 | 3040515-01 | 89.000 | <0.00020 | 0.094 | <0.001 | <0.050 | <0.001 |
| | 06/17/2013 | 3060597-01 | | | 0.105 | | | |
| | 07/12/2013 | 3070549-01 | | | 0.273 | | | |
| | 08/26/2013 | 3080791-01 | 331.000 | <0.00020 | 0.105 | 0.002 | 0.185 | <0.001 |
| | 09/20/2013 | 3090526-01 | | | 0.395 | | | |
| | 10/10/2013 | 3100520-01 | 323.000 | <0.00200 | 0.042 | <0.010 | 0.126 | <0.010 |
| | 11/22/2013 | 3110189-01 | | | 0.037 | | | |
| | 12/05/2013 | | | | 0.015 | | | |
| MW10 | 01/30/2012 | AC23055 | 575.000 | <0.00020 | <0.007 | 0.009 | 0.301 | <0.001 |
| | 04/13/2012 | AC26855 | 932.000 | <0.00020 | <0.007 | <0.007 | <0.250 | <0.001 |
| | 07/09/2012 | AC31702 | 366.000 | <0.00020 | 0.009 | <0.007 | <0.250 | <0.001 |
| | 10/18/2012 | AC36016 | 667.000 | <0.00020 | <0.007 | <0.007 | 0.204 | <0.001 |
| | 01/07/2013 | 3010190-10 | 242.000 | <0.00020 | <0.005 | <0.004 | 0.188 | <0.003 |
| | 05/20/2013 | 3040515-10 | 99.000 | <0.00020 | 0.001 | <0.001 | <0.100 | <0.001 |
| | 08/26/2013 | 3080791-10 | 387.000 | <0.00200 | <0.010 | <0.010 | <0.200 | <0.010 |
| | 10/10/2013 | 3100520-10 | 504.000 | <0.00200 | <0.010 | <0.010 | <0.200 | <0.010 |

# Hutsonville Ash Impoundment
## Analysis Results by Parameter (column), Location (row), and Date (row)

**Date Range: 01/01/2012 to 12/05/2013**

| Well Id | Date Sampled | Lab Id | pH (field), SU | Sb, diss, mg/L | Se, diss, mg/L | SO4, diss, mg/L | TDS, mg/L | Tl, diss, mg/L |
|---|---|---|---|---|---|---|---|---|
| MW1 | 01/30/2012 | AC23054 | 7.790 | <0.007 | <0.007 | 28.700 | 210.000 | <0.007 |
| | 02/16/2012 | AC23950 | 7.800 | | | 26.000 | 210.000 | |
| | 03/15/2012 | AC25361 | 7.600 | | | 24.100 | 430.000 | |
| | 04/13/2012 | AC26846 | 7.270 | <0.007 | <0.007 | 21.500 | 460.000 | <0.007 |
| | 05/10/2012 | AC28222 | 7.200 | | | 25.200 | 370.000 | |
| | 06/11/2012 | AC29901 | 7.160 | | | 26.700 | 150.000 | |
| | 07/09/2012 | AC31693 | 7.310 | <0.007 | <0.007 | 46.200 | 420.000 | <0.007 |
| | 08/23/2012 | AC34284 | 7.300 | | | 53.300 | 420.000 | |
| | 09/21/2012 | AC35462 | 7.100 | | | 51.300 | 40.000 | |
| | 10/18/2012 | AC36007 | 7.220 | <0.007 | <0.007 | 46.500 | 320.000 | <0.007 |
| | 11/12/2012 | AC36299 | 7.100 | | | 37.200 | 320.000 | |
| | 12/17/2012 | 2120463-01 | 7.100 | | | 37.400 | 200.000 | |
| | 01/07/2013 | 3010190-01 | 7.200 | <0.005 | <0.023 | 30.500 | 480.000 | 0.006 |
| | 02/18/2013 | 3020305-01 | 7.080 | | | 38.700 | 196.000 | |
| | 03/08/2013 | 3030534-01 | 7.200 | | | 31.400 | 184.000 | |
| | 04/29/2013 | 3040851-01 | 7.600 | | | 17.900 | 195.000 | |
| | 05/20/2013 | 3040515-01 | 7.360 | <0.001 | <0.001 | 21.500 | 222.000 | <0.001 |
| | 06/17/2013 | 3060597-01 | 7.270 | | | 17.200 | 337.000 | |
| | 07/12/2013 | 3070549-01 | | | | 10.400 | 228.000 | |
| | | 3080791-01 | 7.310 | | | | | |
| | 08/26/2013 | 3080791-01 | 7.180 | <0.001 | <0.001 | 13.800 | 310.000 | <0.001 |
| | 09/20/2013 | 3080791-01 | 7.070 | | | | | |
| | | 3090526-01 | | | | 16.300 | 270.000 | |
| | 10/10/2013 | 3100520-01 | 7.130 | <0.010 | <0.010 | 18.800 | 360.000 | <0.010 |
| | 11/22/2013 | 3110189-01 | 7.230 | | | 11.600 | 290.000 | |
| | 12/05/2013 | | 7.290 | | | 13.500 | 50.000 | |
| MW10 | 01/30/2012 | AC23055 | 7.830 | <0.007 | <0.007 | 21.400 | 370.000 | <0.007 |
| | 04/13/2012 | AC26855 | 7.260 | <0.007 | <0.007 | 21.900 | 390.000 | 0.007 |
| | 07/09/2012 | AC31702 | 7.060 | <0.007 | <0.007 | 17.000 | 310.000 | <0.007 |
| | 10/18/2012 | AC36016 | 7.090 | <0.007 | <0.007 | 20.900 | 220.000 | <0.007 |
| | 01/07/2013 | 3010190-10 | 7.210 | <0.005 | <0.023 | 22.200 | 376.000 | <0.003 |
| | 05/20/2013 | 3040515-10 | 7.020 | <0.001 | 0.011 | 23.400 | 333.000 | <0.001 |
| | 08/26/2013 | 3080791-10 | 6.210 | <0.010 | <0.010 | 22.900 | 380.000 | <0.010 |
| | 10/10/2013 | 3100520-10 | 7.040 | <0.010 | 0.011 | 23.500 | 380.000 | <0.010 |

# Hutsonville Ash Impoundment
## Analysis Results by Parameter (column), Location (row), and Date (row)

**Date Range: 01/01/2012 to 12/05/2013**

| Well Id | Date Sampled | Lab Id | Zn, diss, mg/L |
|---|---|---|---|
| MW1 | 01/30/2012 | AC23054 | 0.014 |
| | 04/13/2012 | AC26846 | 0.017 |
| | 07/09/2012 | AC31693 | <0.007 |
| | 10/18/2012 | AC36007 | 0.008 |
| | 01/07/2013 | 3010190-01 | 0.017 |
| | 05/20/2013 | 3040515-01 | 0.007 |
| | 08/26/2013 | 3080791-01 | 0.006 |
| | 10/10/2013 | 3100520-01 | <0.010 |
| MW10 | 01/30/2012 | AC23055 | 0.009 |
| | 04/13/2012 | AC26855 | 0.011 |
| | 07/09/2012 | AC31702 | <0.007 |
| | 10/18/2012 | AC36016 | <0.007 |
| | 01/07/2013 | 3010190-10 | 0.019 |
| | 05/20/2013 | 3040515-10 | 0.008 |
| | 08/26/2013 | 3080791-10 | <0.010 |
| | 10/10/2013 | 3100520-10 | <0.010 |

# Hutsonville Ash Impoundment
## Statistical Summary for Multiple Locations

### User Supplied Information

**Date Range: 01/01/2012 to 12/05/2013** **Option for LT Pts:** **x 0.5**

**Locations:** **MW1,MW10**

| Location | Type | Class |
|---|---|---|
| **MW1** | **Upper Zone** | **Background** |

| Parameter | Units | Count | Mean | Median | Maximum | Minimum | Std Dev | Sen Slope Units/yr | Normal / Log Normal | % of Non-Detects |
|---|---|---|---|---|---|---|---|---|---|---|
| Ag, diss | mg/L | 8 | 0.0025 | 0.0035 | 0.0050 | 0.0001 | 0.0019 | 0.00 | Yes / No | 100.00 |
| As, diss | mg/L | 8 | 0.004 | 0.004 | 0.012 | 0.001 | 0.004 | 0.00 | No / Yes | 75.00 |
| B, diss | ug/L | 24 | 98.750 | 103.500 | 147.000 | 1.000 | 35.458 | -22.52 | Yes / No | 4.17 |
| Ba, diss | mg/L | 8 | 0.017 | 0.017 | 0.025 | 0.011 | 0.004 | 0.00 | Yes / Yes | 0.00 |
| Be, diss | mg/L | 8 | 0.003 | 0.004 | 0.005 | 0.001 | 0.002 | 0.00 | Yes / No | 100.00 |
| Cd, diss | mg/L | 8 | 0.002 | 0.001 | 0.006 | 0.001 | 0.002 | 0.00 | No / No | 100.00 |
| CN, total | mg/L | 8 | 0.048 | 0.002 | 0.360 | 0.001 | 0.126 | 0.00 | No / Yes | 62.50 |
| Co, diss | mg/L | 8 | 0.003 | 0.004 | 0.005 | 0.001 | 0.002 | 0.00 | Yes / No | 100.00 |
| Cr, diss | mg/L | 8 | 0.002 | 0.001 | 0.011 | 0.001 | 0.004 | 0.00 | No / No | 87.50 |
| Cu, diss | ug/L | 8 | 2.500 | 1.250 | 9.000 | 0.500 | 3.047 | 0.00 | No / No | 62.50 |
| F, diss | mg/L | 8 | 0.089 | 0.078 | 0.176 | 0.061 | 0.037 | 0.00 | No / No | 0.00 |
| Fe, diss | ug/L | 8 | 394.500 | 345.500 | 724.000 | 89.000 | 189.545 | -119.61 | Yes / Yes | 0.00 |
| Hg, diss | mg/L | 8 | 0.00034 | 0.00015 | 0.00100 | 0.00010 | 0.00034 | 0.00 | No / No | 62.50 |
| Mn, diss | mg/L | 24 | 0.060 | 0.024 | 0.395 | 0.000 | 0.092 | 0.00 | No / No | 8.33 |
| Ni, diss | mg/L | 8 | 0.003 | 0.004 | 0.007 | 0.001 | 0.002 | 0.00 | Yes / Yes | 75.00 |
| NO3, diss | mg/L | 8 | 0.430 | 0.253 | 1.090 | 0.025 | 0.426 | -0.07 | Yes / Yes | 12.50 |
| Pb, diss | mg/L | 8 | 0.001 | 0.001 | 0.005 | 0.001 | 0.002 | 0.00 | No / No | 100.00 |
| pH (field) | SU | 24 | 7.286 | 7.225 | 7.800 | 7.070 | 0.208 | -0.09 | No / No | 0.00 |
| Sb, diss | mg/L | 8 | 0.003 | 0.004 | 0.005 | 0.001 | 0.002 | 0.00 | Yes / No | 100.00 |
| Se, diss | mg/L | 8 | 0.004 | 0.004 | 0.012 | 0.001 | 0.003 | 0.00 | No / Yes | 100.00 |
| SO4, diss | mg/L | 24 | 27.738 | 25.600 | 53.300 | 10.400 | 12.691 | -10.68 | Yes / Yes | 0.00 |
| TDS | mg/L | 24 | 278.000 | 280.000 | 480.000 | 40.000 | 119.640 | -29.22 | Yes / No | 0.00 |
| Tl, diss | mg/L | 8 | 0.003 | 0.004 | 0.006 | 0.001 | 0.002 | 0.00 | Yes / No | 87.50 |
| Zn, diss | mg/L | 8 | 0.010 | 0.008 | 0.017 | 0.004 | 0.005 | -0.01 | Yes / Yes | 25.00 |

Shapiro-Wilk Normality test performed at 0.05 significance level.

# Hutsonville Ash Impoundment
## Statistical Summary for Multiple Locations

### User Supplied Information

**Date Range: 01/01/2012 to 12/05/2013** **Option for LT Pts: x 0.5**

**Locations: MW1,MW10**

| Location | Type | Class |
|---|---|---|
| **MW10** | **Upper Zone** | **Background** |

| Parameter | Units | Count | Mean | Median | Maximum | Minimum | Std Dev | Sen Slope Units/yr | Normal / Log Normal | % of Non-Detects |
|---|---|---|---|---|---|---|---|---|---|---|
| Ag, diss | mg/L | 8 | 0.0031 | 0.0035 | 0.0050 | 0.0001 | 0.0018 | 0.00 | No / No | 100.00 |
| As, diss | mg/L | 8 | 0.004 | 0.004 | 0.010 | 0.001 | 0.003 | 0.00 | Yes / No | 87.50 |
| B, diss | ug/L | 8 | 96.500 | 103.500 | 143.000 | 10.000 | 44.204 | -35.81 | Yes / No | 12.50 |
| Ba, diss | mg/L | 8 | 0.017 | 0.018 | 0.022 | 0.013 | 0.003 | 0.00 | Yes / Yes | 0.00 |
| Be, diss | mg/L | 8 | 0.003 | 0.004 | 0.005 | 0.001 | 0.002 | 0.00 | Yes / No | 100.00 |
| Cd, diss | mg/L | 8 | 0.003 | 0.001 | 0.006 | 0.001 | 0.002 | 0.00 | No / No | 100.00 |
| CN, total | mg/L | 8 | 0.004 | 0.002 | 0.013 | 0.001 | 0.005 | 0.00 | No / Yes | 62.50 |
| Co, diss | mg/L | 8 | 0.003 | 0.004 | 0.005 | 0.001 | 0.002 | 0.00 | Yes / No | 100.00 |
| Cr, diss | mg/L | 8 | 0.003 | 0.002 | 0.012 | 0.001 | 0.004 | 0.00 | No / Yes | 75.00 |
| Cu, diss | ug/L | 8 | 1.875 | 0.750 | 5.000 | 0.500 | 1.996 | 0.00 | No / No | 75.00 |
| F, diss | mg/L | 8 | 0.147 | 0.150 | 0.224 | 0.100 | 0.040 | 0.00 | Yes / Yes | 25.00 |
| Fe, diss | ug/L | 8 | 471.500 | 445.500 | 932.000 | 99.000 | 259.600 | -248.85 | Yes / Yes | 0.00 |
| Hg, diss | mg/L | 8 | 0.00033 | 0.00010 | 0.00100 | 0.00010 | 0.00042 | 0.00 | No / No | 100.00 |
| Mn, diss | mg/L | 8 | 0.004 | 0.004 | 0.009 | 0.001 | 0.002 | 0.00 | Yes / Yes | 75.00 |
| Ni, diss | mg/L | 8 | 0.004 | 0.004 | 0.009 | 0.001 | 0.003 | 0.00 | Yes / Yes | 87.50 |
| NO3, diss | mg/L | 8 | 0.149 | 0.125 | 0.301 | 0.050 | 0.079 | -0.09 | Yes / Yes | 62.50 |
| Pb, diss | mg/L | 8 | 0.002 | 0.001 | 0.005 | 0.001 | 0.002 | 0.00 | No / No | 100.00 |
| pH (field) | SU | 8 | 7.090 | 7.075 | 7.830 | 6.210 | 0.443 | -0.40 | Yes / Yes | 0.00 |
| Sb, diss | mg/L | 8 | 0.003 | 0.004 | 0.005 | 0.001 | 0.001 | 0.00 | Yes / No | 100.00 |
| Se, diss | mg/L | 8 | 0.007 | 0.004 | 0.012 | 0.004 | 0.004 | 0.00 | No / No | 75.00 |
| SO4, diss | mg/L | 8 | 21.650 | 22.050 | 23.500 | 17.000 | 2.093 | 1.36 | No / No | 0.00 |
| TDS | mg/L | 8 | 344.875 | 373.000 | 390.000 | 220.000 | 57.389 | 5.90 | No / No | 0.00 |
| Tl, diss | mg/L | 8 | 0.004 | 0.004 | 0.007 | 0.001 | 0.002 | 0.00 | Yes / Yes | 87.50 |
| Zn, diss | mg/L | 8 | 0.008 | 0.007 | 0.019 | 0.004 | 0.005 | 0.00 | Yes / Yes | 50.00 |

Shapiro-Wilk Normality test performed at 0.05 significance level.

# Hutsonville Ash Impoundment

## Statistical Analysis Procedure

Background Date Range: 01/01/2012 to 12/05/2013
Background Locations: MW1,MW10

Compliance Date Range: 01/01/2012 to 12/05/2013
Compliance Locations: MW10

| | |
|---|---|
| Comparison Method if all Background Results are Non-Detect: | STmdl = Last MDL |
| Statistical Test for Parametric Background Data Distributions: | STpar = Parametric Tolerance Interval on Background |
| Statistical Test for Cases with High Percentage of Non-Detect Background Data: | STlow1 = Non-Parametric Tolerance Interval on background (ND Frequency > 50%) |
| Statistical Test for Cases with High Percentage of Non-Detect Background Data: | STlow2 = Non-Parametric Tolerance Interval on background (ND Frequency > 50%) |
| Statistical Test for Non-Parametric Background Data Distributions: | STnon = Non-Parametric Tolerance Interval on background |
| Background Comparison: | Interwell |
| Number of Verification Samples: | 0 |
| Default Type 1 Individual Comparison Error Level (False Positive Rate) for tests other than Prediction Interval | 0.01 |
| Non-Detect Processing (Parametric Tests): | <=15% using MDL * 0.5<br>>15% using MDL * 0.5 |
| Non-Detect Processing (All Other): | <=50% using MDL * 0.5<br>>50% using MDL * 0.5 |
| Tolerance Interval Coverage: | 95% |

| Compliance Location | Parameter | Sample Date | Count Of Bkg Results | Percent of Non detects | Normal / Lognormal | Test | Confidence Level | Upper Limit | Lower Limit | Analysis Result | Exceedance | Trend |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MW10 | Ag, diss, mg/L | 01/30/2012 | 16 | 100.00 | No/No | STmdl | N/A | 0.0100 | | <0.0070 | No | |
| | | 04/13/2012 | 16 | 100.00 | No/No | | N/A | 0.0100 | | <0.0070 | No | |
| | | 01/07/2013 | 16 | 100.00 | No/No | | N/A | 0.0100 | | <0.0002 | No | |
| | | 10/18/2012 | 16 | 100.00 | No/No | | N/A | 0.0100 | | <0.0070 | No | |
| | | 07/09/2012 | 16 | 100.00 | No/No | | N/A | 0.0100 | | <0.0070 | No | |
| | | 05/20/2013 | 16 | 100.00 | No/No | | N/A | 0.0100 | | <0.0010 | No | |
| | | 08/26/2013 | 16 | 100.00 | No/No | | N/A | 0.0100 | | <0.0100 | No | |
| | | 10/10/2013 | 16 | 100.00 | No/No | | N/A | 0.0100 | | <0.0100 | No | |
| MW10 | As, diss, mg/L | 01/30/2012 | 16 | 81.25 | No/No | STlow1 | 55.99 | 0.012 | | <0.007 | No | |
| | | 04/13/2012 | 16 | 81.25 | No/No | | 55.99 | 0.012 | | <0.007 | No | |
| | | 07/09/2012 | 16 | 81.25 | No/No | | 55.99 | 0.012 | | <0.007 | No | |
| | | 01/07/2013 | 16 | 81.25 | No/No | | 55.99 | 0.012 | | 0.010 | No | |
| | | 10/18/2012 | 16 | 81.25 | No/No | | 55.99 | 0.012 | | <0.007 | No | |
| | | 05/20/2013 | 16 | 81.25 | No/No | | 55.99 | 0.012 | | <0.001 | No | |
| | | 08/26/2013 | 16 | 81.25 | No/No | | 55.99 | 0.012 | | <0.010 | No | |
| | | 10/10/2013 | 16 | 81.25 | No/No | | 55.99 | 0.012 | | <0.010 | No | |
| MW10 | Ba, diss, mg/L | 01/30/2012 | 16 | 0.00 | Yes/Yes | STpar | 99.00 | 0.028 | | 0.018 | No | |
| | | 04/13/2012 | 16 | 0.00 | Yes/Yes | | 99.00 | 0.028 | | 0.015 | No | |
| | | 07/09/2012 | 16 | 0.00 | Yes/Yes | | 99.00 | 0.028 | | 0.018 | No | |
| | | 01/07/2013 | 16 | 0.00 | Yes/Yes | | 99.00 | 0.028 | | 0.013 | No | |
| | | 10/18/2012 | 16 | 0.00 | Yes/Yes | | 99.00 | 0.028 | | 0.014 | No | |
| | | 05/20/2013 | 16 | 0.00 | Yes/Yes | | 99.00 | 0.028 | | 0.018 | No | |
| | | 08/26/2013 | 16 | 0.00 | Yes/Yes | | 99.00 | 0.028 | | 0.017 | No | |
| | | 10/10/2013 | 16 | 0.00 | Yes/Yes | | 99.00 | 0.028 | | 0.022 | No | |
| MW10 | Be, diss, mg/L | 01/30/2012 | 16 | 100.00 | No/No | STmdl | N/A | 0.010 | | <0.007 | No | |
| | | 04/13/2012 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.007 | No | |
| | | 07/09/2012 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.007 | No | |
| | | 01/07/2013 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.003 | No | |
| | | 10/18/2012 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.007 | No | |

| Compliance Location | Parameter | Sample Date | Count Of Bkg Results | Percent of Non detects | Normal / Lognormal | Test | Confidence Level | Upper Limit | Lower Limit | Analysis Result | Exceedance | Trend |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MW10 | Be, diss, mg/L | 05/20/2013 | 16 | 100.00 | No/No | STmdl | N/A | 0.010 | | <0.001 | No | |
| | | 08/26/2013 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.010 | No | |
| | | 10/10/2013 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.010 | No | |
| MW10 | Boron, Diss, ug/L | 01/30/2012 | 32 | 6.25 | Yes/No | STpar | 99.00 | 190.014 | | <20.000 | No | |
| | | 04/13/2012 | 32 | 6.25 | Yes/No | | 99.00 | 190.014 | | 143.000 | No | |
| | | 07/09/2012 | 32 | 6.25 | Yes/No | | 99.00 | 190.014 | | 143.000 | No | |
| | | 01/07/2013 | 32 | 6.25 | Yes/No | | 99.00 | 190.014 | | 113.000 | No | |
| | | 10/18/2012 | 32 | 6.25 | Yes/No | | 99.00 | 190.014 | | 119.000 | No | |
| | | 05/20/2013 | 32 | 6.25 | Yes/No | | 99.00 | 190.014 | | 66.000 | No | |
| | | 08/26/2013 | 32 | 6.25 | Yes/No | | 99.00 | 190.014 | | 94.000 | No | |
| | | 10/10/2013 | 32 | 6.25 | Yes/No | | 99.00 | 190.014 | | 84.000 | No | |
| MW10 | Cd, diss, mg/L | 01/30/2012 | 16 | 100.00 | No/No | STmdl | N/A | 0.010 | | <0.002 | No | |
| | | 04/13/2012 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.002 | No | |
| | | 07/09/2012 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.002 | No | |
| | | 01/07/2013 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.012 | No | |
| | | 10/18/2012 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.002 | No | |
| | | 05/20/2013 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.001 | No | |
| | | 08/26/2013 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.010 | No | |
| | | 10/10/2013 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.010 | No | |
| MW10 | Cl, diss, mg/L | 01/30/2012 | 16 | 0.00 | Yes/Yes | STpar | 99.00 | 83.667 | | 66.400 | No | |
| | | 04/13/2012 | 16 | 0.00 | Yes/Yes | | 99.00 | 83.667 | | 33.100 | No | |
| | | 07/09/2012 | 16 | 0.00 | Yes/Yes | | 99.00 | 83.667 | | 22.900 | No | |
| | | 01/07/2013 | 16 | 0.00 | Yes/Yes | | 99.00 | 83.667 | | 20.100 | No | |
| | | 10/18/2012 | 16 | 0.00 | Yes/Yes | | 99.00 | 83.667 | | 22.700 | No | |
| | | 05/20/2013 | 16 | 0.00 | Yes/Yes | | 99.00 | 83.667 | | 38.900 | No | |
| | | 08/26/2013 | 16 | 0.00 | Yes/Yes | | 99.00 | 83.667 | | 49.000 | No | |
| | | 10/10/2013 | 16 | 0.00 | Yes/Yes | | 99.00 | 83.667 | | 48.000 | No | |
| MW10 | CN, total, mg/L | 01/30/2012 | 16 | 62.50 | No/No | STlow1 | 55.99 | 0.360 | | 0.013 | No | |
| | | 04/13/2012 | 16 | 62.50 | No/No | | 55.99 | 0.360 | | <0.001 | No | |

| Compliance Location | Parameter | Sample Date | Count Of Bkg Results | Percent of Non detects | Normal / Lognormal | Test | Confidence Level | Upper Limit | Lower Limit | Analysis Result | Exceedance | Trend |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MW10 | CN, total, mg/L | 07/09/2012 | 16 | 62.50 | No/No | STlow1 | 55.99 | 0.360 | | 0.005 | No | |
| | | 01/07/2013 | 16 | 62.50 | No/No | | 55.99 | 0.360 | | 0.010 | No | |
| | | 10/18/2012 | 16 | 62.50 | No/No | | 55.99 | 0.360 | | <0.001 | No | |
| | | 05/20/2013 | 16 | 62.50 | No/No | | 55.99 | 0.360 | | <0.003 | No | |
| | | 08/26/2013 | 16 | 62.50 | No/No | | 55.99 | 0.360 | | <0.003 | No | |
| | | 10/10/2013 | 16 | 62.50 | No/No | | 55.99 | 0.360 | | <0.003 | No | |
| MW10 | Co, diss, mg/L | 01/30/2012 | 16 | 100.00 | No/No | STmdl | N/A | 0.010 | | <0.007 | No | |
| | | 04/13/2012 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.007 | No | |
| | | 07/09/2012 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.007 | No | |
| | | 01/07/2013 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.003 | No | |
| | | 10/18/2012 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.007 | No | |
| | | 05/20/2013 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.001 | No | |
| | | 08/26/2013 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.010 | No | |
| | | 10/10/2013 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.010 | No | |
| MW10 | Copper, Diss, ug/L | 01/30/2012 | 16 | 68.75 | No/No | STlow1 | 55.99 | 9.000 | | 2.000 | No | |
| | | 04/13/2012 | 16 | 68.75 | No/No | | 55.99 | 9.000 | | 1.000 | No | |
| | | 07/09/2012 | 16 | 68.75 | No/No | | 55.99 | 9.000 | | <1.000 | No | |
| | | 01/07/2013 | 16 | 68.75 | No/No | | 55.99 | 9.000 | | <1.000 | No | |
| | | 10/18/2012 | 16 | 68.75 | No/No | | 55.99 | 9.000 | | <1.000 | No | |
| | | 05/20/2013 | 16 | 68.75 | No/No | | 55.99 | 9.000 | | <1.000 | No | |
| | | 08/26/2013 | 16 | 68.75 | No/No | | 55.99 | 9.000 | | <10.000 | No | |
| | | 10/10/2013 | 16 | 68.75 | No/No | | 55.99 | 9.000 | | <10.000 | No | |
| MW10 | Cr, diss, mg/L | 01/30/2012 | 16 | 81.25 | No/Yes | STlow1 | 55.99 | 0.012 | | 0.004 | No | |
| | | 04/13/2012 | 16 | 81.25 | No/Yes | | 55.99 | 0.012 | | 0.012 | No | |
| | | 07/09/2012 | 16 | 81.25 | No/Yes | | 55.99 | 0.012 | | <0.002 | No | |
| | | 01/07/2013 | 16 | 81.25 | No/Yes | | 55.99 | 0.012 | | <0.004 | No | |
| | | 10/18/2012 | 16 | 81.25 | No/Yes | | 55.99 | 0.012 | | <0.002 | No | |
| | | 05/20/2013 | 16 | 81.25 | No/Yes | | 55.99 | 0.012 | | <0.001 | No | |
| | | 08/26/2013 | 16 | 81.25 | No/Yes | | 55.99 | 0.012 | | <0.010 | No | |

| Compliance Location | Parameter | Sample Date | Count Of Bkg Results | Percent of Non detects | Normal / Lognormal | Test | Confidence Level | Upper Limit | Lower Limit | Analysis Result | Exceedance | Trend |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MW10 | Cr, diss, mg/L | 10/10/2013 | 16 | 81.25 | No/Yes | STlow1 | 55.99 | 0.012 | | <0.001 | No | |
| MW10 | F, diss, mg/L | 01/30/2012 | 16 | 12.50 | Yes/Yes | STpar | 99.00 | 0.262 | | 0.224 | No | |
| | | 04/13/2012 | 16 | 12.50 | Yes/Yes | | 99.00 | 0.262 | | <0.200 | No | |
| | | 07/09/2012 | 16 | 12.50 | Yes/Yes | | 99.00 | 0.262 | | <0.200 | No | |
| | | 01/07/2013 | 16 | 12.50 | Yes/Yes | | 99.00 | 0.262 | | 0.166 | No | |
| | | 10/18/2012 | 16 | 12.50 | Yes/Yes | | 99.00 | 0.262 | | 0.152 | No | |
| | | 05/20/2013 | 16 | 12.50 | Yes/Yes | | 99.00 | 0.262 | | 0.154 | No | |
| | | 08/26/2013 | 16 | 12.50 | Yes/Yes | | 99.00 | 0.262 | | 0.132 | No | |
| | | 10/10/2013 | 16 | 12.50 | Yes/Yes | | 99.00 | 0.262 | | 0.148 | No | |
| MW10 | Hg, diss, mg/L | 01/30/2012 | 16 | 81.25 | No/No | STlow1 | 55.99 | 0.00070 | | <0.00020 | No | |
| | | 04/13/2012 | 16 | 81.25 | No/No | | 55.99 | 0.00070 | | <0.00020 | No | |
| | | 07/09/2012 | 16 | 81.25 | No/No | | 55.99 | 0.00070 | | <0.00020 | No | |
| | | 01/07/2013 | 16 | 81.25 | No/No | | 55.99 | 0.00070 | | <0.00020 | No | |
| | | 10/18/2012 | 16 | 81.25 | No/No | | 55.99 | 0.00070 | | <0.00020 | No | |
| | | 05/20/2013 | 16 | 81.25 | No/No | | 55.99 | 0.00070 | | <0.00020 | No | |
| | | 08/26/2013 | 16 | 81.25 | No/No | | 55.99 | 0.00070 | | <0.00200 | No | |
| | | 10/10/2013 | 16 | 81.25 | No/No | | 55.99 | 0.00070 | | <0.00200 | No | |
| MW10 | Iron, Diss, ug/L | 10/18/2012 | 16 | 0.00 | Yes/Yes | STpar | 99.00 | 1,109.473 | | 667.000 | No | |
| | | 05/20/2013 | 16 | 0.00 | Yes/Yes | | 99.00 | 1,109.473 | | 99.000 | No | |
| | | 08/26/2013 | 16 | 0.00 | Yes/Yes | | 99.00 | 1,109.473 | | 387.000 | No | |
| | | 10/10/2013 | 16 | 0.00 | Yes/Yes | | 99.00 | 1,109.473 | | 504.000 | No | |
| | | 01/30/2012 | 16 | 0.00 | Yes/Yes | | 99.00 | 1,109.473 | | 575.000 | No | |
| | | 04/13/2012 | 16 | 0.00 | Yes/Yes | | 99.00 | 1,109.473 | | 932.000 | No | |
| | | 07/09/2012 | 16 | 0.00 | Yes/Yes | | 99.00 | 1,109.473 | | 366.000 | No | |
| | | 01/07/2013 | 16 | 0.00 | Yes/Yes | | 99.00 | 1,109.473 | | 242.000 | No | |
| MW10 | Mn, diss, mg/L | 01/30/2012 | 32 | 28.13 | No/No | STnon | 80.63 | 0.395 | | <0.007 | No | |
| | | 04/13/2012 | 32 | 28.13 | No/No | | 80.63 | 0.395 | | <0.007 | No | |
| | | 07/09/2012 | 32 | 28.13 | No/No | | 80.63 | 0.395 | | 0.009 | No | |
| | | 01/07/2013 | 32 | 28.13 | No/No | | 80.63 | 0.395 | | <0.005 | No | |

| Compliance Location | Parameter | Sample Date | Count Of Bkg Results | Percent of Non detects | Normal / Lognormal | Test | Confidence Level | Upper Limit | Lower Limit | Analysis Result | Exceedance | Trend |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MW10 | Mn, diss, mg/L | 10/18/2012 | 32 | 28.13 | No/No | STnon | 80.63 | 0.395 | | <0.007 | No | |
| | | 05/20/2013 | 32 | 28.13 | No/No | | 80.63 | 0.395 | | 0.001 | No | |
| | | 08/26/2013 | 32 | 28.13 | No/No | | 80.63 | 0.395 | | <0.010 | No | |
| | | 10/10/2013 | 32 | 28.13 | No/No | | 80.63 | 0.395 | | <0.010 | No | |
| MW10 | Ni, diss, mg/L | 01/30/2012 | 16 | 81.25 | Yes/Yes | STlow1 | 55.99 | 0.009 | | 0.009 | No | |
| | | 04/13/2012 | 16 | 81.25 | Yes/Yes | | 55.99 | 0.009 | | <0.007 | No | |
| | | 01/07/2013 | 16 | 81.25 | Yes/Yes | | 55.99 | 0.009 | | <0.004 | No | |
| | | 10/18/2012 | 16 | 81.25 | Yes/Yes | | 55.99 | 0.009 | | <0.007 | No | |
| | | 07/09/2012 | 16 | 81.25 | Yes/Yes | | 55.99 | 0.009 | | <0.007 | No | |
| | | 05/20/2013 | 16 | 81.25 | Yes/Yes | | 55.99 | 0.009 | | <0.001 | No | |
| | | 08/26/2013 | 16 | 81.25 | Yes/Yes | | 55.99 | 0.009 | | <0.010 | No | |
| | | 10/10/2013 | 16 | 81.25 | Yes/Yes | | 55.99 | 0.009 | | <0.010 | No | |
| MW10 | NO3, diss, mg/L | 01/30/2012 | 16 | 37.50 | No/Yes | STpar | 99.00 | 3.870 | | 0.301 | No | |
| | | 04/13/2012 | 16 | 37.50 | No/Yes | | 99.00 | 3.870 | | <0.250 | No | |
| | | 07/09/2012 | 16 | 37.50 | No/Yes | | 99.00 | 3.870 | | <0.250 | No | |
| | | 01/07/2013 | 16 | 37.50 | No/Yes | | 99.00 | 3.870 | | 0.188 | No | |
| | | 10/18/2012 | 16 | 37.50 | No/Yes | | 99.00 | 3.870 | | 0.204 | No | |
| | | 05/20/2013 | 16 | 37.50 | No/Yes | | 99.00 | 3.870 | | <0.100 | No | |
| | | 08/26/2013 | 16 | 37.50 | No/Yes | | 99.00 | 3.870 | | <0.200 | No | |
| | | 10/10/2013 | 16 | 37.50 | No/Yes | | 99.00 | 3.870 | | <0.200 | No | |
| MW10 | Pb, diss, mg/L | 01/30/2012 | 16 | 100.00 | No/No | STmdl | N/A | 0.010 | | <0.001 | No | |
| | | 04/13/2012 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.001 | No | |
| | | 07/09/2012 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.001 | No | |
| | | 01/07/2013 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.003 | No | |
| | | 10/18/2012 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.001 | No | |
| | | 05/20/2013 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.001 | No | |
| | | 08/26/2013 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.010 | No | |
| | | 10/10/2013 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.010 | No | |
| MW10 | pH (field), SU | 01/30/2012 | 32 | 0.00 | No/No | STnon | 80.63 | 7.830 | 6.210 | 7.830 | No | |

| Compliance Location | Parameter | Sample Date | Count Of Bkg Results | Percent of Non detects | Normal / Lognormal | Test | Confidence Level | Upper Limit | Lower Limit | Analysis Result | Exceedance | Trend |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MW10 | pH (field), SU | 07/09/2012 | 32 | 0.00 | No/No | STnon | 80.63 | 7.830 | 6.210 | 7.060 | No | |
| | | 04/13/2012 | 32 | 0.00 | No/No | | 80.63 | 7.830 | 6.210 | 7.260 | No | |
| | | 01/07/2013 | 32 | 0.00 | No/No | | 80.63 | 7.830 | 6.210 | 7.210 | No | |
| | | 10/18/2012 | 32 | 0.00 | No/No | | 80.63 | 7.830 | 6.210 | 7.090 | No | |
| | | 05/20/2013 | 32 | 0.00 | No/No | | 80.63 | 7.830 | 6.210 | 7.020 | No | |
| | | 08/26/2013 | 32 | 0.00 | No/No | | 80.63 | 7.830 | 6.210 | 6.210 | No | |
| | | 10/10/2013 | 32 | 0.00 | No/No | | 80.63 | 7.830 | 6.210 | 7.040 | No | |
| MW10 | Sb, diss, mg/L | 01/30/2012 | 16 | 100.00 | No/No | STmdl | N/A | 0.010 | | <0.007 | No | |
| | | 04/13/2012 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.007 | No | |
| | | 07/09/2012 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.007 | No | |
| | | 01/07/2013 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.005 | No | |
| | | 10/18/2012 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.007 | No | |
| | | 05/20/2013 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.001 | No | |
| | | 08/26/2013 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.010 | No | |
| | | 10/10/2013 | 16 | 100.00 | No/No | | N/A | 0.010 | | <0.010 | No | |
| MW10 | Se, diss, mg/L | 01/30/2012 | 16 | 87.50 | No/No | STlow1 | 55.99 | 0.011 | | <0.007 | No | |
| | | 04/13/2012 | 16 | 87.50 | No/No | | 55.99 | 0.011 | | <0.007 | No | |
| | | 07/09/2012 | 16 | 87.50 | No/No | | 55.99 | 0.011 | | <0.007 | No | |
| | | 01/07/2013 | 16 | 87.50 | No/No | | 55.99 | 0.011 | | <0.023 | No | |
| | | 10/18/2012 | 16 | 87.50 | No/No | | 55.99 | 0.011 | | <0.007 | No | |
| | | 05/20/2013 | 16 | 87.50 | No/No | | 55.99 | 0.011 | | 0.011 | No | |
| | | 08/26/2013 | 16 | 87.50 | No/No | | 55.99 | 0.011 | | <0.010 | No | |
| | | 10/10/2013 | 16 | 87.50 | No/No | | 55.99 | 0.011 | | 0.011 | No | |
| MW10 | SO4, diss, mg/L | 01/30/2012 | 32 | 0.00 | No/Yes | STpar | 99.00 | 67.371 | | 21.400 | No | |
| | | 04/13/2012 | 32 | 0.00 | No/Yes | | 99.00 | 67.371 | | 21.900 | No | |
| | | 07/09/2012 | 32 | 0.00 | No/Yes | | 99.00 | 67.371 | | 17.000 | No | |
| | | 01/07/2013 | 32 | 0.00 | No/Yes | | 99.00 | 67.371 | | 22.200 | No | |
| | | 10/18/2012 | 32 | 0.00 | No/Yes | | 99.00 | 67.371 | | 20.900 | No | |
| | | 05/20/2013 | 32 | 0.00 | No/Yes | | 99.00 | 67.371 | | 23.400 | No | |

| Compliance Location | Parameter | Sample Date | Count Of Bkg Results | Percent of Non detects | Normal / Lognormal | Test | Confidence Level | Upper Limit | Lower Limit | Analysis Result | Exceedance | Trend |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MW10 | SO4, diss, mg/L | 08/26/2013 | 32 | 0.00 | No/Yes | STpar | 99.00 | 67.371 | | 22.900 | No | |
| | | 10/10/2013 | 32 | 0.00 | No/Yes | | 99.00 | 67.371 | | 23.500 | No | |
| MW10 | TDS, mg/L | 01/30/2012 | 32 | 0.00 | Yes/No | STpar | 99.00 | 568.570 | | 370.000 | No | |
| | | 04/13/2012 | 32 | 0.00 | Yes/No | | 99.00 | 568.570 | | 390.000 | No | |
| | | 07/09/2012 | 32 | 0.00 | Yes/No | | 99.00 | 568.570 | | 310.000 | No | |
| | | 01/07/2013 | 32 | 0.00 | Yes/No | | 99.00 | 568.570 | | 376.000 | No | |
| | | 10/18/2012 | 32 | 0.00 | Yes/No | | 99.00 | 568.570 | | 220.000 | No | |
| | | 05/20/2013 | 32 | 0.00 | Yes/No | | 99.00 | 568.570 | | 333.000 | No | |
| | | 08/26/2013 | 32 | 0.00 | Yes/No | | 99.00 | 568.570 | | 380.000 | No | |
| | | 10/10/2013 | 32 | 0.00 | Yes/No | | 99.00 | 568.570 | | 380.000 | No | |
| MW10 | Tl, diss, mg/L | 07/09/2012 | 16 | 87.50 | Yes/No | STlow1 | 55.99 | 0.007 | | <0.007 | No | |
| | | 01/07/2013 | 16 | 87.50 | Yes/No | | 55.99 | 0.007 | | <0.003 | No | |
| | | 10/18/2012 | 16 | 87.50 | Yes/No | | 55.99 | 0.007 | | <0.007 | No | |
| | | 05/20/2013 | 16 | 87.50 | Yes/No | | 55.99 | 0.007 | | <0.001 | No | |
| | | 08/26/2013 | 16 | 87.50 | Yes/No | | 55.99 | 0.007 | | <0.010 | No | |
| | | 10/10/2013 | 16 | 87.50 | Yes/No | | 55.99 | 0.007 | | <0.010 | No | |
| | | 01/30/2012 | 16 | 87.50 | Yes/No | | 55.99 | 0.007 | | <0.007 | No | |
| | | 04/13/2012 | 16 | 87.50 | Yes/No | | 55.99 | 0.007 | | 0.007 | No | |
| MW10 | Zn, diss, mg/L | 01/30/2012 | 16 | 37.50 | Yes/Yes | STpar | 99.00 | 0.025 | | 0.009 | No | |
| | | 04/13/2012 | 16 | 37.50 | Yes/Yes | | 99.00 | 0.025 | | 0.011 | No | |
| | | 01/07/2013 | 16 | 37.50 | Yes/Yes | | 99.00 | 0.025 | | 0.019 | No | |
| | | 10/18/2012 | 16 | 37.50 | Yes/Yes | | 99.00 | 0.025 | | <0.007 | No | |
| | | 07/09/2012 | 16 | 37.50 | Yes/Yes | | 99.00 | 0.025 | | <0.007 | No | |
| | | 05/20/2013 | 16 | 37.50 | Yes/Yes | | 99.00 | 0.025 | | 0.008 | No | |
| | | 08/26/2013 | 16 | 37.50 | Yes/Yes | | 99.00 | 0.025 | | <0.010 | No | |
| | | 10/10/2013 | 16 | 37.50 | Yes/Yes | | 99.00 | 0.025 | | <0.010 | No | |

# Hutsonville Ash Impoundment
# Normal Tolerance Interval on Background
# Background Data Pool

| | | | |
|---|---|---|---|
| **Probability Distribution:** | **One sided** | **Option for LT Pts:** | **x 0.5** |
| **Confidence Level:** | **99.00%** | **Background Date Range:** | **01/01/2012 to 12/05/2013** |
| **Data Transformation:** | **None** | **Compliance Date Range:** | **01/01/2012 to 12/05/2013** |
| | | **Tolerance Coverage (Gamma):** | **95%** |
| **Compliance Locations:** | **MW10** | | |
| **Background Locations:** | **MW1,MW10** | | |

## BACKGROUND

| Parameter Code | Parameter Name | Units |
|---|---|---|
| **00515** | **Total Dissolved Solids** | **mg/L** |

Pooled Results:

| Normal | Mean | StdDev | K Value | TL (Lower) | TU (Upper) |
|---|---|---|---|---|---|
| Yes | 294.719 | 110.586 | 2.476 | 20.867 | 568.570 |

| Location | Type | Total Pts | LT Pts | % LT Pts |
|---|---|---|---|---|
| MW1 | Upper Zone | 24 | 0 | 0.000 |
| MW10 | Upper Zone | 8 | 0 | 0.000 |

Note: Confidence Level is sometimes referred to as Tolerance Coefficient.

# Hutsonville Ash Impoundment
# Normal Tolerance Interval on Background
# Background Data Pool

| | | | |
|---|---|---|---|
| **Probability Distribution:** | **One sided** | **Option for LT Pts:** | **x 0.5** |
| **Confidence Level:** | **99.00%** | **Background Date Range:** | **01/01/2012 to 12/05/2013** |
| **Data Transformation:** | **None** | **Compliance Date Range:** | **01/01/2012 to 12/05/2013** |
| | | **Tolerance Coverage (Gamma):** | **95%** |
| **Compliance Locations:** | **MW10** | | |
| **Background Locations:** | **MW1,MW10** | | |

## BACKGROUND

| Parameter Code | Parameter Name | Units |
|---|---|---|
| **00941** | **Chloride, dissolved** | **mg/L** |

Pooled Results:

| Normal | Mean | StdDev | K Value | TL (Lower) | TU (Upper) |
|---|---|---|---|---|---|
| No | 20.659 | 20.785 | 3.031 | 0.000 | 83.667 |

| Location | Type | Total Pts | LT Pts | % LT Pts |
|---|---|---|---|---|
| MW1 | Upper Zone | 8 | 0 | 0.000 |
| MW10 | Upper Zone | 8 | 0 | 0.000 |

Note: Confidence Level is sometimes referred to as Tolerance Coefficient.

# Hutsonville Ash Impoundment
# Normal Tolerance Interval on Background
# Background Data Pool

| | | | |
|---|---|---|---|
| **Probability Distribution:** | **One sided** | **Option for LT Pts:** | **x 0.5** |
| **Confidence Level:** | **99.00%** | **Background Date Range:** | **01/01/2012 to 12/05/2013** |
| **Data Transformation:** | **None** | **Compliance Date Range:** | **01/01/2012 to 12/05/2013** |
| | | **Tolerance Coverage (Gamma):** | **95%** |
| **Compliance Locations:** | **MW10** | | |
| **Background Locations:** | **MW1,MW10** | | |

## BACKGROUND

| Parameter Code | Parameter Name | Units |
|---|---|---|
| **00950** | **Fluoride, dissolved** | **mg/L** |

Pooled Results:

| Normal | Mean | StdDev | K Value | TL (Lower) | TU (Upper) |
|---|---|---|---|---|---|
| Yes | 0.118 | 0.048 | 3.031 | 0.000 | 0.262 |

| Location | Type | Total Pts | LT Pts | % LT Pts |
|---|---|---|---|---|
| MW1 | Upper Zone | 8 | 0 | 0.000 |
| MW10 | Upper Zone | 8 | 2 | 25.000 |

Note: Confidence Level is sometimes referred to as Tolerance Coefficient.

# Hutsonville Ash Impoundment
# Normal Tolerance Interval on Background
# Background Data Pool

| | | | |
|---|---|---|---|
| **Probability Distribution:** | **One sided** | **Option for LT Pts:** | **x 0.5** |
| **Confidence Level:** | **99.00%** | **Background Date Range:** | **01/01/2012 to 12/05/2013** |
| **Data Transformation:** | **None** | **Compliance Date Range:** | **01/01/2012 to 12/05/2013** |
| | | **Tolerance Coverage (Gamma):** | **95%** |
| **Compliance Locations:** | **MW10** | | |
| **Background Locations:** | **MW1,MW10** | | |

## BACKGROUND

| Parameter Code | Parameter Name | Units |
|---|---|---|
| **01005** | **Barium, dissolved** | **mg/L** |

Pooled Results:

| Normal | Mean | StdDev | K Value | TL (Lower) | TU (Upper) |
|---|---|---|---|---|---|
| Yes | 0.017 | 0.004 | 3.031 | 0.006 | 0.028 |

| Location | Type | Total Pts | LT Pts | % LT Pts |
|---|---|---|---|---|
| MW1 | Upper Zone | 8 | 0 | 0.000 |
| MW10 | Upper Zone | 8 | 0 | 0.000 |

Note: Confidence Level is sometimes referred to as Tolerance Coefficient.

# Hutsonville Ash Impoundment
# Normal Tolerance Interval on Background
# Background Data Pool

| | | | |
|---|---|---|---|
| **Probability Distribution:** | **One sided** | **Option for LT Pts:** | **x 0.5** |
| **Confidence Level:** | **99.00%** | **Background Date Range:** | **01/01/2012 to 12/05/2013** |
| **Data Transformation:** | **None** | **Compliance Date Range:** | **01/01/2012 to 12/05/2013** |
| | | **Tolerance Coverage (Gamma):** | **95%** |
| **Compliance Locations:** | **MW10** | | |
| **Background Locations:** | **MW1,MW10** | | |

## BACKGROUND

| Parameter Code | Parameter Name | Units |
|---|---|---|
| **01020** | **Boron, dissolved** | **ug/L** |

Pooled Results:

| Normal | Mean | StdDev | K Value | TL (Lower) | TU (Upper) |
|---|---|---|---|---|---|
| No | 98.188 | 37.081 | 2.476 | 6.361 | 190.014 |

| Location | Type | Total Pts | LT Pts | % LT Pts |
|---|---|---|---|---|
| MW1 | Upper Zone | 24 | 1 | 4.167 |
| MW10 | Upper Zone | 8 | 1 | 12.500 |

Note: Confidence Level is sometimes referred to as Tolerance Coefficient.

# Hutsonville Ash Impoundment
# Normal Tolerance Interval on Background
# Background Data Pool

| | | | |
|---|---|---|---|
| **Probability Distribution:** | **One sided** | **Option for LT Pts:** | **x 0.5** |
| **Confidence Level:** | **99.00%** | **Background Date Range:** | **01/01/2012 to 12/05/2013** |
| **Data Transformation:** | **None** | **Compliance Date Range:** | **01/01/2012 to 12/05/2013** |
| | | **Tolerance Coverage (Gamma):** | **95%** |
| **Compliance Locations:** | **MW10** | | |
| **Background Locations:** | **MW1,MW10** | | |

## BACKGROUND

| Parameter Code | Parameter Name | Units |
|---|---|---|
| **01046** | **Iron, dissolved** | **ug/L** |

Pooled Results:

| Normal | Mean | StdDev | K Value | TL (Lower) | TU (Upper) |
|---|---|---|---|---|---|
| Yes | 433.000 | 223.152 | 3.031 | 0.000 | 1,109.473 |

| Location | Type | Total Pts | LT Pts | % LT Pts |
|---|---|---|---|---|
| MW1 | Upper Zone | 8 | 0 | 0.000 |
| MW10 | Upper Zone | 8 | 0 | 0.000 |

Note: Confidence Level is sometimes referred to as Tolerance Coefficient.

# Hutsonville Ash Impoundment
# Normal Tolerance Interval on Background
# Background Data Pool

| | | | |
|---|---|---|---|
| **Probability Distribution:** | **One sided** | **Option for LT Pts:** | **x 0.5** |
| **Confidence Level:** | **99.00%** | **Background Date Range:** | **01/01/2012 to 12/05/2013** |
| **Data Transformation:** | **None** | **Compliance Date Range:** | **01/01/2012 to 12/05/2013** |
| | | **Tolerance Coverage (Gamma):** | **95%** |
| **Compliance Locations:** | **MW10** | | |
| **Background Locations:** | **MW1,MW10** | | |

## BACKGROUND

| Parameter Code | Parameter Name | Units |
|---|---|---|
| **01090** | **Zinc, dissolved** | **mg/L** |

Pooled Results:

| Normal | Mean | StdDev | K Value | TL (Lower) | TU (Upper) |
|---|---|---|---|---|---|
| No | 0.009 | 0.005 | 3.031 | 0.000 | 0.025 |

| Location | Type | Total Pts | LT Pts | % LT Pts |
|---|---|---|---|---|
| MW1 | Upper Zone | 8 | 2 | 25.000 |
| MW10 | Upper Zone | 8 | 4 | 50.000 |

Note: Confidence Level is sometimes referred to as Tolerance Coefficient.

# Hutsonville Ash Impoundment
# Normal Tolerance Interval on Background
# Background Data Pool

| | | | |
|---|---|---|---|
| **Probability Distribution:** | **One sided** | **Option for LT Pts:** | **x 0.5** |
| **Confidence Level:** | **99.00%** | **Background Date Range:** | **01/01/2012 to 12/05/2013** |
| **Data Transformation:** | **Log (Base 10)** | **Compliance Date Range:** | **01/01/2012 to 12/05/2013** |
| | | **Tolerance Coverage (Gamma):** | **95%** |
| **Compliance Locations:** | **MW10** | | |
| **Background Locations:** | **MW1,MW10** | | |

## BACKGROUND

| Parameter Code | Parameter Name | Units |
|---|---|---|
| **00618** | **Nitrate nitrogen, dissolved** | **mg/L** |

Pooled Results:

| Normal | Mean | StdDev | K Value | TL (Lower) | TU (Upper) |
|---|---|---|---|---|---|
| Yes | 0.289 | 0.330 | 3.031 | 0.008 | 3.870 |

| Location | Type | Total Pts | LT Pts | % LT Pts |
|---|---|---|---|---|
| MW1 | Upper Zone | 8 | 1 | 12.500 |
| MW10 | Upper Zone | 8 | 5 | 62.500 |

Note: Confidence Level is sometimes referred to as Tolerance Coefficient.

# Hutsonville Ash Impoundment
# Normal Tolerance Interval on Background
# Background Data Pool

| | | | |
|---|---|---|---|
| **Probability Distribution:** | **One sided** | **Option for LT Pts:** | **x 0.5** |
| **Confidence Level:** | **99.00%** | **Background Date Range:** | **01/01/2012 to 12/05/2013** |
| **Data Transformation:** | **Log (Base 10)** | **Compliance Date Range:** | **01/01/2012 to 12/05/2013** |
| | | **Tolerance Coverage (Gamma):** | **95%** |
| **Compliance Locations:** | **MW10** | | |
| **Background Locations:** | **MW1,MW10** | | |

## BACKGROUND

| Parameter Code | Parameter Name | Units |
|---|---|---|
| **00946** | **Sulfate, dissolved** | **mg/L** |

Pooled Results:

| Normal | Mean | StdDev | K Value | TL (Lower) | TU (Upper) |
|---|---|---|---|---|---|
| Yes | 26.216 | 11.299 | 2.476 | 8.620 | 67.371 |

| Location | Type | Total Pts | LT Pts | % LT Pts |
|---|---|---|---|---|
| MW1 | Upper Zone | 24 | 0 | 0.000 |
| MW10 | Upper Zone | 8 | 0 | 0.000 |

Note: Confidence Level is sometimes referred to as Tolerance Coefficient.

# Appendix C

# Groundwater Sampling Protocol

## C.1 Sampling Protocol

The following procedures shall be used in sampling groundwater at the site. This sampling protocol shall apply to the routine quarterly (or modified semi-annual or annual) sampling events. A sample collector's worksheet, comparable to the example located in Exhibit A-1, may be used for noting relevant information in regard to each well.

If conditions at the time of sampling could influence the results, sampling should be postponed until a later date. However, under no circumstances will sampling deviate from the schedule in Section 5.1 .

### *C.1.1 Water Levels*

Water levels shall be taken in each well prior to purging and/or sampling. Water levels should be taken as close together as practical, to prevent any time distortion of the water surface data. The following steps shall be followed to obtain accurate water level readings:

1. Note the general condition of the monitoring well on the worksheet. This shall include, but is not limited to the condition of the casing, the lock, evidence of tampering, condition of the pad, and any standing water.
2. Remove the lock and open the monitoring well. Note the condition of the interior of the casing and the condition of the well cap and riser. Open the cap, taking care not to allow dirt or foreign material into the monitoring well.
3. The technician shall rinse the probe and cable of the water level meter with DeCon water.
4. Slowly lower the probe into the monitoring well until the meter indicates the water surface has been reached.
5. Note the depth to water (to the nearest 0.01 ft) and the time on the worksheet.
6. Lower the probe to the bottom of well. (If a dedicated pump is installed in the well, skip this step). Note the well depth on the worksheet. The depth of the well will be measured on an annual basis, at wells that do not contain dedicated pumps. The depth of wells with dedicated pumps will be measured at least once every 5 years, or whenever the pump is removed.
7. Slowly remove the probe from the well. Rinse the probe and line with DeCon water.
8. Replace cap. Close and lock the well. Proceed to the next well, and repeat.

### *C.1.2 Purging of Monitoring Well – Pump Method*

After all water level measurements have been taken, the monitoring wells shall be purged to provide a representative sample. Each groundwater monitoring well shall be purged by using a dedicated pump. The pump construction shall consist of inert materials consistent with the monitoring well construction (e.g., stainless steel pump bodies installed in stainless steel wells).

Purging shall be conducted utilizing a "low-flow" or minimal drawdown technique. Flow rates for this technique will typically fall below 0.5 liters/minutes, with an overall goal of not reducing the water level in the monitoring well by more than 0.3 ft during purging. Water levels should be checked frequently to ensure that the drawdown in the well does not exceed the 0.3-ft limits. Every 3 minutes to 5 minutes, readings shall be taken on the following water quality indicators to determine if a representative water sample is available.

- pH (in SU),
- Specific Conductance (in µmhos/cm or µS/cm),
- Temperature (in ºF),
- And, it is suggested, at least one of the following:
  - Redox Potential (in mV);
  - Dissolved Oxygen (in mg/L); and/or
  - Turbidity (in NTU).

The water quality indicators will be considered stabilized when the following tolerances are reached after three consecutive readings:

- pH..... ±0.05 SU
- Specific Conductance ..... ±5 percent
- Temperature..... ±0.5ºF
- Redox Potential ..... ±10 percent
- Dissolved Oxygen..... ±10 percent
- Turbidity..... ±10 percent

Slow recovering wells require special consideration. If a well is dry, or is purged below the bottom of the pump intake, the well will be allowed to recharge for at least 12 hours. Samples shall be collected until all sample containers have been filled or the well becomes dry. Notes shall be kept on the worksheet with regard to water levels, times, volume of water removed, and any other parameters considered to be relevant.

### *C.1.3 Purging of Monitoring Well – Bailer Method*

Purging and sample collection with a bailer shall be performed in the event of a non-functioning pump or from a well that does not have a dedicated pump installed. A sample shall be collected utilizing a factory packaged, clean, disposable bailer with an appropriate length of new, clean rope attached.

Calculate the number of bailer volumes of water needed to remove one (1) well volume of water.

Well Volume Calculations (2-inch well):

Schedule 40 PVC has an inside diameter of 2.067 inches.

$\therefore$ ((2.067 inches/12 inches/ft)/2)$^2$ • $\pi$ • 1 ft of water = 0.0233 ft$^3$/ft of water.

0.0233 ft$^3$/ft • 7.48 gallons/ft$^3$ = 0.174 gallon/ft

Schedule 5 Stainless Steel (304 or 316) has an inside diameter of 2.245 inches.

$\therefore$ ((2.245 inches/12 inches/ft)/2)$^2$ • $\pi$ • 1 ft of water = 0.0275 ft$^3$/ft of water.

0.0275 ft$^3$/ft • 7.48 gallons/ft$^3$ = 0.206 gallon/ft

Volume of well (in gallons) = well type gallon/ft • (DTB - DTW);
where, DTB ≡ depth to bottom of well (from measuring point), and
DTW ≡ depth to water (from measuring point)

Bailer Volumes: Disposable bailer volumes will vary by type and manufacturer. Volume information should be obtained before going to the site. For comparison, a 3 ft stainless steel bailer has a volume of approximately 1220 cc or 0.322 gallon and a 5 ft PVC bailer has a volume of approximately 1085 cc or 0.287 gallon.

1. Open monitoring well, being careful that no potential contaminant enters the well.
2. Remove one (1) bailer volume of water from the monitoring well. Test pH, specific conductance and temperature. Note values on worksheet. (Turbidity, redox potential and dissolved oxygen will vary considerably due to the agitation a bailer will cause in the well. Testing for these parameters is not recommended with this method.)
3. Remove one-half (½) gallon of water from the monitoring well. Test pH, specific conductance and temperature. Note values on worksheet.
4. Remove ½ to 1 gallon of water. Test pH, specific conductance and temperature. Record data on worksheet.
5. Repeat Number 5 until pH, specific conductance and temperature stabilize or three (3) well volumes of water have been removed.
6. If the monitoring well becomes dry, or there is insufficient water to obtain all necessary samples, the monitoring well will be allowed to recharge for 24 hours. Samples shall be collected until all sample containers are filled or the well becomes dry. Notes shall be kept on the worksheet regarding water levels, times, volume of water removed, and any other parameters considered by the technician to be relevant.
7. If there is sufficient water volume in the monitoring well to obtain all samples, sample collection shall begin at this time.

### *C.1.4 Sample Collection Order*

Samples shall be collected starting at the monitoring well with the least likelihood for contamination. Sampling shall proceed from the well with the lowest potential for contamination to the well with the highest potential for contamination.

### *C.1.5 Field Measurements*

C.1.5a General

Upon arrival at each groundwater monitoring well, the technician shall note on the sampler's worksheet or in a field notebook the date, time, ambient air temperature, general weather conditions, and individuals present, including sample team members and any observers. (Note: Any observers shall need at a minimum, the same personal protective gear as the members of the sample team.)

Establish a "clean area" near the monitoring well where the sample containers and equipment can be stored while not in use. Every effort should be made to keep the sampling equipment and containers from contacting the ground surface. If necessary, a disposable, plastic tarp can be used as a ground cover to prevent potential contamination of the sample containers and equipment. Typically, the back of the field vehicle will be used as the "clean area".

Any non-dedicated sampling equipment (meter probes, thermometers, etc.) shall be washed in a commercial, laboratory cleaner (Alconox®, Liqui-nox®, or equivalent), and thoroughly rinsed in DeCon water before each use. Calibration shall be performed at each new monitoring location after the initial decontamination. After use, each device shall be powered down (if necessary) decontaminated, and stored in its manufacturer-approved container.

### C.1.5b Temperature

Obtain a water sample from the well. Place the sample aliquot in a disposable container, insert the thermometer (or electronic probe), wait until the readings have stabilized, and record the temperature on the worksheet. Temperature for a glass thermometer should be noted to the nearest degree Fahrenheit (1ºF). For electronic thermometers (thermocouples), temperature should be noted to the nearest tenth degree Fahrenheit (0.1ºF). The thermometer or probe shall be cleaned and rinsed with DeCon water after use.

### C.1.5c pH

Confirm calibration of the instrument by comparing with an appropriate buffer solution. Adjust for temperature compensation (if meter is not self-compensating). Rinse probe with DeCon water. Obtain a sample from the well and place the probe in sample aliquot. Note the pH and record on the sample worksheet. Note pH readings to the nearest tenth unit (0.1).

### C.1.5d Specific Conductance

Confirm calibration of the instrument by comparing against an appropriate buffer solution. Adjust for temperature compensation (if meter is not self-compensating). Rinse the probe with DeCon water. Obtain a sample from the well and place the probe in sample aliquot. Note the specific conductance and record on the sample worksheet. Specific conductance should be noted to the nearest micromhos per centimeter (µmhos/cm) or microSiemens per centimeter (µS/cm).

## *C.1.6 Sample Collection Procedures*

Jars and vials may ship pre-labeled from the laboratory, identifying the analysis and preservative for each type of sample. Dependent upon circumstances, sample containers may be prepared by non-laboratory personnel. If so, this should be noted on the sample worksheet or in the field notebook.

A technician shall remove a sample container from the cooler, affix a label, and in indelible, waterproof ink write the well number and/or sample I.D., the facility name, the sample collection date and time, the type of sample in the container, and the sample collector's name. A technician shall organize the containers in the following sampling order:

1. Metals and Minerals (dissolved);
2. Anions (dissolved);
3. Total Dissolved Solids (TDS); and
4. Cyanides (total);

Dissolved parameters include dissolved metals and minerals, total dissolved solids (TDS), and nitrogen should be field filtered. Samples should be filtered using a 0.45-micron filter attached to the sample pump line. Other filter apparatus may be utilized as long as Illinois EPA guidelines are followed. Filters should be replaced no less frequently than at each new well, and may need to be replaced more often if flow is restricted due to particulate matter in the sample water.

## C.2 Transportation of Monitoring Samples

### *C.2.1 Sample Preservation Techniques*

The preservation techniques utilized in the groundwater samples will typically adhere to those listed in Handbook for Sampling and Sample Preservation of Water and Wastewater, U.S. EPA, EPA-600/4-82-029, September 1982 and/or Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, EPA/530/SW-846, 3rd Edition, Final Update IV (January 2008).

### *C.2.2 Transportation of Samples*

Samples shall be transported to the laboratory in sealed, insulated shipping containers, ice chests, or coolers. The shipping containers should be sturdy, and if samples are contained in glass bottles, dividers and/or bubble wrap should be used to restrict potential breakage. All samples will be packed in ice or a packaged refrigerant as necessary for proper preservation. Samples should be packed to maintain sample temperatures as close to 4ºC (degrees Celsius) or 39ºF as possible from the time the samples are collected to the time the samples are received by the laboratory. The samples should be shipped/delivered to the laboratory as soon as practical, preferably within 24 hours of sample collection.

All samples shall be accompanied by a chain-of-custody record. The sampler shall retain a copy of the record and forward the original with the samples to the analytical laboratory. Once the laboratory has received the samples, a representative from the laboratory is to complete the record, retain the original and return a copy with the chemical analysis reports to the sampler. The chain-of-custody shall contain the facility name, the wells sampled, time and date of sampling, members of the sampling party, type of samples (i.e. water, soil, leachate, etc.), number of sample bottles, requested analysis, overnight courier, etc. A sample chain-of-custody record is provided in Exhibit A-2.

# Exhibit C-1

## Example Groundwater Sampling Worksheet

# GROUNDWATER SAMPLING WORKSHEET

HANSON

**BACKGROUND INFORMATION:** **Well ID:** _____

**Site:** _____ **Project:** _____

**Well Condition:** _____

**Well Information:** Well pipe diameter: _____ Well material: _____

Constructed depth: _____ ft. from m.p. Screen length: _____ feet

**Sample Depth to Water:** _____ ft. from m.p. Date: _____ Time: _____

**Water Volume:** Btm of well: _____ ft. from m.p. Well volume [0.164*(CD-DTW)]: _____ gal.

**SAMPLE COLLECTION:**

**Personnel:** Technician 1: _____ Technician 2: _____

Company: _____ Location: _____

**Weather:** _____

**STABILIZATION TEST:**

| Reading | Time | Temp. (in ºF) | pH (in std .units) | Conductance (in µS/cm) | *Dis. $O_2$** *(in mg/L)* | *RedOx Pot.** *(in mV)* | *Turbidity** *(in NTU)* |
|---|---|---|---|---|---|---|---|
| 1 *(start)* | | | | | | | |
| 2 | | | | | | | |
| 3 | | | | | | | |
| 4 | | | | | | | |
| 5 | | | | | | | |
| 6 | | | | | | | |
| 7 | | | | | | | |
| 8 | | | | | | | |
| 9 | | | | | | | |
| 10 | | | | | | | |
| 11 | | | | | | | |
| 12 | | | | | | | |

* Optional stabilization parameter(s)

**SAMPLE APPEARANCE:**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Clarity:** | | Clear | | Hazy | | Sl. Turbid | | Turbid | | V. Turbid | | Opaque |
| **Color:** | | Clear | | Yellow | | Brown | | Rust | | White | | Gray |
| **Odor** | | Sulfurous | | Petroleum | | Musty | | Solvent | | | | None |

**SAMPLE DATA:**

| General Information | Sample Types Collected | | | |
|---|---|---|---|---|
| Well or Sample ID: | | Anions (dissolved) | | Anions (total) |
| Date Collected: | | Metals (dissolved) | | Metals (total) |
| Time Collected: | | Cyanide (total) | | |
| | | Total Dissolved Solids | | |
| Date Sent to Lab: | | | | |
| Time Sent to Lab: | | | | |

**EXPENDABLES:**

| | Bladder | | Filter (lg) | | Filter (med) | | Filter (sm) | | Bailer | | Lock | | Tubing/Rope (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

**NOTES:** _____

_____

_____

# Exhibit C-2

## Example Chain-of-Custody Record

# CHAIN OF CUSTODY RECORD

HANSON

## CLIENT INFORMATION:

Client: _____

Address: _____

_____

_____

Contact Name: _____

Telephone No.: _____

Fax No.: _____

Project ID/PO: _____

## SAMPLE INFORMATION:

Sampler (please print): _____ Sampler (signature): _____

| Sample Description | Date Collected | Time Collected | Type: Grab | Type: Composite | Matrix: Water | Matrix: Soil | Matrix: Other | Number of Containers | Analyses Desired | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

Relinquished by (signature): _____ Date/ Time _____ Received by (signature): _____ Date/ Time _____

Relinquished by (signature): _____ Date/ Time _____ Received by (signature): _____ Date/ Time _____

Samples received:

Chilled (≤4ºC) Y or N

in proper container Y or N

within holding time Y or N