Statistical Analysis Plan
Sherco Scrubbers Solids Pond No.3

Northern States Power Company, a Minnesota Corporation
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1. Introduction

On April 17, 2015 the US Environmental Protection Agency (EPA) published the final rule for the management of Coal Combustion Residuals (CCR). The CCR rule is formally promulgated in the U.S. Code of Federal Regulations, Title 40, Parts 257 and 261 (EPA, 2015). This rule is applicable to the Scrubber Solids Pond No. 3 (Facility) at the Sherburne County Generating Plant (Sherco), which is owned and operated by Northern States Power Company, a Minnesota Corporation (NSPM). The Facility is located approximately 1.2 miles SW from the city of Becker, Minnesota, on the Sherco Plant property.

Pursuant to the 40 CFR, §257.93, the Facility must develop a groundwater sampling and analysis program by October 17, 2017. The program must address the selection of statistical methods and be certified by a Qualified Professional Engineer. This Statistical Analysis Plan (Plan) describes the method(s) to be used in identifying a statistically significant increase (SSI) over the upgradient or background groundwater quality. This Plan is included as Appendix A within the Facility's *Sherco Scrubber Solids Pond No. 3, CCR Ground Water Sampling Plan* (NSPM, 2017), and the reader is referred to the Sampling Plan for additional information on the site-specific hydrogeology, groundwater monitoring system, sampling and analysis procedures, and reporting requirements.

2. Statistical Method

The fundamental goal of statistical analysis is to provide a quantifiable means to evaluate whether a CCR management unit has released contaminants into the groundwater. Upon completion of each compliance monitoring event, detected constituents will be statistically evaluated to identify if an SSI over background has occurred. Statistical methods used to test for an SSI will be implemented in accordance with the EPA's Unified Guidance Document (EPA 2009). The computer software MANAGES, developed by the Electrical Power Research Institute, will be used to perform the analysis; however Xcel Energy reserves the right to perform the analysis using comparable statistical tools at a later date.

As groundwater monitoring progresses, the use of the selected statistical method will be subject to ongoing review. NSPM reserves the right to use other statistical tests in place of, or in addition to, the methods specified in this Plan if such methods are better suited for analysis of future results. Additionally, the methods in this Plan have been developed in accordance with the requirements of the CCR rule as published on April 17, 2015 (EPA, 2015), and modifications to this Plan may occur if future revisions or amendments are made to the CCR rule. If test methods are changed this work plan will be revised, as appropriate, and its certification updated.

2.1 Inter-well vs Intra-well Analysis

Based on the site hydrogeology and existing groundwater monitoring system described in the CCR Groundwater Monitoring System Certification (Carlson McCain, 2017), the site is well suited for inter-well analysis based upon the following:

- Historical data indicate consistent ground water gradients and flow directions for the site.
- Ground water travel times are sufficiently fast, 330ft/yr, ensuring the bi-annual samples collected are independent. (Carlson/McCain 2017.)
- The monitoring wells that comprise the groundwater monitoring system at the Facility are all completed in the same aquifer and are positioned to detect a release from the Facility.
- Baseline data reflect background sources which can be characterized with up-gradient wells.

2.2 Background Data

The background data set is comprised of nine rounds of ground water samples collected from each of the wells in the groundwater monitoring system from December of 2016 through September of 2017. This exceeds the minimum of eight samples required by §257.94. Each sample was analyzed for each of the parameters listed in Appendix III and Appendix IV of 40 CFR §257, as required by §257.94 (b). Up-gradient data are defined by seven wells: P-130, P-131, P-150, P-151, P-152A, P-153 and P-154A.

Background data will be evaluated and the data set amended, if appropriate, at a frequency of every two years.

2.3 Data review & Outliers

Data for each event will be reviewed for outliers and trends. The review will include:

- Basic statistics will be prepared for each well, and parameter. This will include: total observations, % non-detects, pooled mean, mean, median, standard deviation, and type of distribution.
- Data will be reviewed for trends in background wells using either parametric or non-parametric methods.
- Time series plots, Box-Whisker plots and the Grubbs Outlier test will be prepared for each well and parameter.

If the data is determined to be an outlier, one of three options is possible: keep the data point “as is” in the database, replace the data point with a corrected value, or discard the data point from statistical calculations. Unless the data point can clearly be shown as an error, it will be retained “as is” for all calculations.

2.4 Non-detects, Testing for Normality & Trends

Statistical analysis will be cognizant of the data's distribution type, normal or non-normal. The Shapiro-Wilk test for normality will be performed for each combination of well and parameter. As part of the normality test, non-detect values will be replaced as a function of percent non-detect. If the percentage of non-detects is less than 50%, the non-detect value will be replaced with one-half the laboratory reporting limit (EPRI 2016). If the percentage of non-detects is 50% or higher, a non-parameteric test will be used in lieu of parametric testing. Analytical results between the reporting limit and the method detection limit, i.e. "J-flagged" values, will be utilized if provided by the laboratory.

The presence of temporal effects such as seasonality or other time-dependent trends may be identifying using time series plots, analysis of variance (ANOVA), a formal trend test such as Mann-Kendall, or one of the tests for autocorrelation listed in Chapter 14 of the Unified Guidance (EPA, 2009). If temporal trends are apparent, the data set will be adjusted as recommended in the Unified Guidance.

2.5 Duplicate Data

Blind duplicate samples are collected in the field as part of the Facility's quality assurance / quality control (QA/QC) program. Results from these samples will be used strictly for QA/QC evaluation and not for statistical analysis.

2.6 Detection Monitoring and Determination of Statistically Significant Increases

During detection monitoring, each Appendix III parameter listed in Table 4 of the Sampling Plan will be statistically evaluated to determine whether an SSI has occurred. The appropriate test method, parametric or non-parametric, will be determined for each parameter, well and event combination based on the background evaluation criteria discussed in Sections 2.3 and 2.4, above. Interwell prediction intervals will be the primary method to compare compliance data to background data during detection monitoring. Compliance well data will be compared to the upper limit of the prediction interval generated using pooled background data from the upgradient wells. Interwell prediction limits on future values (or means), will be constructed in accordance with the procedures outlined Chapters 18 and 19 of the Unified Guidance to target appropriate annual site-wide false positive rates and statistical power.

If compliance data exceeds the upper prediction limit, a one-of-two pass resampling will be performed. The specific well and parameter will be re-sampled and re-analyzed. Re-sample results will be incorporated into the database, the new data will be reviewed as described in steps 2.3 & 2.4 above, and the data re-processed statistically. If the statistical analysis again reports the compliance data in exceedance of the upper prediction limit, an SSI will be confirmed.

For constituents which report 100% non-detects in background and compliance wells, the double quantification rule will be applied. Whereas, if the constituent concentration in a compliance well exceeds the highest historical laboratory reporting limit for two consecutive events, an SSI will be confirmed.

3. Response to a Verified SSI

In accordance with §257.94 item (e); NSPM Energy will:

1) Within 90 days of the determination of and SSI, demonstrate that a source other than the Facility caused the SSI. Due to the complexity of chemical analysis, hydrogeology and back ground influences, the components of an alternate source demonstration (ASD) are not prescriptive. However, an ASD shall contain sufficient information to confirm the CCR Unit is not the cause of the SSI, and shall be certified by a qualified professional engineer. If a certified ASD is provided, the Facility may continue with detection monitoring.
    a. The ASD will be included in the Facility's annual groundwater monitoring and corrective action report.
2) If a successful ASD is not made within 90 days of the SSI, the Facility must initiate assessment monitoring as required under §257.95.
    a. A notification that an assessment monitoring program has been established will be placed in the Facility's operating record and posted to the CCR web site.

3.1 Assessment Monitoring

Assessment monitoring will be initiated if a successful ASD is not completed within 90 days of identifying an SSI, and will include the following steps:

1) Within 90 days of triggering an assessment monitoring program, and annually thereafter, sample each well for the Appendix IV parameters listed in Table 4 of the Sampling Plan.
2) Within 90 days of receiving results from step 1), above, resample all wells for Appendix III parameters and detected (i.e. concentration above the reporting limit) Appendix IV parameters.
3) Establish groundwater protection standards (GWPS) for each detected Appendix IV parameter. The GWPS shall be either the U.S. EPA Maximum Contaminant Level (MCL), or the background concentrations for the constituent, whichever is higher.
4) Determine whether concentrations of Appendix IV parameters exceed the GWPS. This will be done using confidence intervals. If the lower confidence limit exceeds the GWPS at the 95% confidence level then the constituent has been detected at a statistically significant level above the GWPS.
5) If concentrations of all Appendix III and Appendix IV parameters continue to be above background concentrations but below the applicable groundwater protection standard, assessment monitoring will continue.

6) If one or more Appendix IV parameters is shown by step 4) to exceed the GWPS, the following actions will be taken:
    a. Place a notification in the operating record identifying the GWPS exceedances
    b. Characterize the nature and extent of the release
    c. Notify adjacent landowners located in the delineated extent of the contamination, and document notifications in the operating record.
    d. Within 90 days:
        i. Prepare an ASD for the exceedance, or
        ii. Initiate an assessment of corrective measures in accordance with §257.96.

Assessment monitoring will continue until two consecutive rounds demonstrate Appendix III and Appendix IV constituents are below back ground levels, at which time the Facility may return to detection monitoring.

4. References

Carlson McCain, 2017. CCR Groundwater Monitoring System Certification; Scrubber Solids Pond No. 3. Sherburne County (Sherco) Generating Plant; Becker, Minnesota. Prepared for Northern States Power Company, a Minnesota Corporation. October, 2017.

EPA, 2009. Statistical analysis of Groundwater Monitoring Data at RCRA Facilities: Unified guidance. Environmental Protection Agency Office of Resource Conservation and Recovery. EPA 530/R-09-007. March, 2009

EPA, 2015. 40 CFR Parts 257 and 261; Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule, Federal Register vol. 80, no. 74. Environmental Protection Agency. April 17, 2015.

EPRI, 2016. Presentation by Kirk Cameron on Treating Non-detects. Groundwater Resource Center Workshop, Statistical Methods for Analysis of Groundwater Monitoring Data. Electrical Power Research Institute, October 2016.

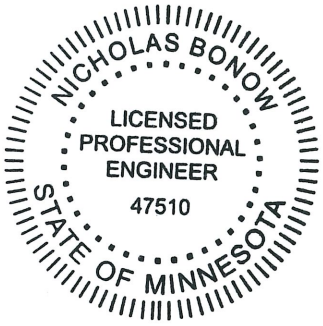
NSPM, 2017. CCR Ground Water Sampling Plan, Sherco Scrubber Solids Pond No. 3. Northern States Power Company, a Minnesota Corporation. October, 2017.

5. Professional Engineer Certification

"I hereby certify that the selected statistical method described herein is appropriate for evaluating the ground water monitoring data for Scrubber Solids Pond No. 3 at the Sherburne County Generating Plant, pursuant to 40 CFR 257.93(f). I am a duly licensed Professional Engineer under the laws of the state of Minnesota".

Nicholas Bonow, PE, PG
License No. 47510
Carlson McCain, Inc.

October 16, 2017
Date



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