

# Groundwater Monitoring Statistical Certification

Omaha Public Power District

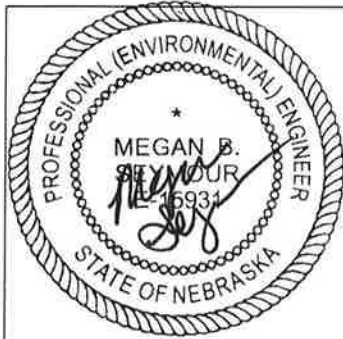
Nebraska City Station – NC1  
Combustion Ash Landfill

*Nebraska City, Nebraska*

Date: June 2016  
Revised: July 2018

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# Certification



I hereby certify that the selected statistical method described herein is appropriate for evaluating the groundwater monitoring data for the Omaha Public Power District NC1 Combustion Ash Landfill, and meets the requirements of 40 CFR 257.93 (f) and (g).

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Megan B. Seymour, P.E.

*7/31/2018*  
Date

Nebraska License No. E-15931

My license renewal date is December 31, 2018.

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# 1 Introduction

On April 17, 2015 the U.S. Environmental Protection Agency (EPA) published the final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA). The CCR rule is formally promulgated in the U.S. Code of Federal Regulations (CFR), Title 40, Parts 257 and 261 (EPA, 2015). The rule – effective on October 19, 2015 – applies to electric utilities and independent power producers that fall within NAICS code 221112, and the facility produces or stores CCR materials in surface impoundments or landfills.

This regulation applies to the Omaha Public Power District's (OPPD's) Nebraska City Generation Station. The Station, located southeast of Nebraska City, Nebraska has a two-unit fuel-fired generation station with two active CCR ash disposal landfills – NC1 and NC2. This statistical certification covers the NC1 ash disposal landfill. The NC1 Ash Disposal Area is an unlined CCR landfill which encompasses a total area of approximately 52 acres. The NC1 ash disposal is permitted under the current Nebraska Department of Environmental Quality (NDEQ) Title 132 regulations for fossil fuel combustion ash disposal areas.

Pursuant to the 40 CFR, 257.93, the facility must develop a program to address the selection of statistical methods to be certified by a Qualified Professional Engineer. HDR Engineering, Inc. (HDR) has prepared this Statistical Methods Certification Report to certify that the statistical methods selected for evaluating the groundwater monitoring data at the NC1 Ash Landfill are appropriate under the requirements of 40 CFR 257.93 (f) and (g).

# 2 Statistical Methodology Summary

This Statistical Selection Certification Report describes the method(s) that will be implemented for evaluating the groundwater monitoring data at the NC1 Ash Landfill. The method(s) described herein will be implemented in accordance with the EPA's Unified Guidance Document (EPA 2009). 40CFR 257.93(f) includes a list of statistical methods from which to choose for evaluating the groundwater monitoring data from CCR management areas. The options include:

- A parametric analysis of variance followed by multiple comparison.
- An analysis of variance based on ranks followed by multiple comparison procedures.
- A tolerance or prediction interval procedure, in which an interval for each constituent is established from the distribution of the background data and the level of each constituent in each compliance well is compared to the upper tolerance or prediction limit.
- A control chart approach that gives control limits for each constituent.
- Another statistical test method that meets the performance of 40 CFR 257.93(g).



The goal of the statistical analysis is to provide a quantified means to evaluate whether a CCR management unit has released contaminants into the groundwater. Following the collection of groundwater monitoring data, detected constituents will be statistically evaluated to identify if a statistically significant increase (SSI) over background has occurred. The Sanitas™ Statistical Software will be used to conduct statistical analysis of groundwater analytical data collected for the NC1 Ash Landfill. However, if during the period of the groundwater monitoring program at the NC1 Ash Landfill an updated or more comprehensive statistical software program is available or may become available, OPPD reserves the right to change software packages.

As groundwater monitoring progresses, the use of the selected statistical method will be subject to ongoing review. OPPD reserves the right to use other statistical tests in place of, or in addition to, the methods specified in this Statistical Selection Certification if such methods are better suited for analysis of future results. If test methods are changed, this Statistical Selection Certification will be revised, as appropriate, and its certification updated.

## 2.1 Data Review & Outliers

Data for each sampling and analysis event will be reviewed for outliers and trends. The review will include evaluations utilizing time series plots, box-whisker plots, Sen's Slope/Mann-Kendall trend test, and Tukey's Outlier screening. If the data is determined to be an outlier, the data point may be replaced with a corrected value, discarded from statistical calculations, or left "as is" in the database. Unless the data point can clearly be shown as a sample collection or transcription error or shown as not representative of the groundwater system sampled, it will be retained "as is" for all calculations. In accordance with 40 CFR 257.93(g)(6), data will be evaluated, as necessary, for seasonal and spatial variability using the procedures previously mentioned.

Statistical analysis will be completed in accordance with the data's distribution type, parametric or non-parametric. The Shapiro-Wilk test for normality will be performed for each combination of well and constituent. During the normality test, non-detect values are identified as a function of percent non-detect. If 15 percent to 50 percent of the data are non-detects, the Kaplan-Meier method or robust regression on order statistic (ROS) can be used to determine the sample mean and variance. If fewer than 15% of the data are non-detect, the non-detect data may be replaced with one-half of the laboratory reporting limit. If the percent of non-detects is 50 percent or higher, or when the data do not follow a normal or transformed-normal distribution, a non-parametric test may be used in lieu of parametric testing. Analytical results between the method detection limit and reporting limit (i.e. "J-flagged" values) will be entered into the database if provided by the laboratory.

A duplicate sample is 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 will not be used for statistical analysis.

## 2.2 Determining Statistically Significant Increases (SSIs)

Appendix III monitoring results will be statistically compared to established background levels through interwell statistical methods to determine if there is an SSI above background. Interwell upper prediction limits (UPLs) will be used to statistically evaluate SSIs over established background for the Appendix III constituents. As previously discussed, parametric or non-parametric UPLs can be used to compare Appendix III data to background. A “1-of-2” retesting plan will be used on individual sample results. The 1-of-2 retesting plan as defined in the EPA Unified Guidance concludes that an SSI has occurred when 2 out of 2 consecutive sample results exceed the prediction limit, while no SSI is concluded if 1-of-2 is below the limit. Verification resampling will be collected within 90 days of the constituents being initially detected above its limit. The results of the verification resampling will be incorporated into the database for statistical analysis. In the event a confirmed “2-of-2” SSI over background is identified for any of the Appendix III parameters, an SSI has been confirmed for the monitoring network. If it can be shown that the SSI resulted from a release from another source, from an error in sampling or analysis, or from natural variability, then an alternative source demonstration (ASD) of this finding must be made in writing and certified by a qualified professional engineer within 90 days of the statistical evaluation of the confirmed SSI. If a successful ASD is not made within 90 days of the statistical evaluation of the confirmed SSI, then the site must begin assessment monitoring.

According to 40 CFR 257.95(e), the CCR unit may return from assessment monitoring to detection monitoring when all Appendix III and Appendix IV constituents are “shown to be at or below background values, using the statistical procedures in paragraph 257.93(g) for two consecutive sampling events.” Interwell UPLs or upper tolerance limits (UTLs) can be used to compare assessment monitoring data to background. Prediction limits represent a range where a future result is expected to lie, tolerance intervals represent a range where a proportion of the population is expected to lie. In either case, a UPL or UTL is calculated from the background dataset. Recent data are then compared to the UPL or UTL. As previously discussed, UTLs and UPLs can be calculated parametrically or non-parametrically.

## 2.3 Determining Statistically Significant Levels (SSLs)

Appendix IV monitoring results are statistically compared to the Groundwater Protection Standards (GWPS) as defined in 40 CFR 257.95(h). Appendix IV constituents are statistically compared to the GWPS, using confidence intervals, to identify statistically significant levels (SSLs) above the GWPS. As required in 40 CFR 257.95(h), the CCR owner must establish GWPS for each constituent in Appendix IV detected in the groundwater. The GWPS shall be defined as the following:

- The U.S. EPA Maximum Contaminant Level (MCL) for constituents for which an MCL has been established;
- the background concentration for constituents for which an MCL has not been established, or

- the background concentration for constituents for which the background level is higher than the U.S. EPA MCL established.

The GWPS shall be set as the greater of the USEPA MCL established for that constituent or computed from background data by calculating the UTL with 95% confidence and 95% coverage. In the case where a published MCL does not exist or where the background level is higher than the MCL, necessitating the use of background to determine regulatory compliance, a UTL is used as the GWPS. UTLs can be calculated parametrically or non-parametrically.

Once a GWPS has been established, confidence intervals constructed on the recent data against the GWPS is used to determine whether a move to corrective action is warranted. When the lower confidence limit (LCL) of this interval exceeds the GWPS at the 95 percent confidence level, corrective action may be justified. Evaluations should be done for each detected Appendix IV constituent at each well. Parametric or non-parametric confidence intervals can be utilized. GWPSs should only be determined for detected Appendix IV constituents in accordance with 40 CFR 257.95(d)(2). If all the data for a constituent are non-detect, no statistical evaluation need to be performed.

### 3 References

- 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.