BURNS McDONNELL

October 17, 2017

Ms. Ingrid Setzler
Environmental Director
Kansas City Board of Public Utilities
300 N 65th Street, Kansas City, KS, 66102

Re: Selection of Statistical Method for Evaluating Groundwater at Kansas City Board of Public Utilities Nearman Creek Power Station Bottom Ash Pond

Dear Ms. Setzler:

On April 17, 2015 the final rule for the regulation and management of Coal Combustion Residuals (CCR) was published by the United States Environmental Protection Agency (USEPA) in 40 CFR §257 and §261 (herein referred to as the Final Rule). The Final Rule applies to the CCR surface impoundment known as the Bottom Ash Pond that is present at Kansas City Board of Public Utilities' (BPU) Nearman Creek Power Station (NCPS). 40 CFR §257.93 of the Final Rule requires BPU to develop a groundwater sampling and analysis program to be implemented at the Bottom Ash Pond and identify statistical methods that have been selected to assess groundwater data generated pursuant to the rule. BPU has contracted Burns & McDonnell Engineering Company, Inc. (Burns & McDonnell) to develop and implement a groundwater monitoring program at the Bottom Ash Pond in accordance with the requirements of the Final Rule. Groundwater monitoring activities completed to date include: development of a groundwater monitoring program capable of detecting a release from the Bottom Ash Pond to groundwater, installation of a groundwater monitoring well network at the Bottom Ash Pond, and collection of at least eight independent groundwater samples from each monitoring well in the monitoring network at the Bottom Ash Pond. These activities have been performed in accordance with 40 CFR §257.93.

Per 40 CFR §257.105(h)(4) and 40 CFR §257.93(f)(6) and by October 17, 2017, BPU is required to place this selection of a statistical method certification in the NCPS operating record. This letter presents the method(s) that will be used to assess the available groundwater data and a narrative of the tests that will be used to perform statistical evaluations of groundwater data collected at the Bottom Ash Pond.

Selection of Statistical Method

Burns & McDonnell, in consultation with BPU, has initiated evaluation of the data from constituents included in 40 CFR §257 Appendix III and Appendix IV that were collected from groundwater samples in the Bottom Ash Pond monitoring well network prior to October 17, 2017. Based on our initial review of the results, the statistical methods described in 40 CFR §257.93 (f)(1), parametric analysis of variance (ANOVA), and §257.93 (f)(2), ANOVA based on ranks, have been selected to perform assessment of whether groundwater results are indicative of a release to groundwater from the Bottom Ash Pond. These methods were selected due to their ability to recognize a statistically significant difference between data populations generated to

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date for upgradient monitoring wells and downgradient monitoring wells. In instances where statistically significant differences are identified in the upgradient versus downgradient datasets, additional tests will be performed to identify analyte/well pairs where statistically significant increases (SSIs) are present. Statistical analysis will be performed using the computer software package Sanitas™ and in general accordance with USEPA's guidance document titled *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities* dated March 2009.

The following presents a step-wise narrative of how the statistical evaluation will be performed:

1. Fully validated groundwater data will be compiled into a database that is compatible with the Sanitas™ software package.
2. Prior to performing the ANOVA, descriptive statistical analyses will be performed. These descriptive tests may include: time series plots to present changes in concentration versus time for each analyte/well pair, box and whisker plots to provide a visual display of each analyte/well pair's range of historic detections relative to other locations, trend analysis, and outlier tests.
3. ANOVA will be used to compare the magnitude and range of each Appendix III and IV constituent observed in the downgradient monitoring wells to that of the upgradient monitoring wells. This comparison will test the hypothesis that the upgradient and downgradient data are similar and could represent the same overall dataset. Depending upon the normality of the data sets that are used in this assessment, a parametric or a non-parametric ANOVA will be used in this analysis. In the event seasonal fluctuations are observed in the background dataset, the Sanitas™ software package may be used to correct for seasonal variation when performing the ANOVA.
    a. When normal data distributions are observed and less than 15 percent of the dataset are nondetect values, a parametric ANOVA will be used. The parametric ANOVA compares two populations using the calculated mean of each dataset and the variability of the data around that arithmetic mean. Where the calculated F-statistic (a ratio of the mean sum of squares for the between-wells and within-wells components) is greater than the F-distribution critical point, it will be determined that evidence of a significant difference is present. Bonferroni t-tests will then be used to compare each downgradient well to the upgradient dataset to determine which downgradient well exhibits an SSI for that particular analyte.
    b. In instances where non-normal distribution in the data is observed and/or more than 15 percent of the dataset are nondetect values, a non-parametric ANOVA will be used to compare the upgradient and downgradient datasets using their median concentrations. Instances, where the adjusted Kruskal-Wallis test statistic (H) exceeds the chi-squared value, will be considered evidence of a significant difference and contrast tests will be performed to determine which downgradient well exhibits a SSI for that particular analyte.

4. The results of the trend analysis discussed in item 2 above will be reviewed to determine whether upward or downward trends are present for analyte/well pairs where SSIs are observed.

While this certification presents statistical methods that have been selected to assess groundwater data generated to date in accordance with 40 CFR §257.93, BPU and Burns & McDonnell reserve the right to adjust the procedures identified above or select a different statistical approach altogether. In the event statistical methods other than ANOVA are used to assess groundwater monitoring data in accordance with 40 CFR §257.93, a subsequent certification will be prepared pursuant to the Final Rule.

Limitations of this Certification

This letter has been prepared in accordance with generally accepted environmental engineering practices for groundwater quality assessment and reporting. Conclusions contained herein are Burns & McDonnell's interpretation of readily available data and constitute a professional opinion based on said data. No other warranty, expressed or implied, is made as to the information included in this document. In the event that others make conclusions and recommendations based on data contained herein, such conclusions and recommendations are the responsibility of others.

Burns & McDonnell has exercised reasonable skill, care, and diligence in preparation of this letter in accordance with customarily accepted standards of good professional practice in effect at the time this report was prepared.

Sincerely,

Mr. Scott A. Martin, PE
Professional Engineer

Mr. Brian R. Hoye, PG
Project Manager

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