Project No.153-1406

COAL COMBUSTION RESIDUALS (CCR) RULE
STATISTICAL METHOD CERTIFICATION (40 CFR §257.93(f)(6))
SCPC SURFACE IMPOUNDMENT, SIOUX ENERGY CENTER, ST. CHARLES COUNTY, MISSOURI

1.0 COAL COMBUSTION RULE REQUIREMENTS

This Statistical Method Certification (SMC) presents statistical procedures to be used for the Ameren Missouri (Ameren) Sioux Energy Center (Facility), Utility Waste Landfill (UWL) in St. Charles County, Missouri. The facility manages coal combustion materials at an on-site surface impoundment known as "Cell 1" or "SCPC". The following sections provide a description of the statistical method selected to evaluate the groundwater quality data at SCPC.

2.0 SUMMARY OF STATISTICAL PLAN

The selected statistical method for Sioux Energy Center's SCPC was developed in accordance with 40 CFR §257.93 using methodology presented in Statistical Analysis of Groundwater Data at RCRA Facilities, Unified Guidance, March 2009, EPA 530/R-09-007 (Unified Guidance). The following sections provide a summary of the statistical methods that are to be used for this CCR unit. The full statistical analysis plan is provided in the Groundwater Monitoring Plan for this CCR unit. The statistical evaluation techniques described herein are to be used for detection and assessment monitoring (if needed). If corrective action is required, a statistical plan and corresponding SMC will need to be generated as a part of the corrective action program.

2.1 Statistical Methodology

2.1.1 Outlier Testing

Prior to completing the statistical analysis, a review of potential outliers will be completed. A statistical outlier is a value that is different than the other values in the data set. Generally, a value is considered to be suspect if it appears to be distant from the rest of the group such as an order of magnitude larger or smaller than the rest of the data, for example. Testing for outliers will be completed using time series plots as well as Dixon's and Rosner's Tests.

Once a value is identified as a statistical outlier, the source for the noted difference should be checked. Potential sources include sampling errors, field contamination, analytical errors, laboratory contamination, recordkeeping or transcription errors, faulty sample preparation or preservation, and/or extreme environmental conditions. Outliers may exist naturally if there is large inherent variability in the data, or if there is an on-site problem such as leakage or a new source of contamination. An outlier should not be removed from the data set unless the value has been documented to be erroneous. An exception is in outlier screening of background data where extreme values are removed in order to establish statistical limits that are regulatory conservative and will rapidly detect a change.

2.1.2 Reporting of Low and Zero Values

Analyte concentrations that are detected between the method detection limit (MDL) and the practical quantitation limit (PQL) for any given compound are considered trace values (or estimated values). These values are typically flagged with a "J" or "I" qualifier in the analytical data reports and are referred to as

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"trace values". Trace values will be imported into the statistical database at the value reported by the laboratory and will be flagged as trace values, which will be used in the statistical calculations described in the following sections.

Non-Detect Values (ND) are concentrations that were not detected at a concentration above the MDL and are typically flagged with "U" or "ND" flags in the analytical data reports. For the purpose of the statistical procedures described in the following sections, ND values will be managed and utilized as follows:

- If <15% ND, substitute ½ the PQL;
- If between 15% to 50% ND, use the Kaplan-Meier or robust regression on ordered statistics to estimate the mean and standard deviation; or
- If >50% but less than 100% ND, use a non-parametric test.

If all concentrations for a particular analyte are detected below the PQL then the Double Quantification Rule will be used.

2.1.3 Data Distribution

Prior to completing statistical calculations to establish compliance limits, the data distribution will be tested to determine if the data is normally distributed, transform-normally distributed, or non-normally distributed. If the data are normally or transform-normally distributed, parametric testing methods will be used. If the data is non-normally distributed, non-parametric testing techniques will be used. Data distribution will be evaluated using the Shapiro-Wilk/Shapiro-Francia testing methods for this CCR Unit.

2.1.4 Detection Monitoring

The prediction interval method will be used to evaluate the groundwater monitoring data for the Part 257 Appendix III parameters. An intrawell testing approach will be utilized – meaning that data from each downgradient well will be compared to compliance limits based on historical groundwater quality data from each monitoring well location. Using this approach, historical data from each compliance well will be pooled to calculate an upper prediction limit (UPL) (and lower prediction limit (LPL) for pH) for each Appendix III parameter. Results from the final detection monitoring event at the downgradient monitoring wells will be evaluated by comparing individual results to the UPL (and LPL for pH) for each monitoring event. Based on this method, an "initial exceedance" occurs when the concentration of any Appendix III constituent in a downgradient well exceeds the UPL (or is lower than the LPL for pH).

If data from a downgradient well exceeds the UPL, a 1-of-2 resampling strategy will be used to verify the result. In 1-of-2 resampling, one independent resample will be collected and evaluated within 90 days of the initial statistical evaluation to determine whether the initial exceedance is verified. If the resample result does not verify the initial result, the initial exceedance is considered a spurious result and detection monitoring continues for that constituent/well combination. If the resample results confirms the initial exceedance, the verified result is considered a statistically significant increase (SSI). Unless an alternate source demonstration (ASD) can be provided to contradict the SSI, the next step will be to enter Assessment Monitoring, as described below.

2.1.5 Assessment Monitoring

If Assessment Monitoring is required, the statistical testing method used to evaluate the assessment groundwater monitoring data will be the confidence interval method. As in detection monitoring, an intrawell approach will be utilized – meaning that data from downgradient wells will be compared to compliance limits based on historical groundwater quality data from each compliance well. Using this approach, a specific groundwater protection standard (GWPS) will be calculated for each analyte at each compliance well for each Appendix IV constituent. The GWPS will be the maximum contaminant level (MCL) (if a MCL exists) or the background concentration for each analyte at each compliance well based on a tolerance/prediction

limit procedure. Results from the downgradient monitoring wells will be evaluated by comparing the calculated lower confidence limit (LCL) with the GWPS for each analyte at each well. If the LCL exceeds the GWPS, there is statistical evidence of a statistically significant level (SSL), which will trigger additional response activities including a delineation of the nature and extent of the noted SSLs and potentially Corrective Action.

3.0 CERTIFICATION

I, Mark Haddock, P.E., being a Registered Professional Engineer, in accordance with the Missouri Professional Engineer's Registration, possessing the technical knowledge and experience to make the specific technical certifications required under 40 CFR §257, Subpart D, Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments, and being licensed in the state where the referenced CCR unit(s) is/are located, do hereby certify to the best of my knowledge, information, and belief, that the selected statistical method is appropriate for evaluating the groundwater monitoring data for Ameren Missouri's SCPC Surface Impoundment at the Sioux Energy Center in St. Charles County, Missouri in accordance with the requirements of 40 CFR §257.93.

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Qualified Professional Engineer's Signature

Date: October 6, 2017