November 2019 Project No. 153140601

COAL COMBUSTION RESIDUALS (CCR) RULE
STATISTICAL METHOD CERTIFICATION (40 CFR §257.98(C)(2) and §257.93(f)(6)) FOR CORRECTIVE ACTION

MERAMEC SURFACE IMPOUNDMENTS, MERAMEC ENERGY CENTER, ST. LOUIS COUNTY, MISSOURI

1.0 COAL COMBUSTION RULE (CCR RULE) REQUIREMENTS

This Statistical Method Certification (SMC) presents statistical procedures to be used for the Ameren Missouri (Ameren) Meramec Energy Center (Facility) in St. Louis County, Missouri. The facility manages coal combustion materials at several on-site surface impoundments known as the "Meramec Surface Impoundments". The following sections provide a description of the statistical method selected to evaluate the groundwater quality data at the Meramec Surface Impoundments for Corrective Action.

2.0 SUMMARY OF STATISTICAL PLAN

The selected statistical method for Meramec Energy Center's Surface Impoundments 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 in Corrective Action. The full statistical analysis plan is provided in the Corrective Action Groundwater Monitoring Plan for this CCR unit. The statistical evaluation techniques described herein are to be used for Corrective Action. Detection and Assessment monitoring statistical methods are outlined in the Groundwater Monitoring Plan for this CCR Unit.

2.1 Statistical Methodology

2.1.1 Outlier Testing

Just as in Detection and Assessment Monitoring, 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 normality of the data set, so that more conservative statistical limits are generated.

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 “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. Additional description of the Double Quantification Rule is provided in the Groundwater Monitoring Plan for this CCR Unit.

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 are 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 are non-normally distributed, non-parametric statistical techniques will be used. Data distribution will be evaluated using the Shapiro-Wilk/Shapiro-Francia testing methods for this CCR Unit.

2.1.4 Corrective Action Monitoring

The statistical testing method used to evaluate the Corrective Action monitoring data will be the confidence interval method, which is the same method used during Assessment Monitoring, except the null hypothesis for the confidence intervals is reversed. For Corrective Action, the Unified Guidance states that the appropriate null hypothesis is that the groundwater population (mean) exceeds the GWPS for those constituents that exceed the GWPS under Assessment Monitoring program. Therefore, in Corrective Action the Upper Confidence Limit (UCL) is compared to the Groundwater Protection Standard (GWPS) instead of the Lower Confidence Limit (LCL) [as was used during Assessment Monitoring].

Additionally, as in Detection and Assessment monitoring for this CCR unit, an interwell approach will be used during Corrective Action – meaning that data from downgradient wells will be compared to compliance limits that are based on background groundwater quality data from hydraulically upgradient locations. Initially, the ground water protection standards (GWPSs) that were calculated in Assessment Monitoring will be used for the Corrective Action monitoring program. However, the GWPS may be updated in the future as more background data becomes available. If the GWPS is updated, the same procedure that was used during Assessment Monitoring will be applied for establishing a GWPS.

Results from the downgradient monitoring wells will be evaluated by comparing the calculated upper confidence limit (UCL) to the GWPS for each analyte at each well. If the UCL exceeds the GWPS, the constituent is still present at a concentration that is statistically above the GWPS; however, if the UCL is less than the GWPS, the constituent's concentration is considered to be below the GWPS. If the UCL for each analyte in a well is lower than the GWPS for three consecutive years, then the monitoring well is considered to be in full compliance and may be removed from the network. The Corrective Action Program will be deemed complete once all points within the plume beyond the Detection/Assessment Monitoring well system are statistically within compliance of the GWPS for three consecutive years. Once this demonstration can be made, a notification stating that the remedy has been completed is required to be posted to the operating record and the publicly available website. This notification must be certified by a Professional Engineer.

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 Corrective Action groundwater monitoring data for Ameren Missouri's Meramec Surface Impoundments at the Meramec Energy Center in St. Louis County, Missouri in accordance with the requirements of 40 CFR §257.98(c)(2) and §257.93(f)(6).

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Qualified Professional Engineer's Signature

Date: November 27, 2019