# Statistical Methods Certification

## Roy S. Nelson Generating Plant
## Westlake, Louisiana

**October 2017**

*Prepared For*
*Entergy Louisiana, LLC*

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# Section 1
# Regulatory Requirement

The Environmental Protection Agency's (EPA) "Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule" (40 C.F.R. Part 257 and Part 261) requires pursuant to § 257.93(f), the owner or operator of an existing coal combustion residual (CCR) unit must select one of the statistical methods specified in 40 C.F.R. § 257.93(f)(1) through 40 C.F.R. § 257.93(f)(5) to evaluate groundwater monitoring data for each specified constituent. 40 C.F.R. § 257.93(f)(6) requires the owner or operator to obtain a certification from a qualified professional engineer stating the selected statistical method is appropriate for evaluating the groundwater monitoring data for the CCR management area.

# Section 2
# Statistical Method Narrative

Statistical evaluations of groundwater monitoring data for the permitted CCR facilities will be performed using a method specified in 40 C.F.R § 257.93(f). These statistical evaluations will be conducted in accordance with the performance criteria outlined in the applicable portions of 40 C.F.R. §275.93(g) and the Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Unified Guidance (U.S. Environmental Protection Agency, March, 2009). The number of samples collected, the frequency of collection, and the management of non-detect data will be consistent with the statistical method selected. The data set to be considered in the statistical analysis will consist of data generated from the implementation of the CCR groundwater monitoring program.

The goal of the statistical evaluation is to determine if there is statistically significant evidence to show that facility operations may have adversely affected groundwater quality downgradient of the CCR units. As shown in the decision logic flowchart for detection monitoring (Figure 1), an evaluation of groundwater flow and upgradient well data will be performed first before determining which statistical evaluation method will be selected. If the background wells are not impacted by a release from any CCR unit and have groundwater quality statistically similar to downgradient wells (assuming no impacts from the CCR units in the downgradient wells), then interwell statistical evaluation will be performed. If the initial sampling results indicate that background groundwater is statistically dissimilar to downgradient groundwater, then intrawell statistical evaluation will be performed. These techniques are discussed below.

- Interwell statistical evaluations involve an upgradient/downgradient comparison to determine if there are any statistically significant increases (SSIs) between groundwater quality upgradient and groundwater quality downgradient of the CCR units. Interwell prediction limits will be constructed from the upgradient well data and based on the distribution of that data for each parameter. If the assumption of normality is not rejected for the upgradient data set, then a parametric prediction limit will be calculated. If the assumption of normality is rejected for the upgradient data set, then a non-parametric prediction limit will be calculated, in which case, the prediction limit will be based on the highest value in the upgradient data set. The most recent result for each downgradient well for each parameter will be compared to the applicable prediction limit.

- Intrawell statistical evaluations are comparisons of past and present data within an individual well. In the case of intrawell prediction limits, historical data from within a given well for a given parameter will be used to construct a limit. Compliance points will be compared to the limit to determine whether a change is occurring on a per-well/per-parameter basis. If the assumption of normality is not rejected for the background data set, then a parametric prediction limit will be calculated. If the assumption of normality is rejected for the background data set, then a non-parametric prediction limit will be calculated, in which case, the prediction limit will be based on the highest value in the background data set. For pH both upper and lower prediction limits will be used for intrawell evaluations.

Intrawell limit-based tests are recommended when there is evidence of natural spatial variability in groundwater quality, particularly among unimpacted upgradient wells, as it is inappropriate to pool those data across wells for the purpose of creating interwell limits for comparison with downgradient well data. Intrawell tests may be used at both new and existing facilities. Data used in intrawell limit-based tests will be screened for outliers, which, if found, will be removed from the background data set prior to constructing limits for each well/parameter pair.

An integral part of using prediction limits for statistical evaluation of groundwater data is the selection of a verification resampling strategy. For the Roy S. Nelson Plant Coal Ash Disposal Landfill site, a 1 of 2 verification resampling strategy will be used to lower the site-wide false positive rate (SWFPR). Verification resampling is mathematically incorporated into the prediction limit calculations, which improves statistical power while maintaining the SWFPR. In the event that intrawell statistical evaluations are performed, verification resampling for SSIs will only be conducted for SSIs calculated in downgradient wells. Intrawell statistics will be performed on all wells; however, since the goal of the statistical evaluation is to determine if there is statistically significant evidence to show that facility operations may have adversely affected groundwater quality downgradient of the CCR units, only downgradient wells will be subject to verification resampling.

In the event that SSIs are calculated, verification resampling will be conducted for the appropriate well/parameter pairs. If SSIs are confirmed through verification resampling, the timelines listed in 40 C.F.R. § 257.94(e) will be followed.

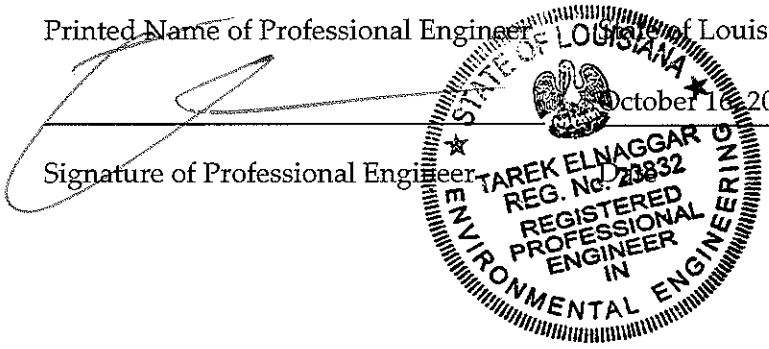
# Section 3
# Certification

I, the undersigned Louisiana Professional Engineer, hereby certify that I am familiar with the technical requirements of 40 C.F.R. § 257.93. I also certify that it is my professional opinion that, to the best of my knowledge, information, and belief, the statistical methods described herein are appropriate for evaluating the ground water monitoring data and are in accordance with current good and accepted engineering practice(s) and standard(s) appropriate to the nature of the project and the technical requirements of 40 C.F.R. § 257.93.

For the purpose of this document, "certify" and "certification" shall be interpreted and construed to be a "statement of professional opinion". The certification is understood and intended to be an expression of my professional opinion as an Louisiana Licensed Professional Engineer, based upon knowledge, information, and belief. The statement(s) of professional opinion are not and shall not be interpreted or construed to be a guarantee or a warranty of the monitoring system.

Tarek Elnaggar — 23832

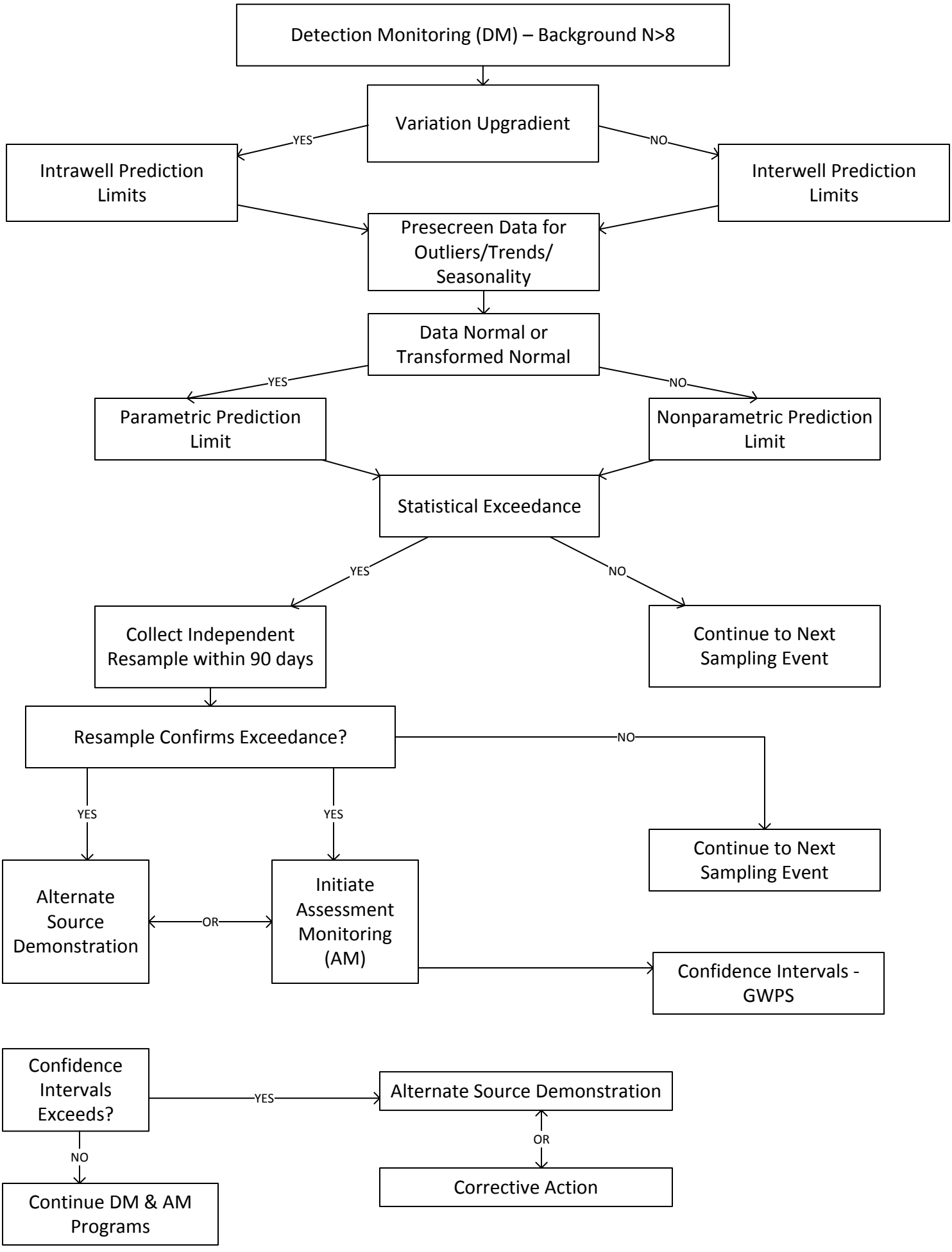
Printed Name of Professional Engineer — State of Louisiana License Number




October 16, 2017

Signature of Professional Engineer

# Figure 1


Detection Monitoring (DM) – Background N>8
Variation Upgradient
YES
NO
Intrawell Prediction Limits
Interwell Prediction Limits
Presecreen Data for Outliers/Trends/ Seasonality
Data Normal or Transformed Normal
YES
NO
Parametric Prediction Limit
Nonparametric Prediction Limit
Statistical Exceedance
YES
NO
Collect Independent Resample within 90 days
Continue to Next Sampling Event
Resample Confirms Exceedance?
NO
YES
YES
Continue to Next Sampling Event
Alternate Source Demonstration
OR
Initiate Assessment Monitoring (AM)
Confidence Intervals - GWPS
Confidence Intervals Exceeds?
YES
Alternate Source Demonstration
OR
NO
Corrective Action
Continue DM & AM Programs