Big Rivers Electric Corporation
Disposal of Coal Combustion Residuals (CCR) from Electric Utilities Final Rule
CCR Impoundment Groundwater Monitoring System and Statistical Methods
Assessment and Certification

CCR Surface Impoundment Information

Name:	Reid/HMPL Station CCR Surface Impoundment
Operator:	Sebree Generating Station
Address:	9000 Highway 2096 Robards, Kentucky 42452

Qualified Professional Engineer

Name:	David A. Lamb
Company:	Associated Engineers, Inc.
Kentucky P.E. Number:	17822

Regulatory Applicability

Per 40 CFR § 257.90, § 257.91 and § 257.93

Groundwater Monitoring and Corrective Action

§ 257.90 Applicability.

(a) Except as provided for in § 257.100 for inactive CCR surface impoundments, all CCR landfills, CCR surface impoundments, and lateral expansions of CCR units are subject to the groundwater monitoring and corrective action requirements under § 257.90 through § 257.98.

(b) Initial timeframes - (1) Existing CCR landfills and existing CCR surface impoundments. No later than October 17, 2017, the owner or operator of the CCR unit must be in compliance with the following groundwater monitoring requirements:

i. Install the groundwater monitoring system as required by § 257.91;

ii. Develop the groundwater sampling and analysis program to include selection of the statistical procedures to be used for evaluating groundwater monitoring data as required by § 257.93;

iii. Initiate the detection monitoring program to include obtaining a minimum of eight independent samples for each background and downgradient well as required by § 257.94(b); and

iv. Begin evaluating the groundwater monitoring data for statistically significant increases over background levels for the constituents listed in appendix III of this part as required by § 257.94.

§ 257.91 Groundwater monitoring systems.

(f) The owner or operator must obtain a certification from a qualified professional engineer stating that the groundwater monitoring system has been designed and constructed to meet the requirements of this section. If the groundwater monitoring system includes the minimum number of monitoring wells specified in paragraph (c)(1) of this section, the certification must document the basis supporting this determination.

§ 257.93 Groundwater sampling and analysis requirements.

(f) The owner or operator of the CCR unit must select one of the statistical methods specified in paragraphs (f)(1) through (5) of this section to be used in evaluating groundwater monitoring data for each specified constituent. The statistical test chosen shall be conducted separately for each constituent in each monitoring well.

(6) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the selected statistical method is appropriate for evaluating the groundwater monitoring data for the CCR management area. The certification must include a narrative description of the statistical method selected to evaluate the groundwater monitoring data.

Groundwater Monitoring System Assessment

For existing CCR surface impoundments, the owner or operator of the CCR unit must:

- Install the groundwater monitoring system consisting of at least one up-gradient and three down-gradient monitoring wells; as described under applicable groundwater monitoring systems sections of the rule;

- Develop the groundwater sampling and analysis program to include selection of the statistical procedures to be used for evaluating groundwater monitoring data as required by the rule and described under the Groundwater sampling and analysis requirements section;

- Initiate the detection monitoring program to include obtaining a minimum of eight independent samples for each background and down-gradient well as required by the rule and described under the detection monitoring program section; and

- Begin evaluating the groundwater monitoring data for statistically significant increases over background levels for the constituents listed in the rule.

The Reid/HMPL CCR surface impoundment is a combined incised/dike earthen embankment structure. It is diked on the west, south and east sides, while the north side is incised. The west dike has the greatest height reaching approximately 42 feet. The original terrain on which the pond was constructed generally sloped toward the west.

The stratigraphic interval considered as the most prominent water transmitting zone within and adjacent to the Sebree Generating Station is considered to be the Upper Sandstone Member (Sebree sandstone) of the Carbondale Formation. The U.S.G.S. Geologic Map of the Robards Quadrangle describes the Sebree sandstone sequence as "Siltstone, sandstone, shale and coal: Siltstone, light- to medium-gray, micaceous, thin-bedded, locally calcareous. Sandstone, light- to medium-gray, grayish- and yellowish-brown, fine- to medium-grained slightly micaceous, thin-bedded to massive; locally fills channels." For purposes of compliance with the USEPA Disposal of Coal Combustion Residuals (CCR) from Electric Utilities; Final Rule groundwater monitoring requirements; this sequence, and in particular the member sandstone intervals, is considered to be the uppermost aquifer underlying the Reid/HMPL CCR surface impoundment.

Five temporary piezometers (P-13/P-13A, P-14 and P-15/P-15A) were installed adjacent to and respectively; northwest, southeast and southwest of the Reid/HMPL CCR impoundment to determine general direction of groundwater movement. Measured static water levels, from the highest to lowest elevation were observed in P-13/13A (highest), P-14 and P-15/P-15A (lowest) resulting in a calculated hydraulic gradient or apparent direction of groundwater movement is generally from east-northeast to west-southwest. This groundwater gradient characterization and the ability to locate monitoring wells specific to the CCR unit justify the placement of the minimum of one up-gradient and three down-gradient monitoring wells. The up-gradient monitoring well (M-7) was installed adjacent to, and east-northeast of the impoundment. The down-gradient monitoring wells (M-8, M-9 and M-10) were installed adjacent to, and respectively; west, southwest and south-southwest of the impoundment. All monitoring wells are completed in the stratigraphic interval described above. Approximate locations of the groundwater monitoring wells are shown on the Groundwater Monitoring Well Location Aerial Photo.

Statistical Methods Assessment

For existing CCR surface impoundments, any statistical method chosen shall comply with the following performance standards, based on the statistical test method used:

- The statistical method used to evaluate groundwater monitoring data shall be appropriate for the distribution of constituents. Normal distributions of data values shall use parametric methods. Non-normal distributions shall use non-parametric methods.

- If an individual well comparison procedure is used to compare an individual compliance well constituent concentration with background constituent concentrations or a groundwater protection standard, the test shall be done at a Type I error level no less than 0.01 for each testing period. If a multiple comparison procedure is used, the Type I experiment wise error rate for each testing period shall be no less than 0.05.

- If a control chart approach is used to evaluate groundwater monitoring data, the specific type of control chart and its associated parameter values shall be such that this approach is at least as effective as any other approach in this section for evaluating groundwater data.

- If a tolerance interval or a predictional interval is used to evaluate groundwater monitoring data, the levels of confidence and, for tolerance intervals, the percentage of the population that the interval must contain, shall be such that this approach is at least as effective as any other approach in this section for evaluating groundwater data.

- The statistical method must account for data below the limit of detection with one or more statistical procedures that shall be at least as effective as any other approach in this section for evaluating groundwater data.

- If necessary, the statistical method must include procedures to control or correct for seasonal and spatial variability as well as temporal correlation in the data.

Big Rivers Electric Corporation utilizes a comprehensive statistical methods computer program called DUMPStat 2.1.8 (groundwater detection monitoring statistics) developed by Robert D. Gibbons Ltd. And Discerning Systems Inc. (Copyright 2003). The program user's guide provides the following description:

> "In the context of groundwater monitoring at waste disposal facilities, legislation has required statistical methods as the basis for investigating potential environmental impact due to waste disposal facility operation. Owner/Operators must perform a statistical analysis on a quarterly or semi-annual basis. A statistical test is performed on each of many constituents (i.e. 10 to 50) for each of many wells (5 to 100 or more). The result is potentially hundreds, and in some cases, a thousand or more statistical comparisons performed on each monitoring event. Even if the false positive rate for a single test is small (e.g. 1%), the possibility of failing at least one test on any monitoring event is virtually guaranteed. This assumes you have used the correct statistic in the first place.
>
> DUMPStat is an easy-to-learn system for performing state-of- the-art statistical groundwater monitoring analyses. Its statistical procedures balance

both false positive and false negative rates for the entire facility; and it offers complete consistency with USEPA Subtitle C and D regulations, all USEPA guidance, and ASTM D6312-98 guidance.

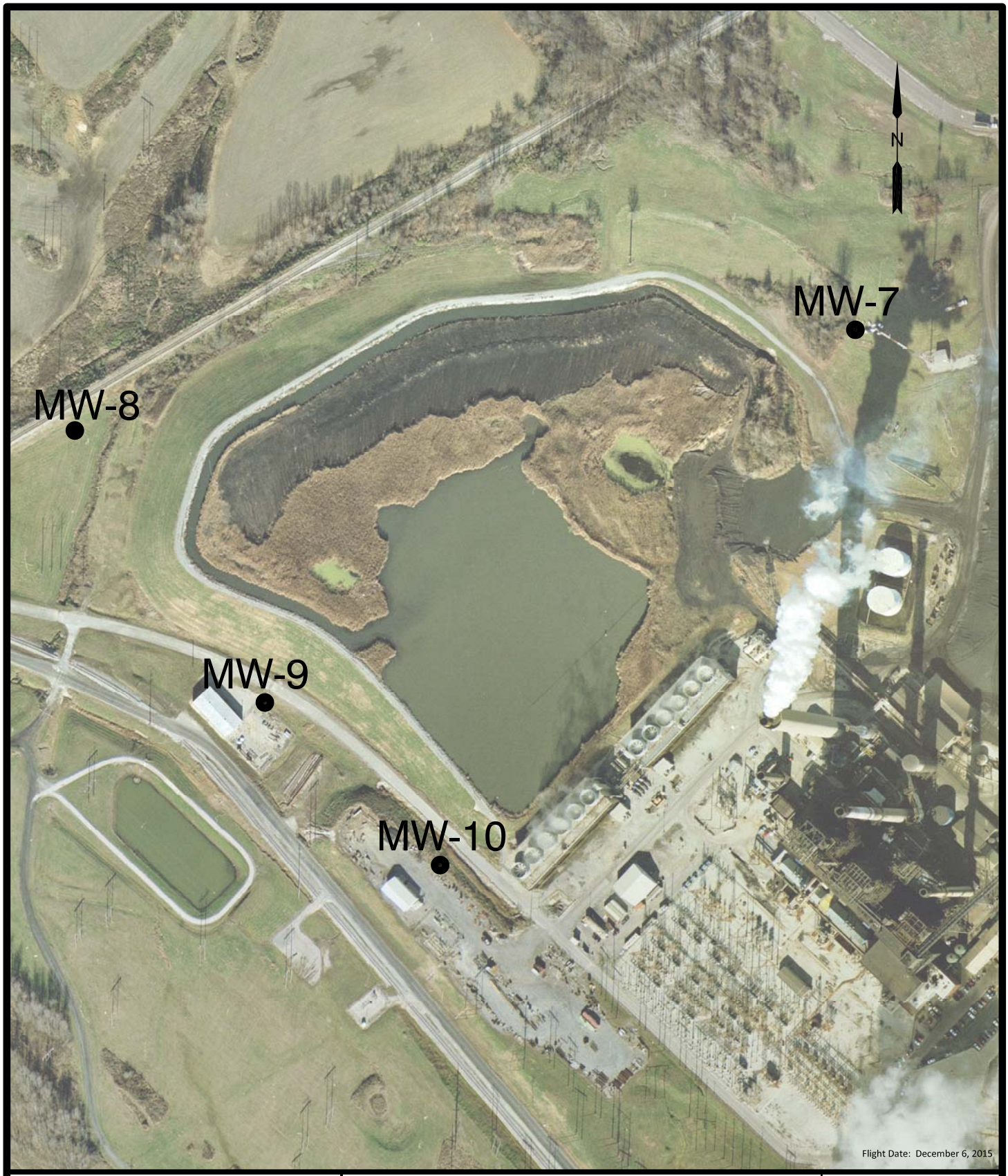
When you use DUMPStat, you will find that data sets in most formats and of any size are easily imported into the program. The well network is defined by simple 'point and click' techniques, and then analyses can be performed at the touch of a single button. DUMPStat automatically performs upgradient versus downgradient or intra-well comparisons, and provides results in both graphical and tabular formats showing all intermediate calculations. Appropriate prediction limits, distribution testing, treatment of nondetects, trend analysis and outlier detection are automatically generated by the program. In addition, DUMPStat also performs such analyses as VOC detections, time series, data summaries, and surface water and air monitoring.

As you will discover, the most appropriate statistics for your site are automatically selected, avoiding those USEPA-approved methods that result in excessive false positive and false negative rates. DUMPStat helps quickly and easily eliminate costly site assessments due to common misapplication of statistical methods to groundwater monitoring data."

DUMPStat 2.1.8 is currently utilized by Big Rivers Electric Corporation to analyze data as required by its Kentucky Division of Waste Management Special Waste Landfill permits (see below) and is considered consistent with § 257.93 requirements.

- The owner or operator shall conduct statistical analysis of the groundwater data in accordance with 401 KAR 45:160 Section 6 and the approved applications. The statistical test chosen shall be conducted separately for each parameter in each well for each monitoring event. The results shall be maintained as part of the facility record throughout the operating and postclosure life of the facility. [401 KAR 45:160 Section 6, 401 KAR 45:140 Section 1(1)]

- The groundwater analytical data and statistical analysis shall be submitted on forms provided by the cabinet, within sixty (60) days after sampling or 15 days of the completion of statistical analysis, whichever is sooner. [401 KAR45:160 Section 4]



Big Rivers Electric Corporation

Sebree Generating Station: Reid/HMPL Station
CCR Surface Impoundment
Groundwater Monitoring Well Locations

Job Number:	16-0089
Date:	5/16/2016
Scale:	NOT TO SCALE
Drawn By:	AEI

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Reid/HMPL Station CCR Impoundment
Groundwater Monitoring System and Statistical Methods
Professional Engineer Certification [Per 40 CFR §257.91 and §257.93]

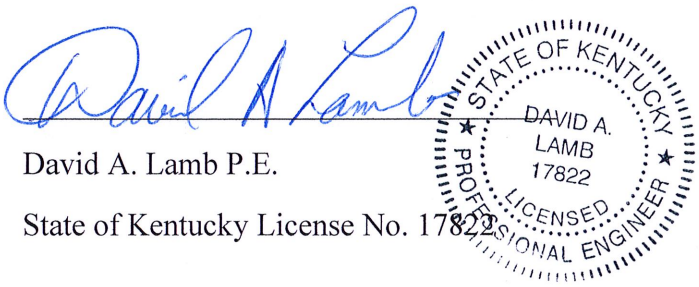
I hereby certify that myself or an agent under my review has prepared this Groundwater Monitoring System and Statistical Method Assessment and being familiar with the provisions of the final rule to regulate the disposal of coal combustion residuals (CCR) as solid waste under subtitle D of the Resource Conservation and Recovery Act (RCRA), attest that:

- The Groundwater Monitoring System meets the requirements of § 257.91 as specified below:

  (f) The owner or operator must obtain a certification from a qualified professional engineer stating that the groundwater monitoring system has been designed and constructed to meet the requirements of this section. If the groundwater monitoring system includes the minimum number of monitoring wells specified in paragraph (c)(1) of this section, the certification must document the basis supporting this determination.

- The Statistical Method meets the requirements of § 257.93 as specified below:

  (f)(6) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the selected statistical method is appropriate for evaluating the groundwater monitoring data for the CCR management area. The certification must include a narrative description of the statistical method selected to evaluate the groundwater monitoring data.



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Date: 6/28/2016