1/6/2012

Todd Tolbert
Alternate Designated Representative
Associated Electric Cooperative, Inc.
New Madrid Plant
2814 S. Golden
P.O. Box 754
Springfield, MO 65801-0754

Re: Petition for Approval of Alternative Data Substitution Methodology for Unit 1 at the New Madrid Power Plant (Facility ID (ORISPL) 2167)

Dear Mr. Tolbert:

The United States Environmental Protection Agency (EPA) has reviewed the September 7, 2011 petition submitted under 40 CFR 75.66(a) by Associated Electric Cooperative, Inc. (AECI), in which AECI requested approval to use an alternative data substitution methodology for Unit 1 at the New Madrid Power Plant, to replace certain hourly sulfur dioxide (SO_2), nitrogen oxides (NO_x), and carbon dioxide (CO_2) concentration values recorded during the 2nd and 3rd quarters of 2011. EPA approves the petition, with conditions, as discussed below.

Background

AECI owns and operates the New Madrid Power Plant (New Madrid), which is located in New Madrid County, Missouri. New Madrid Unit 1 is a coal-fired cyclone boiler. According to AECI, Unit 1 is subject to the Acid Rain Program and the Clean Air Interstate Rule (CAIR) SO_2 and NO_x Trading Programs. Therefore, AECI is required to monitor and report SO_2, NO_x, and CO_2 emissions and heat input for Unit 1 in accordance with 40 CFR Part 75. To meet the monitoring requirements of Part 75, AECI has installed and certified dilution-extractive continuous emission monitoring system (CEMS).

On May 30, 2011, AECI personnel applied EPA's Control Chart Methodology[1] to the data recorded by the CO_2 CEMS and discovered that the CO_2 concentrations were abnormally low, indicating a possible probe leak. Upon investigation, AECI determined that the internal components of the CEMS probe were at fault. AECI replaced the probe on July 13, 2011 and the CO_2 readings returned to normal.

[1] A detailed description of this methodology, which assesses CO_2 concentration as a function of unit load, is found on the Clean Air Markets Division web site, at the following address: http://www.epa.gov/airmarkets/emissions/other.html

According to AECI, the SO_2, CO_2, and NO_x concentration data recorded by the CEMS in the time period extending from May 30 through July 13, 2011 are suspect, due to the probe leak. In an attempt to quantify the magnitude of the leak, AECI used the Control Chart Methodology to analyze the CEMS data recorded during that time period, focusing on the CO_2 concentration in a representative load range. CO_2 data were chosen for the analysis because CO_2 concentration has a relatively low variability in a given load range, unlike SO_2 and NO_x, which are affected by fuel variability or other factors in the combustion process. Therefore, observed changes in CO_2 concentration can be used to derive an appropriate bias correction factor when a uniform bias is detected.

AECI's analysis compared the CO_2 data recorded during the probe leak incident to a 30 day baseline period of quality-assured CO_2 data collected immediately after the most recent CO_2 relative accuracy test audit (RATA). To eliminate operational variation, the analysis focused on the load bin at which the unit was most often operated during the probe leak period (i.e., load bin 10). The CO_2 concentrations in load bin 10 were averaged arithmetically and the standard deviation from the mean value was calculated, resulting in a baseline concentration of 14.24% CO_2 and a standard deviation of 0.16 % CO_2.

When the CO_2 data recorded in load bin 10 between May 30 and July 13, 2011 were graphed and compared to the baseline data, two distinct periods of uniform low bias were observed, i.e., one from May 30 through June 5, 2011, and the other from June 6 through July 13, 2011. AECI averaged the CO_2 concentrations in load bin 10 for these two time periods. A base correction factor was calculated for each time period by dividing the baseline average CO_2 value by the arithmetic average of the CO_2 concentrations during that time period. To account for the uncertainty of the calculated correction factor and any additional variability caused by the probe leak, AECI calculated the standard deviation from the mean during each biased period and used that value in combination with the standard deviation for the baseline data to determine an overall uncertainty for the calculated correction factor. This uncertainty was then added to the base correction factor to derive a final correction factor, in order to ensure that the corrections are conservative and that the corrected data will be reasonably overstated. The following formula demonstrates how the final correction factors were determined.[2]

$$CF = \frac{x \pm dx}{y \pm dy} = \frac{x}{y}\left(1 \pm \sqrt{\left(\frac{dx}{x}\right)^2 + \left(\frac{dy}{y}\right)^2}\right)$$

Where:

CF = Correction factor for the low-biased period;
x = Average baseline CO_2 concentration value (14.24% CO_2);

[2] Note that the uncertainty of a quotient is equal to the square root of the sum of squared fractional uncertainties for the individual input values times the quotient result. See, e.g., John R. Taylor, An Introduction to Error Analysis at 56-57 (1982).

dx = Standard deviation of the baseline CO_2 concentration values (0.16% CO_2);
y = Average CO_2 concentration value during the biased period; and
dy = Standard deviation of the CO_2 concentration values during the biased period.

Table 1a below summarizes the results of AECI's analysis:

Table 1a: Derivation of Correction Factors (AECI)

Biased Time Period in 2011	May 30 through June 5	June 6 through July 13
Average baseline CO_2, *x*	14.24% CO_2	14.24% CO_2
Standard deviation of baseline, *dx*	0.16% CO_2	0.16% CO_2
Lower control limit, $x - 3dx$	13.77% CO_2	13.77% CO_2
Upper control limit, $x + 3dx$	14.71% CO_2	14.71% CO_2
Average biased CO_2, *y*	13.58% CO_2	12.12% CO_2
Standard deviation of biased data, *dy*	0.26% CO_2	0.34% CO_2
Base correction factor	1.049	1.175
Uncertainty	0.023	0.035
Final correction factor	**1.072**	**1.209**

In the September 7, 2011 petition, AECI requested permission to use the final correction factors shown in Table 1a to adjust the hourly SO_2, NO_x, and CO_2 concentration data recorded during the probe leak incident, instead of invalidating those data and using standard Part 75 missing data substitution. AECI provided EPA with a compact disc that included the hourly data that were used to derive the correction factors.

EPA's Determination

To evaluate the proposed correction factors, EPA applied the Control Chart Methodology to the data provided by AECI. EPA's analysis included only data from days on which at least 6 hours of quality-assured data were recorded in load bin 10. This ensures that the

data are representative because they reflect stable boiler operation and are not distorted by changes in CO_2 caused by increasing or decreasing load. For each day on which this criterion was met, the CO_2 concentrations were averaged. The daily average CO_2 concentrations were then averaged arithmetically, and the standard deviation of the daily averages from the mean was calculated.

The results of EPA's data analysis are presented in Table 1b, below. Note that the Agency's results are similar, but not identical, to those in Table 1a, due to differences in the way the data were analyzed. AECI's data analysis did not follow the Control Chart Methodology to the letter. For each time period, AECI averaged all of the hourly CO_2 data in load bin 10 arithmetically, rather than excluding days with fewer than 6 hours of CO_2 data in load bin 10 and calculating daily average CO_2 concentrations for the rest of the days. In view of this, the final correction factors in Table 1b are the approved values.

Table 1b: Derivation of Correction Factors (EPA)

Biased Time Period in 2011	May 30 through June 5	June 6 through July 13
Average baseline CO_2, x	14.23% CO_2	14.23% CO_2
Standard deviation of baseline, dx	0.11% CO_2	0.11% CO_2
Lower control limit, $x - 3dx$	13.91% CO_2	13.91% CO_2
Upper control limit, $x + 3dx$	14.56% CO_2	14.56% CO_2
Average biased CO_2, y	13.58% CO_2	12.11% CO_2
Standard deviation of biased data, dy	0.22% CO_2	0.25% CO_2
Base correction factor	1.048	1.175
Uncertainty	0.019	0.026
Final, approved correction factor	**1.067**	**1.201**

Ordinarily, for any unit operating hour in which quality-assured data are not obtained with a certified monitor, the standard missing data provisions in §§ 75.30 through 75.37 are used to determine appropriate substitute data values. Substitute data tends to overstate emissions,

particularly for very long missing data periods. Missing data substitution is designed to provide a conservative estimate of the actual emissions and to encourage sources to use good operation and maintenance (O & M) practices, to minimize monitoring system downtime.

However, in the case of New Madrid Unit 1, EPA finds that using standard Part 75 substitute data during the probe leak period grossly overstates the unit's emissions. As reflected in Tables 2a and 2b below, the use of standard missing data substitution in this case would result in reported emissions equaling about 122% of EPA's estimate of Unit 1's likely SO_2 mass emissions and 292% of the likely NO_x mass emissions during the probe leak period [3]. Applying the approved correction factors from Table 1b results in emissions estimates that are much more reasonable, yet still conservatively high[4].

Table 2a: Impact of Standard and Alternative Substitute Data on Reported SO_2 Mass Emissions for New Madrid Unit 1 (May 30 through July 13, 2011)

SO_2 Calculation Method	Total SO_2 Emissions (tons)
Unadjusted Data, as originally recorded	911
Estimate of likely actual emissions	1050
Standard Part 75 Missing Data Substitution	1280
Adjusted Data (using EPA-approved correction factors)	1072

[3] These estimates of the "likely emissions" were obtained by applying the appropriate base correction factor in Table 1b to the reported emissions each time period. These estimates assume that SO_2 and NO_x were underreported by the same percentage in each time period, but do not take into account the uncertainty of the averages used to calculate the factors.

[4] Note that, due to rounding issues, the adjusted emissions totals shown in Tables 2a and 2b are solely for purposes of illustration and may differ slightly from the values that will result from application of the data correction factors as approved by EPA in this letter.

Table 2b: Impact of Standard and Alternative Substitute Data on Reported NO_X Mass Emissions for New Madrid Unit 1 (May 30 through July 13, 2011)

NO_X Calculation Method	Total NO_X Emissions (tons)
Unadjusted Data, as originally recorded	256
Estimate of likely actual emissions	295
Standard Part 75 Missing Data Substitution	861
Adjusted Data (using EPA-approved correction factors)	302

In view of these considerations, EPA approves AECI's petition to make an upward adjustment of the SO_2, NO_x, and CO_2 emissions data recorded during the probe leak period, in lieu of using the standard Part 75 missing data routines.

Conditions of Approval

As conditions of this approval, AECI shall:

(1) Adjust the hourly SO_2, NO_x, and CO_2 concentration data recorded during the probe leak incident as follows. Multiply each recorded SO_2, NO_x, and CO_2 concentration value by the approved correction factor in each time period.

- From May 30 through June 5, 2011, a correction factor of 1.067 shall be applied.
- From June 6 through July 13, 2011, a correction factor of 1.201 shall be applied.

(2) Each adjusted hourly SO_2, NO_x, and CO_2 concentration shall be reported using a special method of determination code (MODC) of "53", which means "other quality assured methodology approved through petition." These hours must be included in missing data lookbacks and are treated as available hours for percent monitor data availability (PMA) calculations.

(3) Recalculate all hourly emission rate, heat input, and mass emissions values using the adjusted SO_2, NO_x, and CO_2 concentrations.

(4) Resubmit the 2nd and 3rd quarter 2011 electronic data reports (EDRs) for New Madrid Unit 1. Coordinate resubmission of the data with Mr. Craig Hillock, who may be reached at (202) 343-9105, or by e-mail at hillock.craig@epa.gov.

(5) Resolve any CAIR NO_x ozone season allowance accounting issues by contacting Mr. Kenon Smith, at (202) 343-9164, or by e-mail at smith.kenon@epa.gov.

EPA's determination relies on the accuracy and completeness of AECI's September 7, 2011 petition and the data provided in the accompanying compact disc, and is appealable under Part 78. If you have any questions regarding this correspondence, please contact Robert Vollaro at (202) 343-9116. Thank you for your continued cooperation.

Sincerely,

/s/
Richard Haeuber, Acting, Director
Clean Air Markets Division

cc: Jon Knodel, EPA Region VII
Peter Yronwode, Missouri DNR
Craig Hillock, CAMD
Kenon Smith, CAMD
Robert Vollaro, CAMD