February 2, 2009

Daniel F. Cole
Designated Representative
Ameren Services
One Ameren Plaza
1901 Chouteau Avenue
P.O. Box 66149
St. Louis, MO 63166-6149

Re: Petition to Use an Alternative to Standard Missing Data Substitution for Unit 1 at the Sioux Power Plant (Facility ID (ORISPL) 2107)

Dear Mr. Cole:

The United States Environmental Protection Agency (EPA) has reviewed the November 7, 2008 petition under 40 CFR 75.66, in which Ameren Services (Ameren) requested to use an alternative to the standard missing data substitution routines under 40 CFR 75.33 for Unit 1 at the Sioux, Missouri facility (Sioux). EPA approves the petition in part, with conditions, as discussed below.

Background

Ameren owns and operates a coal-fired boiler, Unit 1, at its Sioux Power Plant in West Alton, Missouri. Unit 1 is subject to the Acid Rain Program and to the NO_x Budget Trading Program. Therefore, Ameren is required to continuously monitor and report sulfur dioxide (SO_2), nitrogen oxides (NO_x) and carbon dioxide (CO_2) emissions and heat input for Unit 1, in accordance with 40 CFR Part 75. To meet these monitoring requirements, Ameren has installed and certified dilution extractive continuous emission monitoring systems (CEMS) for SO_2, NO_x, and CO_2, and a flow monitor.

The dilution extractive sample probe has an add-on probe heater. The annular space between the probe and the heater is sealed with an o-ring. If the o-ring is damaged or missing, ambient air is drawn into the probe and dilutes the gas samples. According to Ameren, a problem with this o-ring caused the measured gas concentrations at Sioux Unit 1 (most notably CO_2) to be lower than normal for an extended period of time, from June 23, 2008, hour 10 to August 19, 2008, hour 10. The low CO_2 readings were first noticed at the time of the scheduled annual relative accuracy test audit (RATA) of the gas monitors. The ambient air in-leakage was not suspected prior to the RATA. The gas monitors had been passing their required daily calibration error tests and linearity checks. During these tests, the probe is flooded with calibration gas under positive pressure, and there can be no air in-leakage. However, when stack gas is sampled, the system is under

a vacuum (negative pressure), and ambient air will enter the probe if a leak is present in the system.

In the November 7, 2008 petition, Ameren proposed to apply conservative adjustment factors to the data recorded by Unit 1's gas monitors between June 23, 2008 and August 19, 2008, rather than using standard Part 75 missing data substitution. Based on an analysis of emissions data from Sioux Unit 2 (the "sister" unit) during this time interval, Ameren concluded that the SO_2, and CO_2 data recorded by the Unit 1 CEMS during the probe leak period were 9.2 and 7.6 percent lower than expected, respectively. Therefore, Ameren proposed to adjust the SO_2 data upward by a factor of 1.122 (i.e., 1.092 plus 0.03) and to adjust the CO_2 data upward by a factor of 1.076. According to Ameren, the proposed SO_2 adjustment factor includes an additional 0.03, to ensure that emissions are not underreported. For NO_x, Ameren proposed to adjust the lb/mmBtu emission rates upward by a factor of only 1.03 because the low biases in the measured NO_x and CO_2 concentrations tend to cancel out when the NO_x emission rate is calculated.

According to Ameren, improvements are being made to its monitoring systems and facilities to prevent this type of problem from recurring. Elevators are being installed to facilitate access to the monitoring platform, which is expected to improve monitor operation and maintenance. Also, Ameren plans to provide additional training, for individuals involved in operating and maintaining the CEMS, aimed at providing a better understanding of the data generated by the monitoring systems.

EPA's Determination

EPA conditionally approves Ameren's petition to use an alternative to standard Part 75 missing data substitution to adjust Sioux Unit 1's reported emissions data in the time period extending from June 23, 2008, hour 10 to August 19, 2008, hour 10. However, the approved data adjustment factor differs from the correction factors proposed by Ameren. The basis for this approval and the conditions of approval are presented below.

As previously noted, Ameren based its proposed SO_2, NO_x, and CO_2 data adjustment factors on a comparison of data recorded during the probe leak period by the gas monitors on Units 1 and 2. However, this methodology can only provide a rough estimate of the effects of the probe leak on Unit 1's emissions data. Although Units 1 and 2 are similar and have the same design, it cannot be assumed that the emissions from the two units are the same at a given load level. For instance, although both units draw from the same coal pile, coal (even from the same mine) is not homogeneous in sulfur content, which can cause variation in SO_2 emissions. EPA therefore disapproves the data correction factors proposed by Ameren, and, for reasons stated below, approves instead a single adjustment factor of 1.149, to be applied uniformly to the hourly SO_2, NO_x, and CO_2 emissions data.

To assess the appropriateness of Ameren's proposed correction factor, EPA performed an analysis of CEMS data only from the unit whose emissions are at issue,

Unit 1, and focused on the CO_2 concentration at a representative load. The CO_2 data were selected for the analysis because of the relatively low variability of CO_2 concentration in a given load range, as compared to other parameters that vary more due to fuel variability or due to other factors in the combustion process. Therefore, differences in CO_2 concentration may be used to derive an appropriate bias correction factor when a uniform bias can be detected. EPA's analysis compared the low-biased CO_2 data recorded from June 23 to August 19, 2008 to a baseline period of quality-assured CO_2 concentration data collected following the most recent CO_2 RATA. To eliminate operational variation, EPA focused its analysis on the load bin for which the unit was most often operated during the evaluated period (i.e., load bin "9"). The baseline period (September 17 through October 16, 2007) was selected to give 30 days worth of data where at least six hours of quality-assured data per day were collected when the unit was operated within the desired load bin for the analysis. For each day where these criteria were met, the average CO_2 concentration for that load bin was calculated. Then the average daily average CO_2 concentration and standard deviation of the daily averages was calculated resulting in a baseline expected CO_2 concentration of 12.27 $\%CO_2$ with a standard deviation of 0.12 $\%CO_2$.

Next, EPA calculated daily average CO_2 concentrations in load bin 9, for each day in the period from June 23 through August 18, 2008. A base correction factor was calculated for this time period by dividing the baseline daily average CO_2 value by the daily average CO_2 concentration calculated for the biased period. To account for the uncertainty of the calculated correction factor and any additional variability caused by the leak, EPA calculated the standard deviation of the daily averages during the biased period and used that value in combination with the standard deviation calculated for the baseline data to calculate an overall uncertainty for the calculated correction factor. This uncertainty was then added to the base correction factor to derive the final correction factor, which ensures that the corrections are conservative and that the corrected data will be reasonably overstated. The following formula demonstrates how this calculation was made.[1]

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

Where;

CF = Correction factor to correct for the low bias during the in-leakage
x = Average baseline CO_2 concentration value
dx = Standard deviation of the baseline CO_2 concentration values
y = Average CO_2 concentration value during the biased period

[1] 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).

dy = Standard deviation of the CO_2 concentration value during the biased period

The correction factor was determined to be 1.149 for the probe leak period (see Table 1, below). This correction factor is higher than the correction factors that Ameren proposed. EPA could not identify two clearly distinct periods within the time period from June 23 to August 19, 2008 where different stable biases clearly existed and therefore is adopting a single correction factor in this instance. The same correction factors should be used for all three gases, SO_2, NO_x, and CO_2, because air in-leakage at the probe of a dilution-extractive CEMS lowers the concentrations of all components of a stack gas sample by an equal percentage.[2]

Table 1 – Derivation of Correction Factor

Probe Leak Period	Average %CO_2 During Leak Period	Standard Deviation (uncertainty)	Base Correction Needed	Base Correction Uncertainty	Final Correction Factor
6/ 23/08 to 8/19/08	11.04	± 0.35	1.112	± 0.037	1.149

Ordinarily, for any unit operating hour in which valid, quality-assured data are not obtained with a certified monitor, the standard missing data provisions in §75.33 would be used to determine the appropriate substitute data values to be reported. Substitute data tends to overstate emissions, particularly when the period of missing data is composed of a large number of consecutive hours. It is designed to provide a conservative estimate of the actual emissions and at the same time encourage good maintenance practices that increases data capture.

However, EPA finds that using standard substitute data in this case during the time period identified grossly overstates the unit's emissions. As discussed in detail below, use of standard substitute data in this case would result in reported emissions of about 176 % and 335 % of EPA's estimates of Unit 1's likely SO_2 and NO_x mass emissions, respectively[3].

Furthermore, the data analysis described above has demonstrated that there was a consistent, uni-directional bias in the data recorded by Unit 1's CEMS in the period extending from June 23 to August 19, 2008. As discussed in detail below, applying an adjustment factor of 1.149 to account for this uniform bias results in more reasonable emissions estimates. Correcting the emissions data in this manner will cause the

[2] The assumption of equal dilution of the three gases is based on the fact that the concentrations of SO_2, NO_x, and CO_2 in the in-leaked gas are insignificant.

[3] This estimate of the "likely emissions" was obtained by applying the base correction factor in Table 1, which assumes that SO_2, NO_x and CO_2 were all underreported by the same percentage in each time period but does not take into account the uncertainty of the averages used to calculate the factors.

previously-reported SO_2, NO_x, and CO_2 mass emissions for 2008 to increase. The increase in the reported SO_2 emissions affects compliance with the requirement to hold allowances covering SO_2 emissions for 2008 under the Acid Rain Program. The increase in NO_x mass emissions also affects compliance with the 2008 allowance holding requirement under the NO_x Budget Trading Program, because the probe leak occurred inside the ozone season. The increase in CO_2 mass emissions will have no significant effect since CO_2 has no emission limit at the present time.

Tables 2 and 3 below compare the unadjusted SO_2 and NO_x mass emissions during the probe leak period, as originally reported, to: (a) the estimated likely actual emissions; (b) the SO_2 and NO_x mass emissions that would be reported using standard Part 75 missing data substitution; (c) the emissions that would be reported using Ameren's proposed data adjustment factors; and (d) the emissions that would be reported using the approved data adjustment factor of 1.149.

Table 2: Impact of Standard and Alternative Missing Data on Reported SO_2 Emissions During Probe Leak

SO_2 Calculation Method	**Total SO_2 Emissions (tons)**
Unadjusted data, as originally reported	3,952
Adjusted data (estimate of likely actual emissions)	4,394
Standard Part 75 missing data substitution	7,716
Adjusted data using Ameren's proposed factor	4,434
Adjusted data using EPA-approved factor	4,540

Table 3: Impact of Standard and Alternative Missing Data on Reported NO_x Emissions During Probe Leak

NO_x Calculation Method	**Total NO_x Emissions (tons)**
Unadjusted data, as originally reported	474
Adjusted data (estimate of likely actual emissions)	527
Standard Part 75 missing data substitution	1,763
Adjusted data using Ameren's proposed factor	525
Adjusted data using EPA-approved factor	545

The second lines in Tables 2 and 3 show that EPA's estimates of Unit 1's likely actual SO_2 and NO_x emissions during the probe leak period are 4,394 and 527 tons,

respectively[4]. From this it is clear that using standard Part 75 missing data substitution would grossly overstate the emissions, i.e., overstate SO_2 and NO_x mass emissions by more than 3,300 tons (176%) and 1,200 tons (335%), respectively. The fifth lines in the tables show that applying the approved 1.149 data adjustment factor gives a more reasonable, yet conservatively high, estimate of the emissions, and is estimated to require Ameren to surrender 588 additional SO_2 allowances and 71 additional NO_x allowances[5]. This is consistent with the purposes of the Part 75 standard missing data substitution procedures, which are to ensure that emissions are not underreported and to provide strong incentive for owners and operators to ensure that monitoring systems are properly operated and maintained.

For the reasons discussed above, EPA approves Ameren=s petition to make an upward adjustment of the SO_2, NO_x, and CO_2 emissions data recorded during the probe leak incident, in lieu of using the standard Part 75 missing data routines.

Conditions of Approval

The conditions of this approval are as follows:

(1) Ameren shall resubmit the second, third, and fourth quarter 2008 electronic data reports (EDRs) for Sioux Unit 1, no later than February 15, 2009.

(2) For the time period extending from June 23, 2008, hour 10 to August 19, 2008, hour 10, Ameren shall report alternative quality-assured values for SO_2 concentration, NO_x concentration, and CO_2 concentration, as follows:

(a) Each value of SO_2 concentration originally reported as quality-assured in column 29 of EDR record type (RT) 200 shall be adjusted upward by the approved data correction factor of 1.149;

(b) Each NO_x concentration value originally reported as quality-assured in column 24 of RT 201 shall be multiplied by 1.149;

[4] This estimate was obtained by applying a data correction factor of 1.112 to each hour of the originally-reported emissions data. This correction factor, which approximates the amount by which air in-leakage lowered the gas concentrations, was determined by dividing the average baseline CO_2 concentration by the average CO_2 concentration during the probe leak period. The approved (more conservative) data correction factor of 1.149 takes into consideration the uncertainty of those two average CO_2 concentrations.

[5] The SO_2 and NO_x mass emissions totals in the fifth lines of Tables 2 and 3 are only estimates. The actual number of allowances that must be surrendered may be slightly different, due to adjustment of previously-reported substitute data values during the probe leak incident (see “Conditions of Approval”).

(c) Each CO_2 concentration value originally reported as quality-assured in column 24 of RT 202 and in column 24 of RT 210 shall be multiplied by 1.149; and

(d) Ameren shall report a Method of Determination Code (MODC) of "53" in the appropriate columns of RTs 200, 201, 202, and 210, and 320 for each hourly SO_2, NO_x, and CO_2 concentration originally reported with a MODC of "01", to which the approved data correction factor is applied, and for each NO_x emission rate calculated from the adjusted NO_x and CO_2 concentrations.

(e) For hours originally reported with missing data MODC codes (e.g., "06", "09", "10", or "11"), these codes shall be retained. However, the substitute data values for these hours shall be recalculated by the DAHS (see Condition (4), below).

(3) The adjusted hourly SO_2, NO_x, and CO_2 concentrations and NO_x emission rates reported with a MODC of 53 shall:

(a) Be treated as quality-assured data;

(b) Be used in missing data lookbacks; and

(c) Not lower the percent monitor data availability (PMA) of the CEM systems.

(4) The data acquisition and handling system shall recalculate the substitute data values for all missing data hours during the probe leak period. Unadjusted, quality-assured data with MODC code "01" and adjusted, quality-assured data with MODC code "53" shall be used, as appropriate, to determine the substitute data values.

(5) Ameren shall include EDR record type 910 in each of the resubmitted EDRs for Sioux Unit 1. Each RT 910 shall indicate the period(s) of time for which the emissions data have been adjusted in accordance with this approval.

(6) Ameren shall coordinate resubmission of the EDRs with Mr. Craig Hillock, who may be reached at (202) 343-9105, or by e-mail at hillock.craig@epa.gov

(7) Ameren shall address the SO_2 and NO_x allowance accounting issues for Sioux Unit 1 with Mr. Kenon Smith, who may be reached at (202) 343-9164, or by e-mail at smith.kenon@epa.gov

EPA's determination relies on the accuracy and completeness of the information provided by Ameren in the November 7, 2008 petition and is appealable under Part 78. If you have any questions or concerns about this determination, please contact Robert Vollaro at (202) 343-9116, or by e-mail at vollaro.robert@epa.gov. Thank you for your continued cooperation.

Sincerely,

/s/
Sam Napolitano, Director
Clean Air Markets Division

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