June 2, 2009

Ms. Mary Jo Roth
Designated Representative
Great River Energy
12300 Elm Creek Boulevard
Maple Grove, MN 55369-4718

Re: Approval of the Predictive Emission Monitoring System Installed on Unit 2 at Great River Energy's Cambridge Station (Facility ID (ORISPL) 2038)

Dear Ms. Roth:

The United States Environmental Protection Agency (EPA) has reviewed the June 26, 2008 petition and supplementary information submitted by Great River Energy (GRE) under §75.66(d) and 40 CFR Part 75, Subpart E, in which GRE requested approval of a predictive emission monitoring system (PEMS) to continuously monitor nitrogen oxides (NO_x) emissions from Unit 2 at its Cambridge Station. EPA approves the petition, for the reasons, and with the terms and conditions, stated below.

Background

GRE owns and operates a 176 MW natural gas-fired simple-cycle combustion turbine, Unit 2, at its Cambridge Station in Cambridge, Minnesota. Unit 2 commenced operation on May 3, 2007, and is equipped with a dry-low-NO_x (DLN) combustion design to significantly reduce NO_x emissions.

Unit 2 is subject to the Acid Rain Program and to the Clean Air Interstate Rule (CAIR). Therefore, GRE 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 this unit in accordance with 40 CFR Part 75. To meet the NO_x monitoring requirements of Part 75, GRE installed and certified a NO_x emission rate continuous emission monitoring system (CEMS) on the unit in May 2007. However, GRE intended for the NO_x CEMS to serve only as a temporary monitoring method and planned to replace it with a PEMS.

To obtain EPA approval of an alternative monitoring system (AMS) such as a PEMS, the owner or operator must demonstrate that the AMS provides NO_x emission measurements of comparable precision and reliability to measurements made with a continuous emission monitoring system (CEMS), in accordance with Subpart E of Part 75. To collect the necessary data for the 720-operating hour demonstration required by Subpart E, GRE contracted with CMC Solutions, LLC. The NO_x CEMS was used to provide the hourly reference data during the PEMS training and test periods. A relative accuracy test audit (RATA) of the CEMS was conducted on May 15, 2007 at the "normal" operating load using EPA Methods 7E and 3A. Following the RATA, the SmartCEM™-75 PEMS was installed on the unit and the initial training data for the PEMS were collected. The

SmartCEM^{TM}-75 PEMS is a statistical hybrid computer software system supplied by CMC Solutions that utilizes turbine sensor inputs to produce NO_x outputs.

A model was developed from the training data. Then, the predictive capabilities of the PEMS were activated, and the PEMS and CEMS were operated concurrently from May 2, 2007 through November 15, 2007 to collect the required comparative data for the 720-hour Subpart E demonstration. At the conclusion of the demonstration period, RATAs of the CEMS and the PEMS were performed in May 2008. The June 26, 2008 petition documented the methods for establishing the relationship between the PEMS sensor outputs and NO_x emissions and provided data to demonstrate the precision and reliability of the predictive measurements.

EPA's Determination

Under Subpart E, the owner or operator of an affected unit applying to the Administrator for approval of an AMS must demonstrate that the AMS has the same or better precision, reliability, accessibility, and timeliness (PRAT) as provided by a CEMS. The demonstration must be made by comparing the AMS to a contemporaneously operating, fully certified CEMS or a contemporaneously operating reference method. As previously stated, GRE used the certified NO_x CEMS on Unit 2 to obtain the hourly reference data. Sections 75.41 through 75.46 discuss the criteria for evaluating PRAT, daily quality assurance, and missing data substitution for the AMS. Section 75.48 details the information that must be included in the application in order to demonstrate that the criteria in §§75.41–75.46 are met.

EPA reviewed the certification applications and petitions for approval of the PEMS on Unit 2. The Agency finds that GRE has satisfactorily demonstrated the precision, reliability, accessibility, and timeliness of the PEMS data. Therefore, EPA approves the petition with the terms and conditions stated below. The approval applies to DLN and non-DLN NO_x emission rate (i.e., lb/mmBtu) outputs from the PEMS when the unit is firing natural gas.

1. Precision

Under §75.41, for the normal unit operating level, the owner or operator must provide paired AMS and fully-certified CEMS hourly data for at least 90 percent of the hours during 720 unit operating hours for the primary fuel supply and for at least 24 successive unit operating hours for all alternative fuel supplies that have significantly different sulfur content. Missing data substitution procedures must not be used to provide sample data. The data may be adjusted to account for any lognormality and/or time dependency autocorrelation. Three statistical tests must be passed, i.e., a linear correlation coefficient (r) $\geq$ 0.8, an F-test, and a one-tailed t-test for bias described in Appendix A to Part 75. Further, the owner or operator must provide two separate time series plots for AMS and CEMS data. Each data plot must have a horizontal axis representing the calendar dates and clock hours of the readings, and there must be a separate data point for every hour of the test period. One data plot must show CEMS and AMS readings versus time, and the other data plot must show the percentage difference between the AMS and CEMS readings versus time. Finally, a plot of the paired AMS concentrations (on the vertical axis) and CEMS concentrations (on the horizontal axis) must be provided.

GRE provided 720 unit operating hours of paired PEMS and CEMS data that were collected during the second, third, and fourth quarters of 2007. Included in the data set are hours of "non-

DLN" unit operation (i.e., periods of unit startup and shutdown). GRE performed a Subpart E statistical analysis of the 720 hours of paired PEMS and CEMS data. EPA also performed the same statistics on the non-DLN subset of these data, to demonstrate PEMS performance during unit startup and shutdown.

Table 1 below presents the results of the statistical tests for the SmartCEM™-75 PEMS outputs.[1] The PEMS NO_x lb/mmBtu output passed each of the three statistical tests for all unit operations. Further, GRE supplied the appropriate data plots concerning the paired PEMS and CEMS data under §§75.41(a)(9) and (c)(2)(i).

Table 1: Great River Energy – Cambridge Station Unit 2
SmartCEM™-75 PEMS

All Data (lbs NO_x/mmBtu)	**Non-DLN Startup/Shutdown Data (lbs NO_x/mmBtu)**
N = 720	**n = 542**
t-test: mean difference, d = 0.000219 abs. value of confidence coefficient, cc = 0.000761 **Evaluation:** Because |cc| $\geq$ d, the model passed.	**t-test:** mean difference, d = - 0.000577 abs. value of confidence coefficient, cc = 0.0016 **Evaluation:** Because |cc| $\geq$ d, the model passed.
r-coefficient correlation: r = 0.9521 **Evaluation:** Because r $\geq$ 0.8, the model passed.	**r-coefficient correlation:** r = 0.8541 **Evaluation:** Because r $\geq$ 0.8, the model passed.
F-test: variance of PEMS = 0.001007 variance of CEMS = 0.001157 F = 0.8702 $F_{critical}$ = 1.130 **Evaluation:** Because $F_{critical} \geq F$, the model passed.	**F-test:** variance of PEMS = 0.00108725 variance of CEMS = 0.00125058 F = 0.8694 $F_{critical}$ = 1.15 **Evaluation:** Because $F_{critical} \geq F$, the model passed.

2. Reliability

According to §75.42, the owner or operator must demonstrate that the PEMS is capable of providing valid 1-hr averages for 95.0 percent or more of unit operating hours over a 1-year period and that the system meets the applicable CEMS quality-assurance requirements of Part 75. Valid PEMS data were collected by the data acquisition and handling system (DAHS) for more than 95.0 percent of the operating hours in the Subpart E test period, indicating that the PEMS are capable of meeting the long-term data availability requirements of §75.42. EPA has determined that, by meeting the quality assurance/quality control (QA/QC) requirements described in this petition response, GRE will also meet the applicable Part 75 QA/QC requirements.

3. Accessibility and Timeliness

[1] Under §75.41(b), in preparation for conducting the required statistical tests, the data were screened for lognormality and time dependency autocorrelation. If either is detected, certain calculation adjustments are required. GRE detected neither lognormality nor autocorrelation. Therefore, consistent with §75.41(b), no calculation adjustments were made to the data.

According to §§75.43 and 75.44, the owner or operator must demonstrate that the PEMS meets the recordkeeping and reporting requirements of Subparts F and G of Part 75. In the June 26, 2008 petition, GRE states that the PEMS meets these requirements. The DAHS records all parameters needed to calculate the NO_x emission rate on an hourly basis and is equipped to issue a data record for the previous day within 24 hours. The DAHS provides the operator with a continuous display of real-time emission data, including raw NO_x and O_2 concentration data, calculated NO_x emission data, process operating parameters, and the status of the process as it relates to the PEMS. Data are evaluated for compliance within the model's range of training data. The data are then available to generate reports, e.g., Part 60 compliance reports, Part 75 electronic data reports, or custom reports configurable by the end user.

4. Quality Assurance

Under §75.45, the owner or operator must demonstrate either that daily tests equivalent to those in Part 75 can be performed on the PEMS or that such tests are unnecessary for providing quality-assured data. Sections 75.48(a)(8) though (a)(11) require the following information to be submitted: (i) a detailed description of the process used to collect data, including location and method of ensuring an accurate assessment of operating hourly conditions on a real-time basis; (ii) a detailed description of the operation, maintenance, and quality assurance procedures for the AMS as required in Part 75; (iii) a description of methods used to calculate diluent gas concentration; and (iv) results of tests and measurements necessary to substantiate the equivalency of the AMS to a fully certified CEMS or reference method.

EPA has determined that the PEMS installed on the Unit GT2 turbine will satisfy these requirements if the following QA procedures are implemented:

(a) The PEMS shall use the input parameters listed in Table 2 below. Each parameter minimum and maximum value is a one-minute average. The PEMS input parameters must stay within the minimum and maximum values (inclusive) shown in the table below (referred to as "the PEMS operating envelope"), unless the PEMS is retrained according to section 4(g) in this determination, in which case, the new training values will supersede the values in the below table. If any PEMS input parameter value goes below the minimum or above the maximum table value by 5 percent or more[2], and if there is any fifteen-minute quadrant of an hour in which the unit operates without at least one valid set of inputs[3], the PEMS shall be considered out-of-control, and the maximum potential NO_x emission rate (MER) specified in section 4(h) in this determination shall be reported, starting with the out-of-control hour and ending with the next valid hour. For at least three years, data from each PEMS input parameter shall be maintained on site in a format suitable for inspection.

[2] The PEMS analyzer component additionally scans the historical training dataset to determine if the critical parameters contained in the current process vector correspond to any of the data previously collected (using a configurable tolerance or threshold that is maintained at 5% of the parameter range or less). Thus, a combination of critical input parameters that is not represented in the historical training dataset will invalidate the current minute record even if each of the individual critical parameters are within 5% of the minimum and maximum values established by the model envelope.

[3] However, an hourly average may be computed from at least two valid sets of inputs separated by a minimum of 15 minutes (where the unit operates for more than one quadrant of an hour) if data are unavailable as a result of the performance of calibration, quality assurance, or preventive maintenance activities pursuant to sections 4(b) through (f) of this response, or recertification, pursuant to section 4(g) for this determination.

Table 2: Great River Energy – Cambridge Station Unit 2
SmartCEM™-75 PEMS Operating Envelope

PEMS Input Parameter	Minimum Value	Maximum Value
Natural Gas Fuel Flow (SCFM)	2469	28854
Active Power (MW)	0	165
Calculated Turbine Outlet Temperature (^{o}F)	53	1010
Pilot Gas Flow (SCFM)	0	1
Fuel Gas Pre-mix Control Valve Position (%)	0	39
Pilot Gas Control Valve Position (%)	0	66
Exhaust Air Temperature 1 (^{o}F)	76	1052
Exhaust Air Temperature 2 (^{o}F)	76	1052
Exhaust Air Temperature 3 (^{o}F)	76	1051
Exhaust Air Temperature 4 (^{o}F)	77	1052
Exhaust Air Temperature 5 (^{o}F)	78	1052
Exhaust Air Temperature 6 (^{o}F)	77	1052

(b) Ongoing QA/QC tests of the PEMS shall be performed according to the following table:

Table 3: PEMS Ongoing QA/QC Tests

Test	Performance Specification	Frequency
Daily QA/QC	PEMS output - PEMS output ≤ 0.002 lb NO_X/mmBtu [see section 4(e)]	Daily
3-run RAA	• Accuracy ≤ 10.0% or • For a low emitting source,* results are acceptable if the mean value for the PEMS is within ± 0.020 lb/mmBtu of the reference mean value	Monthly [see section 4(f)].
RATA	For semiannual RATA frequency: • RA > 7.5% and ≤ 10.0% or • For a low emitting source,* results are acceptable if the mean value for the PEMS is within ± 0.020 lb/mmBtu of the reference method mean value. For annual RATA frequency: • RA ≤ 7.5% or • For a low emitting source,* results are acceptable if the mean value for the PEMS is within ± 0.015 lb/mmBtu of the reference method mean value	Semiannual or annual (depending on the RATA results) for routine QA (see §75.74(c)(2)(ii)) Recertification RATA is required when a RAA or a RATA is failed or when operating conditions change. ≥ 9 test runs are required at normal operating level for annual or semiannual QA. ≥ 30 test runs are required at each of 3 operating levels for recertification. [see sections 4(f) and (g)].

Table 3: PEMS Ongoing QA/QC Tests

Test	Performance Specification	Frequency
Sensor validation system (minimum data capture)	Check for production of at least 1 valid data point per 15 minutes [see section 4(c)]	Before each RATA [see sections 4(f) and (g)].
Sensor validation system (failed sensor alert)	Alert operator of any failed sensors [see sections 4(c) and (d)]	Hourly
Bias adjustment factor	If $d_{avg} \leq \|cc\|$, bias test is passed	After each RATA. Perform bias test at the normal operating level [see sections 4(f) and (g)].
PEMS training (Linear correlation and F-test)	$r \geq 0.8$, and $F_{critical} \geq F$	According to section 4(g)
Sensor validation system (alarm system set-up)	[see sections 4(c) and (d)]	After each PEMS training [see section 4(g)]

* The unit is a low-emitting source if the mean reference value during the RATA or RAA is $\leq$ 0.200 lb/mmBtu NO_x.

The sensor alarm system validation procedure is described in sections 4(c) and (d) in this determination. The daily QA/QC test is described in section 4(e). The RATAs, 3-run Relative Accuracy Audits (RAAs), and bias adjustment factor are discussed in sections 4(f) and (g). Recertification, including training, of the PEMS is discussed in section 4(g).

(c) The sensors for the PEMS input parameters must be maintained in accordance with the manufacturer's recommendations. A sensor validation system is required to identify sensor failures hourly to the operator and to reconcile failed sensors by: comparing each sensor to several other sensors; determining, based on the comparison, if a sensor has failed; and calculating a reasonable substitute value for the parameter measured by the failed sensor. GRE must ensure that the sensor validation system validates sensor data in this way every minute of PEMS operation. To comply with §75.10(d)(1), hourly averages must be computed using at least one valid set of inputs in each fifteen-minute quadrant of an hour in which the unit operates.[4] All valid data input to the PEMS during the hour must be used to calculate the hourly averages. All data points collected during an hour shall be, to the extent practicable, evenly spaced over the hour. If the provisions of this paragraph are not met, the PEMS is out-of-control, and Subpart D missing data procedures shall be followed.

(d) The sensor validation system shall include an alarm to inform the operator when sensors need repair and to indicate that the PEMS is out-of-control. In setting up the alarm system, a demonstration shall be performed at a minimum of four different PEMS training conditions, which must be representative of the entire range of expected turbine operations. For each of the four or more training conditions, the demonstration shall consist of the following:

(1) For all of the sensors used in the PEMS model, input a set of reference sensor values that are within the PEMS operating envelope and were recorded either during the training of the PEMS or during a RATA of the PEMS. Verify that

[4] See footnote 3, above

these reference inputs produce the expected PEMS output, i.e., the expected NO_x emission rate;

(2) Perform one-sensor failure analysis, as follows. Artificially fail one of the sensors and then, using the calculated replacement value for that sensor [see section 4(c) of this determination], assess the effect on the accuracy of the PEMS. Calculate the percent difference between the reference NO_x emission rate from step (1) and the PEMS output. Repeat this procedure for each sensor, individually;

(3) Identify the sensor failure in step (2) that results in the worst accuracy. If the highest percent deviation exceeds $\pm$ 10.0 percent, then set up the PEMS to alarm when any single sensor fails. If none of the percent difference values exceeds 10.0 percent, proceed to step (4);

(4) Perform two-sensor failure analysis, as follows: artificially fail the sensor from step (3) that produced the worst accuracy and also fail one of the other sensors. Then, using the calculated replacement values for both sensors, assess the accuracy of the PEMS hourly average output, as in step (2). Repeat this procedure, evaluating each sensor in turn with the sensor from step (3);

(5) Identify the combination of dual sensor failures that results in the worst accuracy. If the highest percent deviation exceeds $\pm$ 10.0 percent, then set up the PEMS to alarm when any two sensors fail. If none of the percent difference values exceeds 10.0 percent, then set up the PEMS to alarm with three sensor failures.

The results of this demonstration shall be maintained on site in a format suitable for inspection. For every hour of PEMS operation, the PEMS shall check for failed sensors and provide an alarm to alert the operator of any sensors needing repair. When the PEMS alarms, the PEMS is out-of-control, and GRE shall report the NO_x MER specified in section 4(h) of this determination, starting with the hour after the sensor validation alarm system alarms and ending with the hour after the sensor value is back within the expected range.

(e) A daily QA/QC test must be performed whenever the unit operates for any portion of the day. GRE shall input to the PEMS a set of turbine operating parameters used by the PEMS during a passed PEMS RATA or the most recent PEMS training. (Note**:** it is important that the same number of decimal places for the PEMS inputs be used here as was used in the passed PEMS RATA or most recent PEMS training.) The resulting PEMS NO_x lb/mmBtu output, if bias-adjusted, shall be divided by the bias adjustment factor (BAF) currently in use; this removes the BAF by resetting it to 1.000, as it was during the passed PEMS RATA or most recent PEMS training. Then, the unbiased PEMS output shall be compared to the corresponding PEMS NO_x lb/mmBtu output produced at the time of the RATA or PEMS training. If the difference between the two PEMS NO_x outputs is within $\pm$ 0.002 lb NO_x/mmBtu, the daily QA/QC test is passed. If a daily QA/QC test is failed or not performed, the

PEMS is out-of-control. Subpart D missing data procedures shall be followed starting with the hour of the failed test or, if the test was not performed, the hour after the test due date, and ending with the hour in which a daily QA/QC test is passed. No grace periods are allowed. The results of this check (pass/fail) shall be reported in the Daily Test Summary Records, see section 2.2 of the ECMPS Emissions Reporting Instructions. Report code ”PEMSCAL” as the Test Type Code for the daily QA/QC check.

(f) Ongoing semi-annual or annual RATAs shall be performed at the normal operating level according to the procedures in Part 75, Appendix B, section 2.3.1, and shall be calculated on a lb/mmBtu basis. The reference method traverse point selection shall be consistent with Part 75, Appendix A, section 6.5.6. Notification of ongoing RATAs shall be provided according to §75.61(a)(5). Immediately prior to a RATA, the BAF shall be set to 1.000. Before each RATA, GRE shall ensure that the sensor validation system is set to provide at least one valid data point per 15 minute period, as discussed in section 4(c) of this determination. After the RATA, GRE shall calculate and apply a bias adjustment factor at the normal operating level according to Part 75, Appendix A, section 7.6. Report the RATA and bias test data and results as described in section 2.4 of the ECMPS Quality Assurance and Certification Reporting Instructions.

Monthly, 3-run (minimum) relative accuracy audits (RAAs), described below, shall be performed in every calendar month of the year in which the unit operates for at least 56 hours, except for a month in which a full 9-run RATA or PEMS recertification is performed.

All required RAAs shall be done on a lb NO_x/mmBtu basis, and shall be performed using either EPA Reference Methods 7E and 3A in Part 60, Appendix A-4 or portable analyzers. To the extent practicable, each RAA shall be done at different operating conditions from the previous one. Follow the portable analyzer manufacturer’s recommended maintenance procedures.

The minimum time per RAA run shall be 20 minutes. The reference method traverse point selection shall be consistent with Part 75, Appendix A, section 6.5.6. Alternatively, a single measurement point located at least 1.0 meter from the stack or duct wall may be used without performing a stratification test.

Results of the RAA shall be calculated using Equation 1-1 in Appendix F to Part 60. Bias-adjusted data from the PEMS (using the bias adjustment factor from the most-recent RATA) shall be used in the calculations. The results of the RAA are acceptable if the performance specifications in the Table 3 in section 4(b) in this determination are met. If the RAA is failed, follow the provisions in section 4(g). No grace periods are allowed.

Report the results of all RAAs in the appropriate quarterly electronic data report. As detailed in section 4.0 of the ECMPS Quality Assurance and Reporting Instructions, report the results of each test as either “pass” or “fail”. Report the Test Type Code as

"PEMSACC" to indicate this is a 3-run RAA for PEMS with reference method or portable analyzer.

If a portable chemiluminescent NO_x analyzer is used to perform the required RAAs, the procedures of Method 7E in 40 CFR Part 60, Appendix A-4 shall be followed. The analyzer performance specifications in Method 7E for calibration error, system bias, and calibration drift shall be met.

If a portable electrochemical analyzer is used to perform the required RAAs, ASTM Method D6522-00[5], as modified below, shall be followed. ASTM D6522-00 applies to the measurement of NO_x (NO and NO_2), CO, and O_2 concentrations in emissions from natural gas-fired combustion systems using electrochemical analyzers. The method was developed based on studies sponsored by the Gas Research Institute (GRI)[6]. It has also been peer-reviewed, approved by ASTM Committees D22.03 and D22, and accepted by EPA as a conditional test method (CTM-030). ASTM D6522-00 prescribes analyzer design specifications, test procedures, and instrument performance requirements that are similar to the checks in EPA's instrumental test methods (e.g., Method 7E). These checks include linearity, interference, stability, pre-test calibration error, and post-test calibration error.

Based on the results of EPA's portable analyzer study[7], the following modifications to ASTM D6522-00 are required to make the method more practical without sacrificing accuracy: (i) NO_x analyzers must provide readings to 0.1 ppm to improve the likelihood of passing the performance specifications for sources with low NO_x levels; (ii) an alternative performance specification (i.e., $\pm$ 1.0 ppm difference from reference value) will be applied to take account of sources with low concentrations of NO_x; and (iii) the measurement system must be purged with ambient air between gas injections during the stability check, to reduce degradation of electrochemical cell performance (see the footnote in the table below).

The measurement system performance specifications as modified by the EPA portable analyzer study are shown in Table 4.

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[5] ASTM D6522-00, "Standard Test Method for Determination of Nitrogen Oxides, Carbon Monoxide, and Oxygen Concentrations in Emissions from Natural Gas-Fired Reciprocating Engines, Combustion Turbines, Boilers, and Process Heaters Using Portable Analyzers."

[6] GRI (Gas Research Institute), "Topical Report, Development of an Electrochemical Cell Emission Analyzer Test Method," July, 1997.

[7] "Evaluation of Portable Analyzers for Use in Quality Assuring Predictive Emission Monitoring Systems for NO_x," The Cadmus Group, Inc., September 8, 2004.

Table 4: ASTM Method D6522-00 Measurement System Performance Specifications (as Modified by EPA Portable Analyzer Study)

Performance Check	Gas	Acceptance Criteria
Zero Calibration Error	NO, NO_2	≤ 3 percent of span gas value or ± 1.0 ppm difference, whichever is less restrictive
	O_2	≤ 0.3 percent O_2
Span Calibration Error	NO, NO_2	≤ 5 percent of span gas value or ± 1.0 ppm difference, whichever is less restrictive
	O_2	≤ 0.5 percent O_2
Interference	NO, NO_2, O_2	≤ 5 percent of average stack NO concentration for each test run (using span gas checks)
Linearity	NO, O_2	≤ 2.5 percent of span gas concentration or ± 1.0 ppm difference, whichever is less restrictive
	NO_2	≤ 3.0 percent of span gas concentration or ± 1.0 ppm difference, whichever is less restrictive
Stability[1]	NO, NO_2, O_2	≤ 2.0 percent of span gas concentration or ± 1.0 ppm max-min difference, whichever is less restrictive, for 30-minute period ≤ 1.0 percent of span gas concentration or ± 1.0 ppm max-min difference, whichever is less restrictive, for 15-minute period
Cell Temperature		± 5 °F from initial temperature

[1] When conducting this check for three cells in an analyzer, the system must be purged with ambient air between gas injections to minimize the possibility of problems with the electrochemical cells. Otherwise, the cells will be exposed to high NO and NO_2 concentrations for prolonged periods of time, which can cause degradation in the cell's performance (i.e., the so-called "O_2-starved exposure").

(g) If a RAA or a RATA is failed due to a problem with the PEMS or if changes occur that result in a significant change in NO_x emission rate relative to the previous PEMS training conditions (e.g., process modification, new process operating modes, or changes to emission controls), the following recertification tests and procedures shall be performed, in this order:

(1) Ensure that the Sensor Validation System meets the requirements of section 4(c) of this determination.

(2) If required, re-train the PEMS according to the manufacturer's recommendations.[8]

(3) Ensure that the requirements in section 4(d) of this determination are met.

(4) Perform a RATA, following the procedures in Part 75, Appendix A, section 6.5, using three different operating levels (low, mid, and high) as defined in section 6.5.2.1 of Part 75, Appendix A. Use paired PEMS and reference method data to calculate the results on a lb NO_x/mmBtu basis.

[8] If a reference method is used to provide training data for the PEMS, the training data may be used to calculate the relative accuracy at each operating level and the normal level bias and to set up the alarm system.

Calculations shall be based on a minimum of 30 runs at each operating level. GRE shall apply to each operating level the RATA performance specifications contained in the Table 3 in section 4(b) of this determination. Report the RATA data and results of only the normal operating level as described in section 2.4 of the ECMPS Quality Assurance and Certification Reporting Instructions and keep the data and results for the other two operating levels on-site, available for inspection. The RATA result for the normal operating level determines when the next RATA is due.

(5) Ensure that requirements in section 4(e) of this determination are met.

(6) Conduct an F-test and a correlation analysis (r-test) using Part 75, Subpart E equations at low, mid, and high operating levels.[9] The r-test shall be performed using all data collected at the three operating levels combined. When the mean value of the reference method NO_x data is less than 5 ppm, data from that operating level may be removed before applying the r-test. The F-test is to be applied to data at each operating level separately. If the standard deviation of the reference method NO_x data at any operating level is less than either 3 percent of the span or 5 ppm, a reference method standard deviation of either 3 percent of span or 5 ppm may be used at that operating level when applying the F-test. Report the calculated F-value, and the critical value of F at the 95-percent confidence level with n-1 degrees of freedom for each operating level, and report the calculated r-value (using Equation 27 in §75.41(c)(2)(ii)) for data from the three operating levels combined using section 4.0 of the ECMPS Quality Assurance and Reporting Instructions.

(7) Perform a bias test (one-tailed t-test) at the normal operating level according to Part 75, Appendix A, section 7.6. If a bias test is failed, calculate and apply a BAF to the subsequent NO_x emission rate data.

The following recertification tests shall be performed *only for startup/shutdown (non-DLN):*

(8) Collect at least 24 successive unit operating hours of paired hourly PEMS and reference method data and conduct an F-test, correlation analysis (r-test), and bias test. If a bias test is failed, calculate and apply a BAF to the subsequent non-DLN NO_x emission rate data. Report the calculated F-value, the critical

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[9] EPA performed a Subpart E statistical analysis of 720 hours of matched pairs of PEMS and CEMS data for one participating combustion turbine and 830 matched data pairs for another, and then performed the same statistics on 30-point subsets of these data. (See "Evaluation and Field Testing of Nitrogen Oxide (NO_x) Predictive Emission Monitoring Systems (PEMS) for Gas-fired Combustion Turbines - Synthesis Report," The Cadmus Group, Inc., December 29, 2004.) The results of these analyses showed that most of the 30-point subsets passed the same combination of statistical tests as the full data set. The field test data also illustrated the importance of testing the PEMS over the full operating range of the unit because of the strong correlation between NO_x emissions to certain unit operating parameters. Based on this evaluation, EPA believes that whenever the PEMS is recertified, a three load RATA (with a minimum of 30 paired data points at each load level) should be required in conjunction with input sensor failure checks and certain abbreviated Subpart E statistical tests, in particular, the F-test, the correlation analysis, and the t-test.

value of F at the 95-percent confidence level with n-1 degrees of freedom, and the calculated r-value (using Equation 27 in §75.41(c)(2)(ii)) using section 4.0 of the ECMPS Quality Assurance and Reporting Instructions. For at least three years, bias test results shall be maintained on site in a form suitable for inspection.

The tests and procedures in this section 4(g) shall be completed by the earlier of 60 unit operating days (as defined in §72.2) or 180 calendar days after the failed RAA or failed RATA or after the change that caused a significant change in NO_x emission rate.

For a failed RAA or RATA, GRE shall use the appropriate Part 75 missing data procedures (see section 5 of this determination), starting from the hour of the failed RAA or RATA and ending with the hour of successful passage or completion of the tests and procedures in steps (1) through (8) above. For a change that caused a significant change in NO_x emission rate, GRE shall report the NO_x MER from section 4(h) of this determination and shall use a Method of Determination Code of "55" (i.e., "Other substitute data approved through petition by EPA") in Derived Hourly Value Data (section 2.5.2 of the ECMPS Emissions Reporting Instructions) for reporting lb NO_x/mmBtu emission rate, starting with the hour after the change that caused a significant change in NO_x emission rate and ending with the hour of successful passage or completion of the tests and procedures in steps (1) through (8) above. Notification of recertification of the PEMS shall be provided according to §75.61.

(h) For the purposes of this approval, the NO_x MER shall be 0.315 lb/mmBtu when the unit is firing pipeline natural gas. A Method of Determination Code "12" (i.e., "Unit or Stack Maximum Emission Rate") shall be used in Derived Hourly Value Data (section 2.5.2 of the ECMPS Emissions Reporting Instructions) when reporting the MER.

5. Missing Data Substitution

Under §75.46, the owner or operator must demonstrate that all missing data can be accounted for in a manner consistent with the applicable missing data procedures in Subpart D of Part 75 (except where alternate procedures are required in this approval). The Subpart D missing data substitution requirements for NO_x emission rate include, but are not limited to: the initial missing data procedures in §75.31; determination of the percent monitor data availability; and the standard missing data procedures in §75.33. The missing data substitution requirements for fuel flow rate are found in Part 75, Appendix D, section 2.4. In the petition, GRE states that the DAHS for the PEMS has already been programmed to meet these missing data substitution requirements.

6. Reporting Requirements

GRE shall submit the operating envelopes for the PEMS to the Minnesota Pollution Control Agency and EPA Region 5 for inclusion in the hardcopy monitoring plan. Any time changes are made to the PEMS operating envelope, the complete, revised PEMS operating envelope shall be submitted in a hardcopy monitoring plan by the applicable deadline in §75.62(a)(2). More information on monitoring plan submittals, revisions and other submittals can be found at:

http://www.epa.gov/airmarkets/emissions/process.html

To report emissions data from the PEMS, GRE shall follow the current published ECMPS Reporting instructions, found at: http://www.epa.gov/airmarkets/business/ecmps/index.html, in conjunction with the supplementary, PEMS-specific ECMPS reporting instructions attached to this petition response.

EPA's determination relies on the accuracy of the information in the June 26, 2008 petition and supplementary information provided by GRE, and is appealable under Part 78. If there are any further questions or concerns about this matter, please contact John Schakenbach of my staff at (202) 343-9158 or at (schakenbach.john@epa.gov).

Thank you for your continued cooperation.

Sincerely,

/s/
Sam Napolitano, Director
Clean Air Markets Division

cc: John Schakenbach, EPA, CAMD
Louis Nichols, EPA, CAMD
Constantine Blathras, EPA Region 5
Yolanda Hernandez, Minnesota Pollution Control Agency

Attachment

December 15, 2008

Attachment

Supplementary Reporting Instructions for PEMS

For a unit with an approved petition to use a predictive emissions monitoring system (PEMS), use the following supplementary instructions, in conjunction with the ECMPS Reporting Instructions documentation, to prepare the required submittals. This document is intended to provide additional instructions to the existing ECMPS reporting instructions, unless otherwise noted, fields or data elements not specifically addressed in these instructions should be completed using the ECMPS reporting instructions. These guidelines are organized by the three ECMPS submission types:

1. Monitoring Plan;
2. Quality Assurance and Certification; and
3. Emissions reporting.

I. Monitoring Plan Reporting Instructions

6.0 Monitoring Method Data

Parameter Code. Report a "NOXR" for NO_x Rate.

Monitoring Method Code. Report "PEM" to indicate NO_x rate is calculated using a petition approved PEMS methodology.

Substitute Data Code. Report "SPTS"

7.0 Component Data

The PEMS monitoring system consists of either one or two DAHS components. For single-component PEMS systems or for systems where the PEMS software and standard DAHS software have the same manufacturer/provider, model or version number, report one DAHS component. If the PEMS software and the standard DAHS software have different manufacturer/providers, model or version numbers, report two DAHS components. Otherwise report the DAHS components normally as you would according to section 7.0 of the ECMPS reporting instructions. You may also report the additional components of "DL" to indicate a data logger or recorder or "PLC" to indicate a programmable logic controller.

8.0 Monitoring System Data

Monitoring System ID. Assign a unique three character alphanumeric ID for each PEMS monitoring system.

System Type Code. Report system type code "NOXP" to indicate this is a NO_x emission rate PEMS system.

System Designation Code. Report "P" to indicate this is the primary monitoring system.

8.2 Monitoring System Component Data

Associate the DAHS component(s) with the NOXP system described as above. While you may associate additional components such as a data logger or a programmable logic controller with the system, a PEMS must have a minimum of one associated DAHS component.

10.0 Monitoring Default Data

Parameter Code. Report "NOXR" as the parameter monitored. (You should report one default record for each fuel type.)

Default Value. Report the fuel specific maximum potential NO_x emission rate (MER), in units of lb/mmBtu.

Default Units of Measure Code. Report "LBMMBTU".

Default Purpose Code. Report "MD" for missing data.

Fuel Code. Report "NFS" to indicate Non-Fuel-Specific.

Operating Condition Code. Report "A" for any hour.

Default Source Code. Report "TEST" to indicate the value was determined from unit/stack testing.

II. Quality Assurance and Certification Instructions

2.4.2 RATA Data

Number of Load Levels. Report "1". (Note: Ongoing RATAs are performed at the normal operating level only. Recertifications are performed following procedures in Part 75, Appendix A, §6.5, using three operating levels (low, mid, and high) as defined in §6.5.2.1 of Part 75, Appendix A. Only the normal operating level data is reported; the other two operating levels are kept on site.)

Relative Accuracy. Report the result of the relative accuracy test, as required and defined for the appropriate test method and in Part 75, Appendix A. Leave this field blank for a RATA that is aborted prior to completion, due to a problem with the monitoring system.

RATA Frequency Code. Report "2QTRS" or "4QTRS" (depending on the RATA results).

Overall Bias Adjustment Factor. Report the BAF at the normal operating level.

2.4.3 RATA Summary Data

Mean CEM Value. Report the arithmetic mean of the PEMS values for the normal operating level.

Bias Adjustment Factor. Report the BAF at the normal operating level.

2.4.4 RATA Run Data

CEM Value. Report the average value recorded by the PEMS, for each RATA run.

4.0 Miscellaneous Tests

Both the 3-run RAA and the PEMS linear correlation and F-test QA tests are reported using the miscellaneous test type. To report the 3-run RAA tests using the miscellaneous test type do the following:

Test Type Code. Report "PEMSACC" for a 3-run RAA for PEMS with RM or portable analyzer.

Monitoring System ID. Report the PEMS NO_x monitoring system ID.

To report the PEMS linear correlation and F-tests do the following:

Test Type Code. Report "OTHER".

Monitoring System ID. Report the PEMS NO_x monitoring system ID.

Test Reason Code. Report either "INITIAL" or "RECERT".

Test Description. Report either "PEMS Initial Certification" or "PEMS Recertification".

Test Comment. Report the results of the F-test and correlation analysis (r-test) as specified by the PEMS Petition Approval documentation.

5.0 QA Certification Event Data

Monitoring System Id. Report the monitoring system ID of the NO_x PEMS system.

QA Cert Event Code. Report the appropriate PEMS specific event code. (Please see section 5.0 Table 47 of the ECMPS Quality Assurance and Certification Reporting Instructions for a list of appropriate event codes).

Required Test Code. Report the appropriate PEMS specific required test code. (Please see section 5.0 Table 48 of the ECMPS Quality Assurance and Certification Reporting Instructions for a list of appropriate required test codes).

Conditional Begin Date. If conditional data validation is used, report the date and hour that the probationary PEMS daily QA/QC test was successfully completed according to the provisions of §75.20(b)(3)(ii).

Note: For PEMS, you may only use conditional data validation if the "event" in column 16 requires RATA testing. If you elect to use conditional data validation, you must complete the RATA within the allotted time in §75.20(b)(3)(iv).

Conditional Begin Hour. If applicable report the hour during which conditional data validation began.

III. Emissions Reporting Instructions

2.2 Daily Test Summary Data

Monitoring System ID. Report the three character Monitoring System ID for the NOXP system.

Component ID. Report the PEMS software component ID.

Test Type Code. Report "PEMSCAL" for daily PEMS calibration tests.

2.5.1 Monitor Hourly Value Data

Do not report a Monitor Hourly Value record. PEMS hourly data should be reported using the Derived Hourly Value records as discussed below.

2.5.2 Derived Hourly Value Data

Parameter Code. Report "NOXR".

Unadjusted Hourly Value. Report the average unadjusted NO_x emission rate for the hour, rounded to three decimal places, as determined by the PEMS. For hours in which you use missing data procedures, leave this field blank.

Adjusted Hourly Value. For each hour in which you report NO_x emission rate in unadjusted hourly value, apply the appropriate factor (1.00 or the BAF) to the unadjusted average emission rate, and report the result rounded to three decimal places. For each hour in which you use missing data procedures, report the appropriate substitute value.

MODC Code. Report "03" when you use the PEMS to determine the NO_x emissions rate. Report "55" when you report the fuel specific maximum NO_x emission rate. During hours when you use other missing data procedures, report the appropriate MODC listed in section 2.5.2, Table 22 of the Emissions Reporting Instructions.