UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

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OFFICE OF
AIR AND RADIATION

Pamela K. Graika
Designated Representative
Northern States Power
414 Nicollet Mall
Minneapolis, Minnesota 55401-1927

Re: Petition for exemption from flow-to-load testing requirements for Northern States Power, Riverside Units 6 and 7

Dear Ms. Graika:

This is in response to Northern States Power"s (NSP) April 5, 2000 petition under § 75.66 and part 75, appendix A, section 7.8, requesting an exemption from the requirement to perform quarterly flow-to-load ratio testing for Riverside Units 6 and 7. NSP also requested an exemption from the related requirement to establish normal load for purposes of performing annual flow monitor relative accuracy test audits (RATAs). As discussed below, EPA denies the petition.

Background

The quarterly flow-to-load ratio test is required for all units with installed stack flow monitors. See 40 CFR part 75, appendix A, section 7.7 and appendix B, section 2.2.5. This quarterly quality assurance test was added to part 75 as a rule revision on May 26, 1999. Prior to the May 26, 1999 final rule, the owner or operator of a non-peaking unit with a flow monitor was required to perform a three-load RATA on the flow monitor annually, i.e., once every four quarters. In the May 26, 1999 final rule, EPA adopted the requirement to perform a quarterly flow-to-load test as an indicator that the flow monitor "remains accurate in between successive .....annual RATAs." 64 FR 28564, 28573 (May 26, 1999). If a unit fails to pass a quarterly flow-to-load test, this indicates that the flow monitor may not be working properly, and the owner or operator may investigate the cause of the failure or may perform a single-load RATA. If an investigation is made, the cause is determined, and corrective action is taken, an abbreviated flow-to-load test must generally be performed. If the cause is not determined, then a single-load RATA must be performed. See 40 CFR part 75, appendix B, sections 2.2.5(b), 2.2.5.1., and 2.2.5.2. Further, "principally because of the reasonable assurance of data quality that will be provided in between RATAs by the new flow-to-load test," EPA reduced the stringency of the

RATA requirements so that routine RATAs can be two load or, in some circumstances, single-load and a three-load RATA is required every five years. 64 FR 28572-3.

Before the flow-to-load ratio test can be performed for a particular unit or stack, both the "range of operation" and the "normal" load level must be defined for the unit or stack. See 40 CFR part 75, appendix A, section 6.5.2.1. The range of operation extends from the minimum safe, stable load to the maximum sustainable load. For common stacks serving two or more affected units, the individual unit loads are added together when determining the range of operation. Once the range of operation has been defined, it is broken into three operating levels, "low" (0-30% of the range), "mid" (30-60% of the range) and "high" (60-100% of the range). The normal load level is established by analyzing at least four representative quarters of historical load data and preparing a load distribution graph, such as a histogram, showing the percentage of the time that each load level has been used historically. The most frequently-used load level is automatically designated as "normal," and the second most frequently-used load level may be designated as a second normal load level.

To perform the flow-to-load ratio test, a reference flow-to-load ratio must be established, using data from the most recent flow RATA at the normal load level. See 40 CFR part 75, appendix A, section 7.7. Data from the most recent flow RATA are used because those data likely reflect the current performance of the unit and the flow monitor and thus the flow-to-load ratio when the flow monitor is operating properly.[1] Then, a data analysis is performed in each subsequent quarter, in which flow rate and load data are evaluated for all unit operating hours where the load is within 10% of the average load during the RATA. An hourly flow-to-load ratio is determined for each of these unit operating hours and compared to the reference flow-to-load ratio. The average percent deviation of the hourly ratios from the reference ratio is then calculated. When bias-adjusted flow rate data are used in the data analysis, the results are acceptable if the average percent deviation is 10.0% or less. If unadjusted flow data are used, the results are acceptable if the average percent deviation is 15.0% or less. See 40 CFR part 75, appendix B, section 2.2.5.

As discussed above, the purpose of the flow-to-load ratio test is to provide assurance that data from a flow monitor remain sufficiently accurate from one annual RATA to the next. The test is intended to serve only as a general indicator of flow monitor performance in order to identify monitors that appear to be drifting excessively or that may be out-of-control. To address concerns that hour-to-hour variations in the flow-to-load ratio might cause "false positive" test failures, EPA built into the flow-to-load test a number of safeguards to take account of hourly variation and to prevent "false positives." First, the test is used only as a general indicator of monitor performance. Second, the test evaluates only flow rate data recorded in a fairly narrow load range, at stable operating conditions, similar to the conditions at the time of the normal load

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[1] For example, the most recent RATAs are more likely to reflect more recent changes in unit performance and more recent adjustments to the flow monitors. EPA therefore rejects NSP's claim that there is only one "true" reference flow-to-load ratio and that the differences among the calculated flow-to-load ratios from one year to the next show that the values are not representative.

flow RATA, and unrepresentative data (e.g., during periods of "ramping up"or "ramping down" when the load is unstable) may be excluded from the data analysis.[2] Third, the percentage deviations of the individual hourly ratios from the reference ratio are averaged over the entire calendar quarter so that the overall test results have relatively little sensitivity to hourly variations in the flow-to-load ratio. Finally, EPA adopted an allowable error band for the test of 10.0%, when bias-adjusted flow rate data are used, and 15.0%, for unadjusted data.

The effluent gases from Riverside Units 6 and 7 discharge to the atmosphere through two commonly-shared stacks (identified as CS0006 and CS0007). NSP's April 5, 2000 petition requested an exemption from the requirement to perform quarterly flow-to-load tests at the units. According to NSP, because of the complexity of the discharge configuration, there is "massive variation in the hourly flow-to-load ratios" for the units and no direct correlation between the flow rate in the individual stacks and unit load. (NSP's April 5, 2000 petition at 1.) NSP stated that, when flow-to-load analysis is performed on a combined stack and unit basis, there is a "stronger correlation" between flow rate and load. (Id. at 2.) However, according to NSP, there is still a "level of variation" that precludes the "tight bracketing associated with the flow-to-load test" and that "suggests that the process of using RATAs to establish 'reference' flow-to-load ratios will not necessarily result in a meaningful benchmark."(Id.) According to NSP, if a reference flow-to-load is established during an "atypical period" or if the RATAs on the two stacks cannot be performed simultaneously, the reference value will not be "representative of the long-term average" value. (Id.) NSP claims that the balance of flow between the two common stacks is variable and that creating "representative flows within each stack" for the purpose of performing RATAs "would not represent the typical balance of the units". (Id. at 3.)

EPA's Determination

EPA notes that NSP's argument essentially is that, because of hourly variation in balance of flow between the two common stacks used by Riverside Units 6 and 7, a reference flow-to-load ratio based on the most recent flow RATAs on the monitors in the stacks may not represent the actual flow-to-load value and may result in "false positive" failures of the test. In order to evaluate these claims, EPA undertook several types of analysis.

EPA's first type of analysis involved assembling a full set of flow-to-load test results for Units 6 and 7 for 11 calendar quarters, i.e., the period from the 3rd quarter of 1998 through the 1st quarter of 2001. The appropriate flow rate and load data from the previous normal load RATAs of the flow monitors installed on CS0006 and CS0007 were used to calculate the reference flow-to-load ratios.

A reference flow-to-load ratio was calculated from the results of each pair of annual flow RATAs at CS0006 and CS0007. Each reference ratio was determined on a combined basis,

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[2] Consequently, NSP's concern about the effect of unrepresentative periods (e.g., when one stack used by Units 6 and 7 is closed or one unit is off-line) on the flow-to-load test periods is not well taken. Data during such periods would not be included in the analysis.

because the flows from Units 6 and 7 combine together before entering the two common stacks, where the combined flows are monitored. Each reference ratio was calculated by summing the average flow rates for the two stacks during the appropriate RATAs, dividing the sum by the average combined load for Units 6 and 7 during the RATAs , and then multiplying the result by 10^{-5}. The reference flow-to-load ratios derived in this manner were 1.56 for the 1998 flow RATAs, 1.68 for the 1999 flow RATAs, and 1.55 for the 2000 flow RATAs.

EPA then performed the flow-to-load ratio test, also on a combined basis, for each of the 11 calendar quarters mentioned above. The applicable reference ratio was applied to each quarter's data. In each quarterly analysis, EPA calculated an hourly flow-to-load ratio for each hour of quality-assured flow rate data recorded at a combined unit load within $\pm$ 10% of the average combined load during the previous RATAs. Note that for the 2nd calendar quarter of 1998 and the 2nd quarter of 2000 (the quarters in which the normal load flow RATAs were performed), all flow rate data recorded prior to the RATAs were excluded from the flow-to-load ratio test, as allowed under part 75, appendix B, section 2.2.5 (c)(5). However, for the 2nd quarter of 1999 this was not done, since the flow RATAs were performed so close to the end of the quarter (on June 23, 1999). Rather, for the 2nd quarter of 1999, the flow rate data recorded *prior to* the RATAs (i.e., from April 1, 1999 through June 22, 1999) were analyzed, using the reference ratio from the 1998 flow RATAs.

For each quarter, the hourly flow-to-load ratios were individually compared against the reference ratio. The flow rates used in the calculations were *unadjusted* rates, in that they were not corrected for bias. The results of the data analyses show that the value of E_f, the average percentage deviation of the hourly flow-to-load ratios from the reference ratio, ranged from 3.1% to 8.4%. These results are well below the allowable E_f value of 15.0% specified in part 75, appendix B, section 2.2.5, when unadjusted flow rates are used in the flow-to-load analysis.[3]

The results of the 11 quarters of flow-to-load tests are set forth in Table 1 of this letter. Table 1 shows that Riverside Units 6 and 7 have passed the flow-to-load ratio test for 11 consecutive calendar quarters, when the results are calculated on a combined basis. EPA maintains that this undermines NSP's claim that the complex emission discharge configuration of the units precludes the "tight bracketing associated with the flow-to-load test" and may cause "false positive" failures of flow-to-load tests at the units. The flow-to-load test requirements apparently provide sufficient safeguards (i.e., use of the test as a general indicator, exclusion of unrepresentative data, use of the quarterly average deviation from the reference value, and use of a flexible, allowable error band) to take account of hourly variation in flow-to-load. Moreover, the fact that the units have passed for 11 consecutive quarters also undermines NSP's suggestion that obtaining a true reference flow-to-load ratio for Units 6 and 7 based on the annual flow

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[3] To illustrate how the data analyses were performed, the hourly data used in the 3rd quarter, 2000 analysis are included, along with summary statistics, as Attachments 1 and 2 to this letter. The 3rd quarter, 2000 statistical analysis shows that for 1,437 hours of high-load data, the mean hourly flow-to-load ratio was 1.55 with a standard deviation of 0.06. The mean percent deviation of the hourly flow-to-load ratios from the reference flow-to-load ratio was 3.1, and approximately 95% the hourly percent deviation values fell between 0.0 and 8.2. Statistical summaries for each of the other quarters are included as Attachment 4 to this letter.

RATA results -- and thus the determining of whether a unit passes or fails the flow-to-load test -- are a "questionable and capricious exercise." (NSP's April 5, 2000 petition at 2.) EPA maintains that Units 6 and 7 likely passed the tests because the reference flow-to-load ratios obtained from the annual RATAs are representative and the units' flow monitors were operating properly.

EPA's second type of analysis involved examination of normal load flow data for Units 6 and 7 in order to consider NSP's claim that the hourly flow distribution between the two common stacks is too variable to allow for determination of a representative reference flow-to-load ratio based on RATAs. EPA performed this data analysis for the 2nd, 3rd and 4th quarters of 2000. The analysis showed first that, during the warmer months, the units appear to operate principally in a cyclical manner but, during the colder months, operate more continuously at high load. For example, in the 2nd and 3rd quarters of 2000, a consistent daily operating pattern was frequently observed, in which the high load was attained and held from morning until late evening. In the 4th quarter of 2000, the units were often operated at high load for several days in succession. During these periods of stable, high-load operation, the hour-to-hour variation in the flow-to-load ratio (on a combined basis) was, in general, small. For example, on August 1, 2000, the units operated for 17 consecutive hours at high load, and the mean hourly flow-to-load ratio for this time period was 1.58 with an average deviation of 0.06. Similarly, for 24 consecutive hours of high-load operation on September 14, 2000, the mean hourly flow-to-load ratio was 1.51 with an average deviation of 0.05.

EPA's examination of normal load flow data for the 2nd , 3rd and 4th quarters of 2000 also focused on the variability of the flow distribution between common stacks CS0006 and CS0007, for all operating hours when the combined unit load was within $\pm$ 10% of 150 MW (the average combined load for the 2000 normal load flow RATAs). EPA's analysis showed that the hourly flow distribution between the stacks -- expressed as flow through CS0007 as a percentage of the combined flow through both stacks -- is reasonably consistent on a long-term basis. For 3,574 high-load operating hours in the three calendar quarter period, the flow through CS0007 was, on average, 52.5% of the combined flow. For the individual quarters, the percentages were very similar, being 51.7% for the second quarter of 2000, 53.3% for the third quarter of 2000 and 52.5% for the fourth quarter of 2000.

The relative distribution of the data for the three quarters, which is summarized in Table 2 of this letter, shows that the data are concentrated within a relatively small range. Table 2 shows that for 3,127 of the 3,574 operating hours (i.e., for 87.5 % of the hours), the flow through CS0007 was between 49 and 54% of the combined flow. A graphical representation of the relative flow distribution for the 3rd quarter of 2000 is provided as Attachment 3 to this letter.

The hourly flow distribution data also show that, although there was some variation in day-to-day flow distribution between the stacks, the hour-to-hour variability in the flow distribution was generally small during the individual daily periods of high-load operation. For example, on August 1, 2000, the units operated for 17 consecutive hours at high load, and the mean hourly percentage of the total flow exiting through CS0007 was 52.4% with an average deviation of 1.1%. Similarly, for 24 consecutive hours of high-load operation on September 14,

2000, the mean hourly percentage of the total flow exiting through CS0007 was 53.6% with an average deviation of 0.8%. This shows that, while the flow distribution between CS0006 and CS0007 varies somewhat from day to day and from hour-to-hour, the degree of variation is not severe, contrary to NSP's claims. EPA maintains that this undermines NSP's claim that the variation in the flow distribution between the stacks is too great to allow for determination of a reference flow-to-load value that reflects the long-term average value.

In view of the above considerations, EPA finds that the complex emission discharge configuration and hourly variations in the flow distribution between the stacks at Riverside Units 6 and 7 do not provide any basis for exempting the units from the quarterly flow-to-load ratio test requirements. Rather, the data analyses described above have shown that when the quarterly flow-to-load ratio evaluation is done on a combined flow and combined load basis, using unadjusted hourly flow rates, the flow-to-load test can be consistently passed. EPA therefore concludes that the petition for exemption of these units from the flow-to-load ratio test requirements should be denied.[4]

EPA also denies NSP's request for exemption from determining normal load levels for Riverside Units 6 and 7. As discussed above, although Units 6 and 7 discharge to the atmosphere through two common stacks, the range of operation and the normal load level can still be determined in a meaningful way by combining the unit loads together and applying the same approach as that used for units that exhaust through a single common stack. Based on information in EDR record type 536 of the current electronic monitoring plans for CS0006 and CS0007, the combined range of operation for Units 6 and 7 extends from 70 to 180 megawatts. Based on this, the normal load "reference" flow RATAs for the flow-to-load ratio test should be performed within the high load portion of the operating range, i.e., between 136 and 180 megawatts. As discussed above, when the quarterly flow-to-load ratio tests are performed in this way, the test can be consistently passed. At the high load level, a strong flow-to-load correlation exists between the combined flow through CS0006 and CS0007 and the combined load for Units 6 and 7.

Recommendations

Although the EPA data analysis described above has shown that the hourly variation in flow distribution between the units' stacks is not severe, the Agency has several recommendations for minimizing any possible effect that this variation may have on the value of the reference flow-to-load ratio. EPA recommends that the flow RATA reference method data for both stacks be collected either simultaneously or on the same day, during a period of stable, high load operation, with both units operating. If this is not possible, the reference data may be collected on different days, provided that the flow distribution between the stacks on both days is confirmed to be sufficiently similar. If the normal load flow RATAs are not conducted

[4] EPA notes that if these units, which are clearly able to pass the flow-to-load ratio test, were exempted from that test, the Agency might impose additional RATA requirements for the units, since there would be no substantive test ensuring that the flow monitors operate properly in between RATAs.

simultaneously, EPA recommends that at the time of both RATAs, the flow through CS0007, expressed as a percentage of the combined stack flow, be confirmed to be in the "typical" range from 49 % to 54% (as suggested by Table 2). The Agency further recommends that the two flow distributions differ by no more than a few percentage points (e.g., 51 % vs. 53 %).

EPA notes that since the 2nd quarter of 2000, NSP has been reporting flow-to-load ratio test results to EPA for CS0006 and CS0007 in the electronic quarterly reports for Riverside. Although the reported results indicate that the flow-to-load tests have been passed each quarter, the results differ from those presented in Table 1. For instance, in the 3rd quarter of 2000, EPA calculated an E_f value of 3.1% on a combined basis, while NSP reported E_f values of 4.3% and 5.7%, respectively, for CS0006 and CS0007. The exact methodology used by NSP to calculate the flow-to-load test results is not readily apparent. However, based on an examination of Riverside's EDR reports, it appears that NSP is not performing the test on a combined basis, but rather is performing a separate flow-to-load analysis for each stack, using the flow rate through the stack and an apportioned load value. It seems that the combined load for Units 6 and 7 is being apportioned in some way to the individual stacks. Further, it appears that NSP uses this same type of apportionment to report hourly load information for CS0006 and CS0007 in EDR record types 300 and 536.

Part 75 does not provide for apportioning combined unit load between common stacks. For example, for purposes of developing substitute data, section 2.2.1 of appendix C requires the owner or operator of units sharing a common stack to develop load bins based on the "combined maximum hourly gross load of all units utilizing the common stack." Also, in section 6.5.2.1 (a) in appendix A, the upper and lower boundaries of the "range of operation" for common stack configurations are generally defined in terms of the "sum of all of the..... loads of the individual units." Therefore, EPA sees no basis for NSP to attribute a specific portion of the combined unit load to the individual common stacks. Instead of apportioning the combined unit load to each stack, NSP should report the same, combined unit load for both CS0006 and CS0007. The load ranges ("load bins") used for missing data purposes at CS0006 and CS0007 should also be defined on a combined load basis. Further, in the monitoring plans for CS0006 and CS0007, the range of operation defined in record type 536 should be on a combined basis (i.e., 70 to 180 MW instead of 35 to 90 MW, as currently reported). When RATAs are performed at CS0006 and CS0007, the gross unit load reported in EDR record type 610 should be the combined unit load. Finally, all required flow-to-load ratio tests should be performed on a combined basis.

To report flow-to-load ratio test results in future calendar quarters, NSP should follow the EDR record type 605 and 606 instructions for multiple stack units in the *EDR Version 2.1 Reporting Instructions (revised as of January 24, 2000)* and the supplementary guidance given in Questions 3.38 through 3.42 of the *Acid Rain Program Policy Manual*. This guidance explains how to report the results of flow-to-load tests on a combined basis when the flue gases from a unit exit to the atmosphere through more than one stack. Even though at Riverside there are two units involved rather than one, the guidance is applicable because the flow from the units is first combined together (as though it were from a single unit) before being discharged to the atmosphere through stacks CS0006 and CS0007.

EPA's denial of the April 5, 2000 petition relies on the accuracy and completeness of the information provided by NSP and is appealable under part 78. If you have any questions about the findings and conclusions presented above, please contact Louis Nichols of my staff, at (202) 564-0161. Thank you for your continued cooperation.

Sincerely,

Brian J. McLean, Director
Clean Air Markets Division

Enclosures

cc: Constantine Blathras, EPA Region V
Steve Sommer, Minnesota PCA
Louis Nichols, CAMD

Table 1: Flow-to-Load Ratio Test Results for Riverside Units 6 and 7 (Combined Basis)

YEAR	QUARTER	AVERAGE DEVIATION FROM REFERENCE FLOW-TO-LOAD RATIO (E_F)
1998	3	4.1
1998	4	4.5
1999	1	6.2
1999	2	5.0
1999	3	8.4
1999	4	3.8
2000	1	6.4
2000	2	3.1
2000	3	3.1
2000	4	3.2
2001	1	4.9

Table 2: Flow Distribution Between CS0006 and CS0007 at Riverside for High Load Operation at 150 MW $\pm$ 10%. (Period of Data Analysis: 2nd Qtr 2000 through 4th Qtr. 2000)

PERCENTAGE OF COMBINED UNIT 6 & 7 FLOW EXHAUSTING THROUGH CS0007	NUMBER OF OPERATING HOURS AT HIGH LOAD
< 49%	50
49-51%	1247
52-54%	1880
55-57%	390
> 57%	7