BEFORE THE ENVIRONMENTAL QUALITY COUNCIL
STATE OF WYOMING

In the Matter of:	)	
Basin Electric Power Cooperative	)	Docket No. 10-2802
Air Quality Permit No. MD-6047	)	
BART Permit: Laramie River Station	)	

RESPONSE TO BASIN ELECTRIC'S MOTION FOR SUMMARY JUDGMENT

Basin Electric's Submittal, received 3/2/09

EXHIBIT 10

Chad

BASIN ELECTRIC POWER COOPERATIVE

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February 25, 2009

Mr. David Finley, Administrator
Air Quality Division
WY Department of Environmental Quality
122 West 25th Street
Herschler Building
Cheyenne, WY 82002

Dear Mr. Finley,

The Department of Environmental Quality (DEQ) notified Basin Electric in June 2006 that the Laramie River Station (LRS) was a Best Available Retrofit Technology (BART) applicable source, which required a BART engineering and modeling analysis for reducing visibility impacts in accordance with the Environmental Protection Agency's Guidelines for BART Determinations under the Regional Haze Rules (40 CFR Part 51). Visibility impacts for LRS were evaluated at two Federal Class I areas -- Badlands National Park and Wind Cave National Park.

A BART review was required to identify the best retrofit technology for the reduction of nitrogen oxides (NOx), sulfur dioxide (SO_2), and particulate matter (PM) emissions from Laramie River Station Units 1, 2 and 3. Basin Electric contracted Black & Veatch to conduct a BART analysis to identify technically feasible and cost-effective technologies following the BART Guidelines. A modeling analysis was completed to evaluate the impact on visibility in the two identified Class I areas. Reports and subsequent revisions of the BART analyses were submitted to your office on February 28, 2007; September 25, 2007; February 14, 2008; and July 24, 2008.

As a result of several discussions between Basin Electric and DEQ, Basin Electric proposes a BART limitation for NOx emissions on a plant-wide 30-day rolling average based on a pound-per-hour limitation of 4,082 pounds per hour for the station.

We are proceeding with our plans to install over-fire air (OFA) on Unit 1 this spring, Unit 2 in the spring of 2010, and on Unit 3 in the spring of 2011. In addition, we plan to upgrade to Low-NOx Burners (LNB) on Units 1, 2, and 3 in 2012, 2013, and 2014, respectively. While we anticipate emissions of 0.18 lb/mmBtu under ideal operating conditions, normal emissions are likely to be higher. Please see the attached letter from our OFA contractor, Burns & McDonnell. A letter is also attached from Black & Veatch, who performed our BART analysis, with their company's perspective on NOx emission rates with LNB/OFA.

After Basin Electric and DEQ agree on a plan, we will present it to the Missouri Basin Power Project (MBPP) management and ask approval from the project owners.

If you have any questions, please contact me at 701-557-5654 or Lyle Witham at 701-557-5652.

Sincerely,

Robert L. Eriksen, P.E.
Sr. Environmental Compliance Administrator

/gmj
Enclosures
cc: Chad Schlichtemeier, DEQ
Mike Fluharty
David Cummings
Lyle Witham

BLACK & VEATCH

MEMORANDUM

Basin Electric Power Cooperative
Laramie River Station
LNB and OFA Control Effectiveness

B&V Project 145423
B&V File 30.0000
February 24, 2009

On September 27, 2007, Basin Electric Power Cooperative (BEPC) submitted the Best Available Retrofit Technology (BART) report for Laramie River Station (LRS), which identifies the control effectiveness for NOx after the retrofit of low NOx burners (LNB) and over-fire air (OFA) at the three LRS units. The BART analysis was prepared by Black & Veatch (B&V) for BEPC.

LRS Units 1, 2, and 3 each have a 550 MW (net) capacity and are equipped with Babcock & Wilcox (B&W) sub-critical boiler and opposed-wall fired burners. In the BART report, LNB with OFA have been identified as a technically available and applicable control technology for the reduction of NOx emissions from the LRS units. The baseline NOx emission rate from the LRS units based on continuous emissions monitoring (CEM) annual emissions averages from 2001 to 2003 is 0.27 lb/MBtu.

In the BART report, the control effectiveness for LNB with OFA of 0.15 lb/MBtu was determined based on the results of a computational fluid dynamics (CFD) modeling study commissioned by BEPC and completed by a third party combustion modeling expert in 2004. The CFD model study simulated the effects of adding and optimizing OFA ports specifically for the LRS units.

Wall fired units are typically fitted with numerous burners mounted on the front and/or rear wall of the furnace. Each burner is fed coal, primary air and secondary air to safely and efficiently burn the pulverized coal fed to that burner. Primary air is the carrier for the pulverized coal fed to that individual burner and secondary air is typically fed to the periphery of the coal and primary air stream to provide sufficient oxygen for complete combustion of the coal.

To reduce the production of unintended byproducts of combustion such as NO_x, the temperature of combustion at the burner as well as the timing and mixing rate of the secondary air with the primary combustion products are controlled to limit NO_x production. In addition to reducing the peak burner flame temperatures, the general philosophy for reducing the NO_x generated from a wall fired burner is to reduce the oxygen and nitrogen that is available in the highest temperature region of the burner flame to limit the rate the fuel bound nitrogen as well as the atmospheric nitrogen is oxidized to form NO_x. Once this initial combustion has taken place at the burners, the balance of the combustion air is provided by over-fire air ports to enable complete combustion of the vaporized fuel components prior to being cooled by the radiant and convective heat transfer surfaces of the boiler. NO_x production can be minimized in the lower furnace area around the burners by limiting the total combustion air and maintaining a reducing atmosphere. This reducing atmosphere especially in the presence of sulfur in the flue gas stream can cause significant corrosive attack of the furnace heat transfer surfaces. This potential for rapid corrosion of the furnace walls, limits the staging of combustion in the lower furnace area and the effectiveness of LNB to limit NO_x production.

As well as the increased potential for fire-side corrosion of the furnace walls in the case of insufficient oxygen in the lower furnace, in a typical coal-fired boiler, there may be as many as 49 individual burners that must operate in concert to provide for the combustion of coal in this manner. To minimize NO_x formation, the quantities of coal, primary air and secondary air must be supplied in a uniform quantity to each burner. The performance of each individual burner must be maintained to minimize NO_x production to the lowest level. Due to the physical difficulty of continuously providing this equal balance of air and fuel as well as fuel fineness to each burner, this theoretical peak performance that could be achieved by one well tuned burner can not be achieved by all of the burners. This results in reduced overall NO_x emission performance.

A typical wall-fired LNB arrangement is shown in Figure 1. Also show in Figure 2 is an illustration of the typical LNB controlled NOx emissions from pulverized coal wall-fired boilers combusting various US coals.

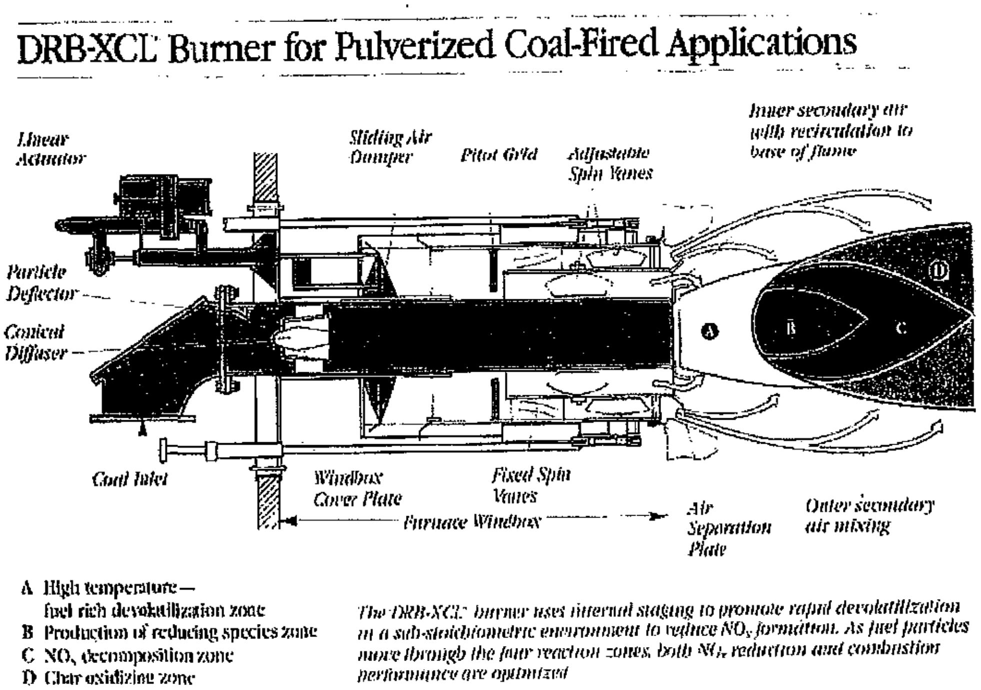

Figure 1 - Typical LNB Arrangement (source: Babcock & Wilcox)

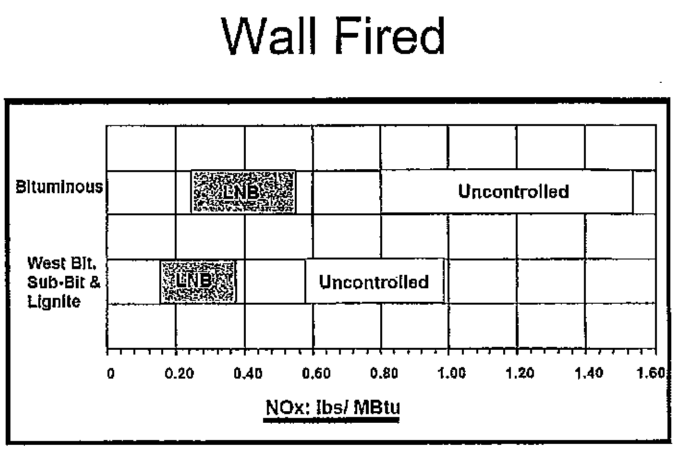

Figure 2 - Controlled and Uncontrolled NOx Emissions from PC Wall-Fired Boilers

In addition to optimizing the LNB-OFA to ensure complete burn-out of char, evaluation of NOx control effectiveness resulting from LNB-OFA system installed in an opposed-wall system needs to take into account several key boiler and combustion characteristics:

- Composition of fuel combusted
- Ability of unit to monitor air and fuel flow (for combustion optimization)
- Boiler physical design and arrangement
- Burner fuel and air balance
- Mill fineness
- Boiler management system (e.g. neural networks)
- Boiler cleaning technologies.

While the CFD model study of the burner with OFA at LRS units considered the items listed above, it assumes a steady-state condition with all these process variables that might impact the production of NOx from the LRS units. At steady-state operation, and with operation to optimize all boiler and combustion characteristics to minimize the production of NOx, an outlet NOx of 0.15 lb/MBtu was determined to be achievable based on the design of the optimized OFA ports.

Therefore, this outlet NOx value is dependent on the LRS boilers/combustion process operating at a steady-state condition, while maintaining an even/optimum combustion air and fuel distribution, with little variation in the composition of the fuel and the fineness out of the coal mills. However, in actual operating conditions, this optimized, steady-state condition can seldom be maintained. Therefore, the controlled outlet NOx of 0.15 lb/MBtu should be classified as a theoretical, lowest achievable outlet NOx when the operating conditions approach the optimum conditions used for the modeling inputs.

In addition to that, a review of the CFD model study recently identified an error with the use of sea-level conditions (for combustion air barometric pressure), when the LRS units are located in an area with an elevation much higher than sea-level. This resulted in the CFD model study based on combustion air that is denser than actual. This impacts the modeled NOx outlet of 0.15 lb/MBtu since denser combustion air is more favorable to minimize the production of NOx during combustion. The correction to the lower flue gas density also reduces the furnace residence time so will increase the potential for excessive unburned char from combustion. To reduce the char and associated slagging, fouling and corrosion, the level of staging in the lower furnace will be reduced as well as the quantity of over fire air flow. This will reduce the performance of the LNB system.

The CFD model expert estimated that a 5% error was introduced into the CFD model study results.

Since the assumptions used to develop the CFD model study was based on optimum and steady-state conditions, which cannot be maintained during normal operations of the LRS boilers, with the impacts of the error introduced by the use of a wrong basis on the density of combustion air, the controlled NOx outlet after the retrofit of LNB-OFA is expected to be higher than the result of the original CFD model study of 0.15 lb/MBtu. For BART, the control effectiveness for NOx should be based on a demonstrated and achievable level. Since BEPC is currently considering LNB with OFA retrofits at the LRS units, the most recent CFD combustion model study performed in 2008 will be more representative than the values reported in the BART analysis report submitted in 2007. It was identified that the controlled outlet NOx from this recent model is 0.18 lb/MBtu with an accuracy of 20%. This range of accuracy is consistent with predicted model information when verified by an actual test from our experience. In addition to the results of this recent combustion model, an evaluation of reported CEM data from 2005 to 2006 indicated that several wall-fired boilers combusting subbituminous coal equipped with LNB-OFA demonstrated a 30-day rolling average NOx ranging from 0.18 to 0.21 lb/MBtu.

Burns & McDonnell
SINCE 1898

January 5, 2009

Mr. Myron Singleton
Basin Electric Power Cooperative
P.O. Box 489 – 347 Grayrocks Road
Wheatland, Wyoming 82201-0489

Laramie River Station
BMcD Project No. 49864
Expected NO_x Performance Evaluation

Dear Mr. Singleton:

We are pleased to submit the expected NO_x performance evaluation for Basin Electric Power Cooperative (BEPC) Laramie River Station. This letter describes expected NO_x emissions for the Laramie River Station with the implementation of new Low NO_x Burners (LNB) and new overfire air systems (OFA).

Burns & McDonnell was selected to design and furnish a new overfire air system for Unit 1 at Laramie River Station. BEPC's objective for the overfire air project is to achieve a NO_x emission rate below 0.19 lb/mmBtu by 2010. During the overfire air system design, a question was raised regarding achieving a lower NO_x emission limit of 0.15 lb/mmBtu on a 30 day rolling average basis. The purpose of this evaluation is to predict performance of the units with new LNB and OFA.

Laramie River Station includes three 570 MW opposed wall fired Babcock & Wilcox boilers located in Wheatland, Wyoming. Each Unit has 49 burners, which are fired with Powder River Basin (PRB) fuel by 7 MPS pulverizers. Unit 1 is being retrofitted with a new overfire air system, which includes a guaranteed performance of 0.19 lb NO_x/mmBtu.

Based on several sources of information, Burns & McDonnell believes it is not feasible to install new LNB with OFA with a resulting NO_x emission rate of 0.15 lb/mmBtu on a 30 day rolling average basis. The sources of information mentioned are as follows:

- Burns & McDonnell experience on several other similar projects,
- Recent computational fluid dynamic (CFD) modeling performed by Reaction Engineering for the Unit 1 OFA project,
- A survey of all other similar coal fired units that report emissions to the EPA.

Burns & McDonnell Experience
Burns & McDonnell has performed numerous NO_x reduction projects around the United States for virtually every boiler type firing various fuels. Specific parameters that affect NO_x

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emissions are: boiler type (wall fired, T- Fired, Cyclone, Cell burner, Turbo Fired), fuel type (bituminous coal, sub-bituminous coal, lignite, natural gas, pet coke, fuel oil), boiler physical dimensions (boiler plan area and height, residence time of boiler gases), control technology implemented (LNB, OFA, SNCR, SCR). From a review of performance on projects with similar boiler type (wall fired), similar fuel (sub-bituminous PRB Coal), similar boiler dimensions and similar control technology implemented (LNB + OFA), there are similar performance trends that can be seen. NO_x emissions from these projects range from 0.19 to 0.28 lb/mmBtu.

It should be noted that there are differences between actual performance, predicted performance, performance guarantee and permitted emission limit. These terms have different meanings and carry with them increasing commercial ramifications as you move down the list. Other variables that have to be taken into consideration are the amount of excess air fired, which mills/burners are in service, whether the unit operates at steady load or cycles up and down, what other constraints are present such as carbon monoxide limits, unit operational problems, LOI concerns, slagging and fouling concerns, overall operating balance, mill performance, operator preferences, the level of instrumentation and operational flexibility that exists with the equipment, and variability in fuel quality. Add to that whether or not the reported emission parameter is based on an averaging period or an instantaneous measurement. The point of all this is to say that there are many things that affect the final measured number and contribute to the successful outcome of a project.

Burns & McDonnell strives to engineer the complete system to achieve consistent performance over long periods of operation for reasonable cost. There is always a balance between operational flexibility from all the "bells and whistles" and overall cost.

Computational Fluid Dynamic Modeling

The purpose of an overfire air (OFA) system is to reduce NO_x emissions from the boiler by staging the combustion process. A portion of the secondary air is diverted from the burner front to a series of OFA ports that are located above the burners. As a result, the burners are fired with less air than originally designed. If the amount of air admitted to the burners is less than the amount theoretically required to completely burn the coal, the burners are said to be firing substoichiometrically. In substoichiometric firing, the oxygen deficiency results in a portion of the fuel converting to CO. As the CO leaves the burner front and migrates up the furnace, it comes in contact with NO_x, which is also formed during combustion. The NO_x, which is thermally unstable at temperatures above 2400°F, readily gives up its oxygen to the CO, thus reducing the NO_x into elemental nitrogen. This NO_x reducing action continues throughout the furnace, until the gases reach the elevation of the OFA nozzles. At this point, further NO_x reduction stops as the OFA is admitted into the furnace to complete the burnout of any remaining high levels of CO into CO_2.

As part of the overfire air system design, Reaction Engineering (REI) was hired to develop a computational fluid dynamic model of the Laramie River Station Unit 1 boiler. REI has modeled many coal fired utility boilers in the past ten years and Burns & McDonnell has used REI's services many times over that period. The CFD model is not an exact representation of the actual combustion and heat transfer occurring within the boiler but it has proven to be a useful tool to aid in the design process. The model predicts performance of a combustion system. The exact predicted numbers can be compared to actual performance after new equipment is installed but the typical use of the model is to test or evaluate various ideas in order to compare results quickly and inexpensively as compared to actually building each option and comparing the results after each is tried.

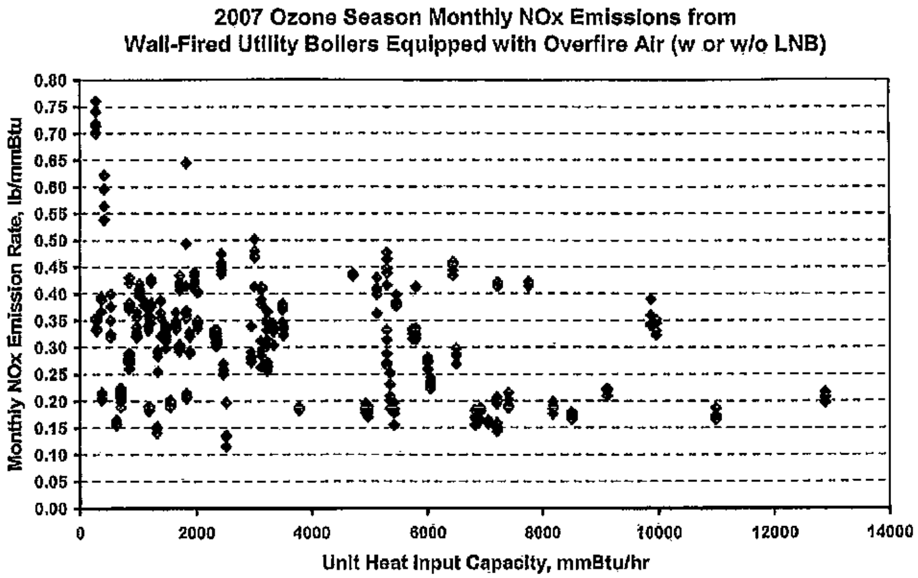
The Laramie River Unit 1 model was used to refine the overfire air design. Several cases were run with different overfire air configurations, different burner zone stoichiometries, as well as simulated existing and new burners. The predicted results show the baseline NO_x emissions at 0.30 lb/mmBtu NO_x and with OFA 0.18 lb/mmBtu NO_x. The model predicted NO_x with new burners and OFA at 0.18 lb/mmBtu also. These results, along with our experience on other projects helped provide confidence to Burns & McDonnell's OFA performance guarantee offering of 0.19 lb/mmBtu per the conditions described in the proposal.

Achieving a certain level of performance after a new system is installed is one thing while consistently achieving performance under many conditions over a long period of time is something completely different. Combustion tuning efforts are directed at parametrically developing a stable set of operating characteristics that can be used to achieve the best performance. Over time, a boiler that was tuned can drift because of a multitude of parameters such as fuel quality, furnace cleanliness, pulverizer performance and load conditions, along with many others. It is not realistic to assume that a tuned boiler can be operated at that point indefinitely. The goal is to provide a system with enough flexibility and control to maintain acceptable performance over time.

The CFD model predictions are based on a long list of parameters and assumptions. It has been our experience that the CFD model is a good tool for predicting trends as mentioned earlier but it is very risky to assume the predicted results will manifest after the equipment is installed. In other words, even if the CFD model had predicted 0.15 lb/mmBtu, taking that number from predicted performance to guaranteed performance and permit emission level would be inappropriate. Burns & McDonnell has seen other system suppliers and vendors guarantee extremely low emission levels but with no real science or engineering behind the guarantee and most importantly with plenty of loopholes and inconsequential penalties offered.

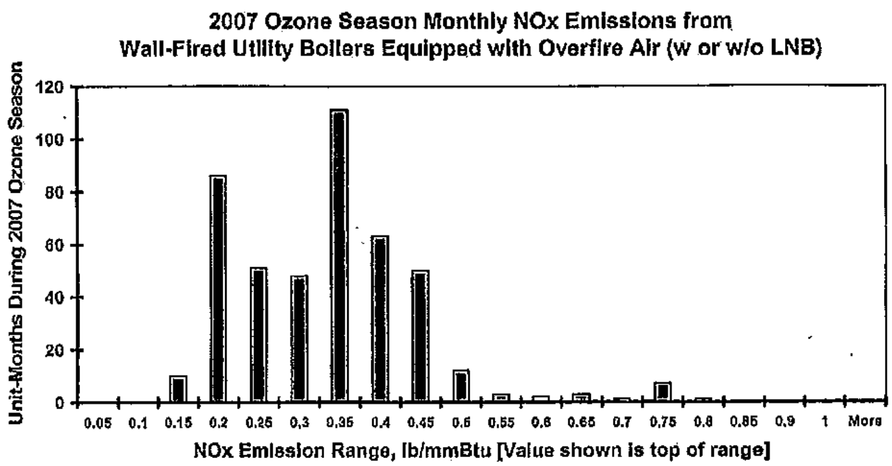
<u>Survey of Utility Boilers</u>
The EPA Acid Rain program database includes emissions data from all emission sources that fall under the program. Coal fired utility boilers are required to monitor and report this data using a certified and continuous emissions monitoring system. This data has been reported since 1995 when the Clean Air Act Amendments of 1990 mandated the 40 CFR Part 75 rules for monitoring and reporting of emissions from regulated sources.

Burns & McDonnell gathered data from all dry bottom wall fired boilers in the United States that were reported in the database to have overfire air (with or without LNB) installed as the primary NO_x control technology in operation. Units with SCR or SNCR were eliminated from the data. The data collected was from the months of May 2007 through September 2007. This was done to simulate 30 day periods when the utility would have been trying to run with low NO_x because of the Ozone season NO_x program. This analysis yielded 448 data points with each point representing the NO_x emission rate reported by a given facility for one month.



In the chart above, there are very few data points that are at or below 0.15 lb/mmBtu. Recall that each point represents the average emission from a given unit for a one month period. The data points are all from May through September 2007. Each unit that was in operation over that period results in five data points on the graph. For purposes of the analysis, units with less than 300 hours of operating data were excluded from the analysis for that month.

To get a better indication of the NO_x emissions achieved by the existing fleet of wall-fired utility boilers, the same data was re-plotted in histogram form as shown below.



Note that out of 448 data points, just 10 are in the range from >0.10 lb/mmBtu to 0.15 lb/mmBtu. Of the low-emitting units (those with monthly emissions of 0.20 lb/mmBtu or less), 90 percent of the data points fall into the >0.15 lb/mmBtu to 0.20 lb/mmBtu range.

A closer look at the 10 data points at 0.15 lb/mmBtu or below reveal that only three units operated in this range for one or more months during the 2007 ozone season. These three are Big Cajun 2 Unit 3, Big Sandy Unit 1 and Neil Simpson II Unit 1. Based on this review, it is highly unlikely that a wall fired dry bottom boiler would achieve 0.15 lb/mmBtu on a monthly basis and given the pattern of the data, a unit that makes that low of an emission rate is likely an outlier from the data set because of something not included in the data such as fuel type, additional control technology being tested, low load operational problems, etc.

Conclusions

The predicted NO_x emissions after the implementation of new LNB and OFA is likely to be 0.18 lb/mmBtu plus or minus 0.02 depending on which mills are in service and several other operational variables. This is based on Burns & McDonnell's previous experience on similar projects, also the CFD modeling work that has been done by Reaction Engineering and the survey of other wall fired units data as reported to the EPA acid rain program database. To reiterate an earlier point, predicted performance as mentioned above should not be confused with guaranteed performance or permitted emission levels. An appropriate emission limit should take into account normal operation variability over the proposed 30 day rolling average. Burns & McDonnell believes the presumptive limit of 0.23 lb/mmBtu is an appropriate number for the Laramie River Station 30 day rolling average NO_x emission limit.

Please contact us to discuss this evaluation in further detail at your convenience. We look forward to assisting BEPC further and Burns & McDonnell is prepared to help in any way. Please advise if you have any questions or comments.

Sincerely,

Carl V. Weilert

Carl V. Weilert, P.E.
Principal Air Pollution Control Consultant

Stephen W. Voss, P.E.
Plant Services Manager