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ATTORNEYS FOR BASIN ELECTRIC
POWER COOPERATIVE

FILED
JUN 30 2010
Jim Ruby, Executive Secretary
Environmental Quality Council

BEFORE THE ENVIRONMENTAL QUALITY COUNCIL
STATE OF WYOMING

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

Basin Electric Power Cooperative's Memorandum in Support of Motion for Summary Judgment

The Department of Environmental Quality (DEQ) properly issued a Best Available Retrofit Technology (BART) permit for Basin Electric's Laramie River Station, but improperly imposed a condition (number 16) in that permit not related to BART but related instead to what is known as a Long-term Strategy . Both BART and Long-term Strategy relate to reducing regional haze (visibility impairment) in Class I areas (national parks and wilderness areas), but there is a great difference between the requirements, procedures and scope for BART compared to Long-term Strategy and the two cannot be lumped together in a BART permit. DEQ's insertion of a Long-term Strategy condition into a BART permit failed to follow the procedural and substantive requirements that must be followed to adopt a Long-term Strategy. DEQ

ignored those requirements, and its actions were not in accordance with law. Basin Electric seeks relief from these errors.

I. EPA's Regional Haze Rule has Three Key Components, but Only One Component (BART) Applies to BART Permits

EPA published its Regional Haze Rule (RHR) on July 1, 1999, and this Rule is designed to improve visibility in mandatory Class I areas—these are designated national parks and wilderness areas.[1] Regional haze refers to visibility impairment that is caused by the cumulative emissions from numerous sources over a wide geographic area, as distinguished from impairment attributable to one source or a small group of sources.[2] The RHR requires states to submit to EPA for approval State Implementation Plans (SIPs) to address regional haze and improve visibility in Class I areas (Regional Haze SIPs or RHR SIPs).[3]

Regional Haze SIPs are intended to reach the goal, established in the RHR, of reaching natural visibility conditions in Class I areas by the year 2064.[4] Progress towards this goal is to be achieved by means of a series of Regional Haze SIPs to be submitted periodically over time. The first SIP was due on December 17, 2007[5], and revisions are due on July 31, 2018 and every

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[1] 64 Fed. Reg. 35714.

[2] *Id.*

[3] 40 C.F.R. § 51.308, codified at 40 C.F.R. Part 51, Subpart P.

[4] 64 Fed. Reg. at 35731.

[5] 40 C.F.R. § 51.308 (b). The majority of states have not met the SIP filing deadline. In January 2009 EPA published a finding that 37 states and the District of Columbia had failed to file SIPs meeting all requirements of the RHR by the December 2007 deadline, and noting that EPA is required to promulgate a Federal Implementation Plan within 2 years of publication of the finding if states have not submitted Regional Haze SIPs and EPA has not approved them by that time. 74 Fed. Reg. 2392 (January 15, 2009).

10 years thereafter.[6] The first round of Regional Haze SIPs must address the first planning period, ending on July 31, 2018.

One of the elements that must be included in Regional Haze SIPs is a requirement for certain existing major sources to meet emission limitations for visibility-impairing pollutants that represent Best Available Retrofit Technology (BART).[7] DEQ determined that the Laramie River Station (LRS) is one of the existing major sources that is subject to BART and requested Basin Electric to conduct an analysis of BART options. Basin Electric conducted and submitted this analysis, and DEQ issued a BART permit requiring emission reductions for the LRS.

The other two primary elements besides BART that must be included in Regional Haze SIPs are Reasonable Progress Goals (RPGs), which establish targets for improving visibility, and Long-term Strategies which include measures for meeting the Reasonable Progress Goals.[8] These elements are very different from the BART requirement, both substantively and procedurally. BART is applied to individual facilities on a case-by-case basis, whereas RPGs and Long-term Strategies are elements that apply broadly to visibility impacts from many sources of visibility impairment, not just those subject to BART.

This appeal does not challenge any condition of the LRS BART permit *that pertains to BART*; it challenges only the one condition that erroneously seeks to impose emission limits based on a Long-term Strategy not yet adopted by the State of Wyoming.

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[6] 40 C.F.R. § 51.308(f)

[7] 40 C.F.R. § 51.303(e). BART is required for facilities in listed categories that were not in operation in August 1962 but were in existence or permitted by August 1977 and are determined to cause or contribute to visibility impairment in Class I areas.

[8] 40 C.F.R. § 51.308(d)(1), (3).

II. The BART Permit for the Laramie River Station Contains BART Limits but Erroneously Attempts to Impose Limits that are Beyond BART

Wyoming makes BART determinations by issuing BART permits. Once DEQ has identified sources subject to BART, WAQS&R Chap. 6, Section 9(d), those sources must submit to DEQ applications for BART permits. *Id.* Section 9(e). The application must include an analysis of emissions control options pursuant to EPA's BART Guidelines at 40 C.F.R. Part 51, App. Y, which are incorporated by reference in Wyoming's air quality regulations at Chap. 6, Section 9(c). After an opportunity for public comment, DEQ issues a BART permit. Chap. 6, Section 9(e).

By letter dated June 14, 2006, DEQ notified Basin Electric that the Laramie River Station (LRS) is subject to BART. LRS has three coal-based electrical generating units: Unit 1 (570 net megawatts) began operating in 1980; Unit 2 (562 net megawatts) began operating in 1981; and Unit 3 (570 net megawatts) began operating in 1982.[9] Responding to the notification from DEQ, on March 5, 2007 Basin Electric submitted a BART application for the LRS. Basin Electric submitted additional information regarding the permit application between February 15, 2008 and March 16, 2009. On May 28, 2009, DEQ issued its LRS BART analysis, including proposed permit conditions for the LRS BART permit.[10] DEQ published notice of the proposed

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[9] DEQ BART Application Analysis, AP-6047, May 28, 2009 (LRS BART analysis), attached as Exhibit A, at p. 3.

[10] BART determinations are made on a case-by-case basis, and must be based on an analysis of the best system of continuous emission control technology available for the source, taking into consideration six factors: (1) the available technology; (2) the costs of compliance; (3) the energy and nonair quality environmental impacts of compliance; (4) any pollution control technology in use at the source; (5) the remaining useful life of the source; and (6) the degree of improvement in visibility which may result from the use of the control technology at that individual source. 40 C.F.R. § 51.308(e)(1)(i); WAQS&R Chap. 6, Section 9. The determination of BART for fossil-fueled power plants having a total generating capacity greater than 750 megawatts (such as the LRS) must also be made pursuant to EPA BART Guidelines, (cont'd)

permit on June 3, 2009 and provided a 65-day period for public comment, ending on August 6, 2009.[11] Additionally, a public hearing on the proposed permit was held on August 6, 2009.[12] DEQ then issued the final LRS BART permit which was received by Basin Electric by mail on January 11, 2010.

The LRS BART permit established emission limitations, including limits for nitrogen oxides (NOx). BART for NOx for each of LRS Units 1-3 was determined to be 0.23 lb/MMBtu, averaged over a rolling 30-day period, based on installation of new low-NOx burners and overfire air as BART control technology.[13] This 0.23 lb/MMBtu limit is also the presumptive BART limit for the type of boilers at the LRS, established by EPA in its BART Guidelines.[14] An agency may establish an alternative control level in lieu of the presumptive limit, based on careful consideration of the six statutory BART factors. DEQ, however, after considering these statutory factors, determined that the presumptive level of 0.23 lb/MMBtu of NOx emissions constituted BART for the LRS Units, and imposed this emission limit on each of the three Units – *as BART* – which is a fact critical to this appeal.

DEQ's reasons for this BART determination include: (1) the presumptive limit would result in NOx emission reductions of 5645 tons per year; (2) consideration of the costs of compliance and existing pollution control equipment; (3) new low-NOx burners with overfire air, needed to achieve the BART limits, would be cost-effective; (4) the additional capital cost

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which provide additional information about how to make BART determinations in accordance with the foregoing factors. 40 C.F.R. Part 51, App. Y.

[11] Permit No. MD-6047, BART Permit for the Laramie River Station, dated December 31, 2009 (LRS BART permit), attached as Exhibit B, at pp. 1-2.

[12] *Id.*

[13] LRS BART permit, Ex. B, at p.2.

[14] 40 C.F.R. Part 51, App. Y, § IV.E.5.

for installing Selective Catalytic Reduction (SCR) to achieve greater reductions would exceed $100 million for each of the three units, and the increased annual operating costs for SCR would be $4.6 million per Unit; (5) chemical reagents for SCR would require environmental mitigation; (6) SCR would consume almost 5 megawatts of power from each unit; and (7) additional visibility improvement from SCR would be small.[15]

Basin Electric does not contest this BART limit for NOx, or any of the other BART Permit Conditions 1 through 15, which include not only emission limits but also requirements for installing low NOx burners with overfire air on Units 1 through 3, performance testing, ongoing monitoring of compliance, and record keeping. Basin Electric's sole challenge to the BART permit is to Condition 16, *which has nothing to do with BART*, but rather purports to impose requirements regarding NOx emissions under the Long-term Strategy of Wyoming's Regional Haze SIP—a Long-term Strategy that has not yet been determined or adopted.

III. Condition 16 Exceeds the Requirements for BART

Condition 16 of the LRS permit requires Basin Electric to submit future applications for the installation of additional add-on NOx controls on two Units at the LRS. This requirement is said to be prescribed pursuant to the Long-term Strategy of the Wyoming Regional Haze SIP. The applications must include an analysis of the "four statutory factors" and associated visibility impacts for each proposed NOx control technology and resulting emissions. The application

[15] LRS BART Analysis, Ex. A, at pp. 42-43. The combined benefit at *both* Wind Cave and Badlands National Parks, added together, would be approximately one-half of one deciview for each LRS Unit, which is about one-half the one deciview change that is humanly perceptible. 70 Fed Reg. 39104, 39120 (July 6, 2005). Of course, the combined improvement is not an actual improvement in observable visibility, but is a theoretical number that adds together the predicted observable improvement at two different locations. Thus, installing SCR to further reduce NOx emissions would cost more than $100 million per unit and result in a predicted visibility improvement that is a fraction of what is humanly perceptible.

must "address each add-on NOx control as a system of continuous emissions reduction achieving the lowest viable NOx emission, not to exceed a maximum of 0.07 lb/MMBtu on a 30-day rolling average as measured by a certified CEM." The additional add-on NOx controls must be installed on one Unit by December 31, 2018 and on a second Unit by December 31, 2023.

IV. Summary Judgment to Delete Condition 16 from the BART Permit is Appropriate

Summary judgment is appropriate when there is no genuine issue of material fact and the moving party is entitled to judgment as a matter of law. WYO. R. CIV. P. 56. The purpose of summary judgment is to dispose of cases before trial that present no genuine issues of material fact. *Markstein v. Countryside I, LLC*, 77 P.3d 389, 393 (Wyo. 2003). A fact is material if proof of that fact would have the effect of establishing or refuting one of the essential elements of a cause of action or defense asserted by the parties. Schuler v. Community First Nat. Bank, 999 P.2d 1303, 1304 (Wyo.2000). Rule 56 and these standards for summary judgment apply to administrative cases, *Rollins* v. *Wyoming Tribune Eagle,* 152 P.3d 367, 370 (Wyo. 2007), and the Council has recognized and exercised its power to grant summary judgment in previous cases when summary judgment was appropriate, as it is here.

Where there are no genuine issues of material fact, as is the case here, summary judgment requires strict application of the law. *See Board of County Comm'rs of County of Laramie* v. *City of Cheyenne,* 2004 WY 16, ¶ 8; 85 P.3d 999, 1002 (Wyo. 2004). There are no genuine issues of material fact that bear on the issue of DEQ's lack of authority to impose non-BART requirements in a BART permit. Condition 16 violates the substantive and procedural requirements of both Wyoming and federal law. In short, DEQ has arbitrarily inserted into the BART permit a non-BART limitation based on a not yet existent Long-term Strategy. A Long-term Strategy is subject to very different procedures and substantive requirement than BART and DEQ, by including it in the BART permit, has not acted in accordance with law, has acted in

excess of statutory authority, and has acted without observance of procedure as required by law, all in violation of Wyoming's Administrative Procedure Act, W.S. 16-3-114(c)(ii)(A), (C) and (D). There is no need to waste Council and party resources on discovery and a hearing when DEQ improperly imposed Condition 16 without authority or proper procedure to do so.

V. DEQ Lacks the Authority to Impose a Long-term Strategy Emission Limit in a BART Permit

The LRS BART permit was issued pursuant to WAQS&R Chapter 6, Sections 2 and 9.[16] Chapter 6, Section 2 sets forth the general rules for permits for construction, modification and operation of emission sources, and Section 9 sets forth the specific rules for BART permits. Neither Section includes any provision or authority for issuing permits to implement any Long-term Strategy for Regional Haze, or for imposing Long-term Strategy emission limits in BART permits. DEQ cited no provision in Wyoming law that authorizes it to establish Long-term Strategy emission limits by means of a permit, and there is no mention of Long-term Strategy permits in Wyoming statutes or regulations. *A BART permit is issued to impose BART limits. That is its sole purpose.*[17] Long-term Strategy provisions are beyond the scope of the BART permit rule. Nothing in any Wyoming permit regulation authorizes DEQ to include Condition 16 in the LRS BART permit. DEQ's insertion of a Long-term Strategy condition into a BART permit is inconsistent with DEQ's rules, requiring reversal under a longstanding Wyoming requirement that agencies are bound to follow their own rules.[18]

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[16] LRS BART permit, Ex. B, p 1.

[17] WAQS&R Chap. 6, Section 9(e).

[18] *State v. Buggy Bath Unlimited, Inc.*, 18 P.3d 1182, 1188 (Wyo. 2001) ("administrative agency must follow its own rules and regulations."); *See RME Petroleum Co. v. Wyo. Dep't. of Rev.*, 150 P.3d 673, 688 (Wyo. 2007)(agency that does not follow its own rules will "face reversal of its action").

The BART permit rule at WAQS&R Chap. 6, Section 9, was adopted on October 9, 2006 as a "new section . . . .to meet the BART requirements of the Regional Haze Rule . . ."[19] It was necessary to adopt this rule in order to utilize BART permits as the vehicle for establishing BART limits in Wyoming, because previously there was no provision that authorized permits for this purpose. No similar rule has been adopted authorizing the issuance of permits to impose Long-term Strategy emission limits. In fact, no rule has been adopted yet in Wyoming regarding any aspect of the RHR Long-term Strategy.[20]

Pursuant to the federal RHR, Wyoming is required to adopt a Regional Haze SIP that includes a Long-term Strategy. This requirement does not, however, authorize DEQ to fulfill this obligation by means of BART permits or the permitting process. Whatever the appropriate procedure for adopting a Regional Haze SIP and Long-term Strategy, a BART permit is not the vehicle authorized in Wyoming for accomplishing this objective.

VI. Future Long-term Strategy Requirements that Might be Imposed on the LRS, if any, Must be Addressed Through the Regional Haze SIP Process

A Long-term Strategy is a required part of a state's Regional Haze SIP, and Basin Electric does not argue that Wyoming should not develop and adopt its Long-term Strategy as part of its SIP. However, as explained above, the limited purpose of the BART permit for the LRS is to determine what is BART and make the installation of BART controls enforceable, not to impose Long-term Strategy requirements.

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[19] Environmental Quality Council, Statement of Principal Reasons for Adoption, filed October 10, 2006, attached as Ex. C.

[20] WAQS&R Chapter 9 directs the Air Quality Division to establish and periodically revise a long-term strategy for certain visibility impacts on Class I areas. However, by its terms Chapter 9 applies solely to "plume blight impairment in Class I areas", which is impairment attributable to a single source or small group of sources. It does not address Regional Haze, and does not provide for issuance of permits to address plume blight impairment.

DEQ did develop a draft Regional Haze SIP and took public comment on the draft beginning in August 2009.[21] That draft included consideration of many sources and factors for purposes of proposing Reasonable Progress Goals and a Long-term Strategy. It also included provisions for the LRS similar to the provisions of Condition 16. However, no final action has been taken to adopt the Regional Haze SIP for Wyoming or the Long-term Strategy provisions thereof. If additional requirements beyond BART are to be imposed on the LRS, the vehicle for doing so would be the proper and complete development and adoption of the Regional Haze SIP. The LRS BART permit cannot legally substitute as the vehicle for considering beyond-BART requirements.

Basin Electric does not agree with all the provisions of DEQ's draft RHR SIP and specifically disagrees with the draft provisions regarding the LRS that mirror Condition 16. The merits of those provisions, and whether they are consistent with the RPG and Long-term Strategy provisions of the RHR or are otherwise valid, can and should be debated in another forum through the RHR SIP process. That process is not completed, and no RPG or Long-term Strategy has been finalized by Wyoming. Even without the fatal flaws of including Long-term Strategy provisions in the BART permit which are discussed above, including Long-term Strategy provisions in Condition 16 before a Long-term Strategy has been determined in the RH SIP process is premature. If Wyoming seeks to impose Long-term Strategy conditions on the LRS, it should do so in the Regional Haze SIP process.

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[21] The draft Regional Haze SIP is available at deq.state.wy.us/aqd/308%20SIP/308%20SIP%20Draft8-25-09.pdf. It is not clear what is the status of the draft RHR SIP. There is no link to the draft on DEQ's Regional Haze web page.

VII. The LRS BART Permit Also Fails to Meet the Procedural or Substantive Requirements for a Long-term Strategy

Although they are both elements of a Regional Haze SIP, BART and the Long-term Strategy elements are very different things –DEQ cannot sidestep those differences by imposing a Long-term Strategy condition in a BART permit, or imposing a Long-term Strategy condition without complying with Long-term Strategy requirements. The procedures and the substance that apply to BART do not satisfy the requirements for a Long-term Strategy and therefore do not support or justify the Long-term Strategy provisions in Condition 16. BART is a requirement imposed on *individual sources* on a case-by-case basis, and it is appropriate to use an individual permitting process to establish BART emission limits.[22] A Long-term Strategy for Regional Haze, on the other hand, is not a case-by-case matter for individual sources but must instead consider visibility impacts and potential visibility improvements from a *broad range of sources*. The Long-term Strategy process must be "informed by input from all stakeholders,"[23] and no such process occurred for the LRS BART permit. As noted above, the BART permitting rule does not authorize Long-term Strategy conditions in BART permits. And even if a Long-term Strategy could be adopted through a permitting process – which it cannot – a Long-term Strategy must also consider several substantive factors that were not considered at all in the LRS BART permit process. This substantive defect is a separate and independent reason why Condition 16 is invalid.

In the RHR, a Long-term Strategy is closely related to Reasonable Progress Goals. A Reasonable Progress Goal (RPG) is a goal for improving visibility in Class I areas over a given

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[22] WAQS&R Chap.6, Section 9(b).

[23] Regional Haze Regulations, Final Rule, 64 Fed. Reg. 35714, 35731 (July 1, 1999).

planning period.[24] In setting RPGs, states must consider the cost of compliance, the time necessary for compliance, the energy and nonair quality environmental impacts, and the remaining useful life of any potentially affected source. If an RPG is set at a rate slower than necessary to attain natural conditions by 2064 (the Uniform Rate of Progress, or URP), the state must demonstrate that the URP is not reasonable. The first RH SIP planning period ends in 2018, and therefore Reasonable Progress Goals for the current development of RHR SIPs are goals for 2018.[25]

The Long-term Strategy is the plan for achieving the RPGs, and must include emission limitations and other measures for a broad array of sources as necessary to attain that end. Federal regulation outlines the following requirements for a Long-term Strategy.[26] In devising a Long-term Strategy, a state must identify the baseline emission inventory for all visibility-impairing sources, not just a single source. The Long-term Strategy must consider all types of sources, including stationary, minor, major, mobile, and area sources. The Long-term Strategy must consider emission reductions due to ongoing air pollution control programs; measures to mitigate the impacts of construction activities, source retirement and replacement schedules; smoke management techniques for agricultural and forestry management purposes; enforceability of emissions limitations and control measures; and the anticipated net effect on visibility due to projected changes in point, area and mobile source emissions over the planning period. In developing its Long-term Strategy, the state must consult with other states that contribute to visibility impairment in Class I areas within its boundaries; include all measures

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[24] 40 C.F.R. §51.308(d)(1).

[25] 64 Fed. Reg. at 35732.

[26] 40 C.F.R. § 51.308(d)(3).

necessary to obtain its share of emission reductions to meet RPGs in other states; and document the basis, including modeling, monitoring or other means, on which it relies to determine its share of emission reductions necessary to achieve RPGs.

It is clear from the above requirements that a Long-term Strategy must be an *overall plan* for improving visibility in Class I areas that considers *many sources* and *many factors*, and cannot be devised for a single isolated source by itself, ignoring the visibility impairment caused by all the other sources. The problem with Condition 16 is that it seeks, under the guise of a Long-term Strategy, to establish NOx emission limits for the LRS *by itself* through a future permit application process, and specifies a maximum emission rate for the LRS *by itself.* The LRS BART permitting process did not identify, consider, analyze or evaluate the broad number of sources and factors required to develop a Long-term Strategy. In addition to the procedural flaws, these substantive errors preclude the inclusion of Long-term Strategy emission limits in the LRS BART permit.

The LRS BART Analysis, Ex. A, properly considered the five BART factors in determining BART for NOx for the LRS, which is 0.23 lb/MMBtu. However, there was no Long-term Strategy analysis or evaluation of any kind. There was no mention of other major, minor, area or mobile sources, no discussion of RPGs, no mention of consultation with other states, and no modeling of what is necessary to attain RPGs. The NOx visibility modeling for the BART permit included only impacts of the LRS. No other source was modeled, and even the modeling of LRS impacts was limited to impacts on Class I areas outside of Wyoming and did not consider Class I areas in Wyoming.

Condition 16, by its terms, imposes Long-term Strategy emission limits, but it does so without the process, analysis and evaluation required for a Long-term Strategy. Lacking any

support in the permitting record and failing to comply with the procedural and substantive requirements for a Long-term Strategy, Condition 16 cannot stand.

VIII. DEQ Lacks Authority to Impose the "Lowest Viable" Emission Standard in Condition 16, and DEQ Provided No Explanation for the 0.07 lb/MMBtu Emission Limit

Condition 16 requires Basin Electric to submit a future permit application for additional add-on NOx controls that (a) includes an analysis of the "four statutory factors" for RPGs and the associated visibility impacts of such controls and (b) addresses NOx controls that achieve the "lowest viable" NOx emissions, not to exceed 0.07 lb/MMBtu. There is no federal or Wyoming statute or regulation that adopts or authorizes a "lowest viable" criterion for emission standards.

None of the RHR provisions, whether for BART, RPG or Long-term Strategy, requires achievement of a "lowest viable" emission rate, and DEQ lacks statutory authority to impose such a limit.[27] Nothing in Condition 16 defines "lowest viable". Nothing explains the basis of the requirement to reduce NOx emissions to no more than 0.07 lb/MMBtu. It is not BART, because the DEQ determined that BART is 0.23 lb/MMBtu. It is not a Long-term Strategy limit because no Long-term Strategy analysis or justification is provided. Lacking any basis, it is arbitrary.

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[27] As a creature of the legislature, an administrative agency has only the powers granted to it by statute, and the justification for the exercise of any authority by the agency must be found within the applicable statute. A statute will be strictly construed when determining the authority granted to an agency. Any agency decision that falls outside the confines of the statutory guidelines articulated by the legislature is contrary to law and cannot stand. In other words, reasonable doubt of the existence of a power must be resolved against the exercise thereof. A doubtful power does not exist. *In re LePage,* 18 P.3d 1177, 1180 (Wyo. 2003)(internal citations omitted).

IX. Conclusion

Condition 16 suffers from multiple legal flaws. A BART permit is an improper vehicle for adopting Long-term Strategy limits, and DEQ violated its rules and exceeded its authority in imposing Long-term Strategy limits in the LRS BART permit. DEQ further failed to comply with the procedural and substantive requirements for Long-term Strategy when imposing Long-term Strategy conditions on a single source in a BART permit in isolation from other visibility-impairing sources. There is no authority for the "lowest viable" emission criterion in Condition 16 and no justification for a future limit of 0.07 lb/MMBtu. Condition 16 is arbitrary and without basis in the law. DEQ failed to follow the law and failed to observe the procedures required to impose Long-term Strategy limits when it tacked on a Long-term Strategy condition to the LRS BART permit. Pursuant to W.S. 35-11-112(c)(ii), Basin Electric respectfully requests the Council to grant this Motion for Summary Judgment and modify the LRS BART permit to remove the offending Condition 16.

Respectfully submitted on June 30, 2010.

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ATTORNEYS FOR BASIN ELECTRIC POWER COOPERATIVE

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EXHIBIT A

DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

BART Application Analysis
AP-6047

May 28, 2009

NAME OF FIRM:	Basin Electric Power Cooperative
NAME OF FACILITY:	Laramie River Station
FACILITY LOCATION:	347 Grayrocks Road Platte County (Wheatland), Wyoming UTM Zone 13, NAD 27: 509,900 m E; 4,661,675 m N
TYPE OF OPERATION:	Electric Power Generating Station
RESPONSIBLE OFFICIAL:	Mr. Robert Eriksen
MAILING ADDRESS:	1717 East Interstate Avenue Bismarck, North Dakota 58503
TELEPHONE NUMBER:	(701) 355-5654
REVIEWERS:	Cole Anderson, Air Quality Engineer Josh Nall, Air Quality Modeler

PURPOSE OF APPLICATION:

Sections 169A and 169B of the 1990 Clean Air Act Amendments require states to improve visibility at Class I areas. On July 1, 1999, EPA first published the Regional Haze Rule, which provided specific details regarding the overall program requirements to improve visibility. The goal of the regional haze program is to achieve natural conditions by 2064.

Section 308 of the Regional Haze Rule (40 CFR 51) includes discussion on control strategies for improving visibility impairment. One of these strategies is the requirement under 40 CFR 51.308(e) for certain stationary sources to install Best Available Retrofit Technology (BART) to reduce emissions of three (3) visibility impairing pollutants, nitrogen oxides (NO_x), particulate matter (PM), and sulfur dioxide (SO_2). EPA published Appendix Y to part 51 - *Guidelines for BART Determinations Under the Regional Haze Rule* in the July 6, 2005 Federal Register to provide guidance to regulatory authorities for making BART determinations. Chapter 6, Section 9, *Best Available Retrofit Technology* was adopted into the Wyoming Air Quality Standards and Regulations (WAQSR) and became effective on December 5, 2006. The Wyoming Department of Environmental Quality, Air Quality Division (Division) will determine BART for NO_x and PM_{10} for each source subject to BART and include each determination in the §308 Wyoming Regional Haze State Implementation Plan (SIP).

Section 309 of the Regional Haze Rule (40 CFR part 51), *Requirements related to the Grand Canyon*

Visibility Transport Commission, provides states that are included within the Transport Region addressed by the Grand Canyon Visibility Transport Commission (i.e., Arizona, California, Colorado, Idaho, Nevada, New Mexico, Oregon, Utah, and Wyoming) an alternative to the requirements established in 40 CFR 51.308. This alternative control strategy for improving visibility contains special provisions for addressing SO_2 emissions, which include a market trading program and a provision for a 2018 SO_2 milestone. Wyoming submitted a §309 Regional Haze SIP to EPA on December 29, 2003. As of the date of this analysis, EPA has not taken action on the SIP. National litigation issues related to the Regional Haze Rule, including BART, required states to submit revisions. On November 21, 2008, the State of Wyoming submitted revisions to the 2003 §309 Regional Haze SIP submittal. Sources that are subject to BART are required to address SO_2 emissions as part of the BART analysis even though the control strategy has been identified in the Wyoming §309 Regional Haze SIP.

On March 5, 2007, in accordance with the requirements of WAQSR Chapter 6 Section 9(e)(i), Basin Electric submitted a BART application for the Laramie River Station.

On February 15, 2008, Basin Electric submitted replacement pages for the BART application based on revised CALPUFF modeling conducted to correct errors in the CALMET windfield discovered by the Division during review of the initial modeling submittal.

On July 28, 2008, Basin Electric submitted an additional report with the results of additional CALPUFF modeling conducted to provide results for each of the three BART-eligible units separately.

On February 25, 2009, Basin Electric submitted additional information on the NO_x emission rates that would be achievable by the BART-eligible units.

On March 16, 2009, Basin Electric submitted a letter with proposed NO_x emission limits for the BART-eligible units.

BART ELIGIBILITY DETERMINATION:

In August of 2005 the Wyoming Air Quality Division (Division) began an internal review of sources that could be subject to BART. This initial effort followed the methods prescribed in 40 CFR part 51, Appendix Y: *Guidelines for BART Determinations Under the Regional Haze Rule* to identify sources and facilities. The rule requires that States identify and list BART-eligible sources, which are sources that fall within the 26 source categories, have emission units which were in existence on August 7, 1977 but not in operation before August 7, 1962 and have the potential to emit more than 250 tons per year (tpy) of any visibility impairing pollutant when emissions are aggregated from all eligible emission units at a stationary source. Fifty-one (51) sources at fourteen (14) facilities were identified that could be subject to BART in Wyoming.

The next step for the Division was to identify BART-eligible sources that may emit any air pollutant which may reasonably be anticipated to cause or contribute to any impairment of visibility. Three pollutants are identified by 40 CFR part 51, Appendix Y as visibility impairing pollutants. They are sulfur dioxide (SO_2), nitrogen oxides (NO_x), and particulate matter (PM). Particulate matter with an aerodynamic diameter of 10 microns or less (PM_{10}) was used as an indicator of PM.

In order to determine visibility impairment of each source, a screening analysis was performed using the

CALPUFF model. Sources that emitted over 40 tons of SO_2 or NO_x or 15 tons of PM_{10} were included in the screening analysis. Using three years of meteorological data, the screening analysis calculated visibility impacts from sources at nearby Class I areas. Sources with modeled 98th percentile, 24-hour impact (i.e., 8th highest modeled impact) equal to or greater than 0.5 delta deciviews (Δdv) above natural background conditions were determined to be subject to BART. For additional information on the Division's screening analysis see the Visibility Improvement Determination: Screening Modeling section of this analysis. The three existing coal-fired boilers at Basin Electric's Laramie River Station were determined to be subject to BART. Basin Electric was notified in a letter dated June 14, 2006 of the Division's finding.

DESCRIPTION OF BART ELIGIBLE SOURCES:

Basin Electric's Laramie River Station is comprised of three 550 MW (net) dry-bottom, wall-fired boilers burning pulverized coal for a total net generating capacity of 1,650 MW. Laramie River Unit 1 was placed in service in 1980. Unit 2 commenced service in 1981, and Unit 3 entered service in 1982. All three units were manufactured by Babcock & Wilcox (B&W). Each unit is equipped with early generation low NO_x burners (LNBs) to control emission of nitrogen oxides (NO_x). They are also equipped with cold-side electrostatic precipitators (ESPs) to control particulate matter (PM) emissions. To control sulfur dioxide (SO_2) emissions, Units 1 and 2 are equipped with wet flue gas desulfurization (WFGD). Unit 3 is equipped with a dry scrubber (DFGD) for SO_2 removal. All three units burn sub-bituminous coal. Table 1 presents the permitted emission limits for the Laramie River Station prior to 2005, which is considered the baseline year for BART analyses.

Table 1: Laramie River Station Units 1 through 3 (Pre-2005) Emission Limits

Source	Existing Controls	NO_x (lb/MMBtu) [(a)]	SO_2 (lb/MMBtu) [(a)]	PM (lb/MMBtu) [(a)]
Unit 1	LNB, ESP, WFGD	0.5 (3-hour[b])	0.2 (2-hour fixed block)	0.085 (3-hour)
Unit 2	LNB, ESP, WFGD	0.5 (3-hour[b])	0.2 (2-hour fixed block)	0.085 (3-hour)
Unit 3	LNB, ESP, DFGD	0.5 (3-hour[b])	0.2 (2-hour fixed block)	0.083 (3-hour)

[(a)] Emissions taken from current Operating Permit 3-1-102-1.
[(b)] Arithmetic average of three contiguous one-hour periods

CHAPTER 6, SECTION 9 – BEST AVAILABLE RETROFIT TECHNOLOGY (BART):

A BART determination is an emission limit based on the application of a continuous emission reduction technology for each visibility impairing pollutant emitted by a source. It is "...established, on a case-by-case basis, taking into consideration: (1) the costs of compliance, (2) the energy and non-air quality environmental impacts of compliance, (3) any pollution equipment in use or in existence at the source, (4) the remaining useful life of the source, and (5) the degree of improvement in visibility which may

reasonably be anticipated to result from the use of such technology."[1] A BART analysis is a comprehensive evaluation of potential retrofit technologies with respect to the five criteria above. One technology and corresponding emission limit is chosen for each pollutant subject to BART review based on the evaluation.

Visibility control options presented in the application for each of the emission units were reviewed using the methodology prescribed in 40 CFR 51 subpart Y, as required in WAQSR Chapter 6 Section 9(c)(i). This methodology is comprised of five basic steps:

Step 1: Identify all[2] available retrofit control technologies
Step 2: Eliminate technically infeasible options
Step 3: Evaluate control effectiveness of remaining control technologies
Step 4: Evaluate impacts and document the results
Step 5: Evaluate visibility impacts

The Division acknowledges that BART is intended to identify retrofit technology for existing sources and is not the same as the top-down analysis required for new sources under the Prevention of Significant Deterioration (PSD) rules known as Best Available Control Technology (BACT). Although BART is not the same as BACT, it is possible that BART may be equivalent to BACT on a case-by-case basis. The five steps listed above were applied to NO_x, PM, and SO_2 emitted from the Laramie River Station's coal-fired boilers to determine BART control measures.

PRESUMPTIVE LIMITS FOR SO_2 AND NO_X FROM UTILITY BOILERS

EPA conducted detailed analyses of retrofit technology available to control NO_x and SO_2 emissions from coal-fired power plants. These analyses considered unit size, fuel type, cost effectiveness, and existing controls to determine reasonable control levels based on the application of an emissions reduction technology.

EPA's presumptive BART SO_2 limits analysis considered coal-fired units with existing SO_2 controls and units without existing control. Four key elements of the analysis were: "...(1) identification of all potentially BART-eligible EGUs [electric generating units], and (2) technical analyses and industry research to determine applicable and appropriate SO_2 control options, (3) economic analysis to determine cost effectiveness for each potentially BART-eligible EGU, and (4) evaluation of historical emissions and forecast emission reduction for each potentially BART-eligible EGU."[3] 491 BART-eligible coal-fired units were identified and included in the presumptive BART analysis for SO_2. Based on removal efficiencies of 90% for spray dry lime dry flue gas desulfurization systems and 95% for limestone forced oxidation wet flue gas desulfurization systems, EPA calculated projected SO_2 emission reductions and cost effectiveness for each unit. Based on the results of this analysis, EPA concluded that the majority of identified BART-eligible units greater than 200 MW without existing SO_2 control can meet the presumptive limits at a cost of $400 to $2,000 per ton of SO_2 removed.

A presumptive BART NO_x limits analysis was performed using the same 491 BART-eligible coal-fired

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[1] 40 CFR part 51 Appendix Y Guidelines for BART Determinations under the Regional Haze Rule (70 Federal Register 39163).
[2] Footnote 12 of 40 CFR 51 Appendix Y defines the intended use of 'all' by stating "...you must identify the most stringent option and a reasonable set of options for analysis that reflects a comprehensive list of available technologies."
[3] 40 CFR Part 51 Appendix Y Guidelines for BART Determinations under the Regional Haze Rule (70 Federal Register 39133).

units identified in the SO_2 presumptive BART analysis. EPA considered the same four key elements and established presumptive NO_x limits for EGUs based on coal type and boiler configuration. For all boiler types, except cyclone, presumptive limits were based on combustion control technology (e.g., low NO_x burners and overfire air). Presumptive NO_x limits for cyclone boilers are based on the installation of SCR, a post combustion add-on control. EPA acknowledged that approximately 25% of the reviewed units could not meet the proposed limits based on current combustion control technology, but that nearly all the units could meet the presumptive limits using advanced combustion control technology, such as Rotating Opposed Fire Air. National average cost-effectiveness values for presumptive NO_x limits ranged from $281 to $1,296 per ton removed.

Based on the results of the analyses for presumptive NO_x and SO_2 limits, EPA established presumptive limits for EGUs greater than 200 MW operating without NO_x post combustion controls or existing SO_2 controls located at facilities with a generating capacity greater than 750 MW. 40 CFR part 51 Appendix Y states that the presumptive SO_2 level for an uncontrolled unit is either 95% control or 0.15 lb/MMBtu. Presumptive NO_x levels for uncontrolled units are listed in Table 1 of Appendix Y and are classified by the boiler burner configuration (unit type) and coal type. NO_x emission values range from 0.62 lb/MMBtu down to 0.15 lb/MMBtu. While Appendix Y establishes presumptive SO_2 limits and says that states should require presumptive NO_x, it also clearly gives states discretion to "...determine that an alternative [BART] control level is justified based on a careful consideration of the statutory factors."[4] The Division's following BART analyses for NO_x, SO_2, and PM/PM_{10} take into account each of the five statutory factors.

Basin Electric's Laramie River Station generates a net 550 MW from each of three coal-fired units. None of the units has NO_x post-combustion controls. The presumptive NO_x emission limit for dry-bottom, wall-fired boilers burning sub-bituminous coal (i.e., each of the three units) is 0.23 lb/MMBtu.

NO_x: IDENTIFY AVAILABLE RETROFIT CONTROL TECHNOLOGIES

Basin Electric identified six control technology configurations for control of NO_x emissions from Units 1 through 3:

- Overfire Air (OFA)
- New Low NO_x Burners (LNB)
- Selective Catalytic Reduction (SCR)
- Selective Non-Catalytic Reduction (SNCR)
- SNCR/SCR Hybrid
- Natural Gas Reburn

1. Overfire Air – OFA is a combustion control technology that reduces NO_x emissions by controlling the combustion process within the boiler. Within an initial fuel-rich environment that is used to favor the conversion of fuel-bound nitrogen to N_2 instead of NO_x, additional air (or OFA) is introduced downstream of the main burner zone to burn out any residual material. By injecting the OFA into the lower temperature combustion zone, NO_x is less likely to form, while burning the residual solid fuel (char).
2. New Low NO_x Burners - LNB technologies rely on a combination of fuel staging and combustion

[4] Ibid. (70 Federal Register 39171)

air control to suppress the formation of thermal NO_x. Fuel staging occurs in the very beginning of combustion, where the pulverized coal is injected through the burner into the furnace. Careful control of the fuel-air mixture leaving the burner can limit the amount of oxygen available to the fuel during combustion creating a fuel rich zone that converts nitrogen to molecular nitrogen (N_2) rather than using oxygen in the combustion air to oxidize the nitrogen to NO_x. This allows complete combustion of the fuel while reducing both thermal and chemical NO_x formation.

3. Selective Catalytic Reduction – SCR is a post combustion control technique in which vaporized ammonia is injected into the flue gas upstream of a catalyst. NO_x entrained in the flue gas is reduced to N_2 and water. When catalyst temperatures are not in the optimal range for the reduction reaction or when too much ammonia is injected into the process, unreacted ammonia can be released to the atmosphere through the stack. This release is commonly referred to as ammonia slip.

4. Selective Non-Catalytic Reduction - SNCR involves the injection of a reducing agent such as ammonia or urea into the flue gas stream. Rather than rely on a catalyst, SNCR systems rely on appropriate injection temperatures, proper mixing of the reagent and flue gas, and prolonged retention time. The effective temperature range for SNCR is higher than for SCR, and SNCR systems typically have lower NO_x emissions reductions than SCR. Also, SNCR systems are more prone to ammonia slip than SCR.

5. SNCR/SCR Hybrid – A hybrid SNCR/SCR system combines the lower costs and higher ammonia slip of SNCR with the higher NO_x reduction potential and lower ammonia slip of SCR. During operation, the SNCR system is allowed to inject higher amounts of reagent into the flue gas. The increased reagent flow brings about increased NO_x reduction, but also causes increased ammonia slip which is then consumed by the SCR system. The use of the ammonia slip by the SCR system can reduce the size of the required SCR catalyst.

6. Natural Gas Reburn – Fuel reburning is a method of fuel staging designed to reduce NO_x emissions. It involves the introduction of a supplemental fuel into the main section of the steam generator to produce reducing conditions that convert NO_x to N_2. Natural gas reburn requires three separate combustion zones and sufficient residence time (adequate furnace height).

In addition to applying these controls technologies separately, they can be combined to increase overall NO_x reduction. Basin Electric evaluated the combined application of OFA/LNB and the combined application of OFA/LNB with SNCR.

NO_x: ELIMINATE TECHNICALLY INFEASIBLE OPTIONS

Natural Gas Reburn - Basin Electric determined that natural gas reburn is technically infeasible because the effectiveness of such a system would be negatively impacted by the amount of space available in the Laramie River Station furnaces.

NO_x: EVALUATE EFFECTIVENESS OF REMAINING CONTROL TECHNOLOGIES

The Division considers the control effectiveness of a proposed control technology to be equivalent to the permit limit that would be established for that technology if it were chosen as BART. The permit limit is based on continuous compliance when the control equipment is well maintained and operated in a manner consistent with good air pollution control practices. In order to demonstrate continuous compliance with the permit limit, it is important to consider that even well maintained and operated equipment will have some emissions variability. Complex emission control equipment, such as LNB with OFA, generally have inherent variability that must be considered when establishing the permit limit. Otherwise, the source may be out of compliance even though the equipment is operated and maintained as well as possible.

Basin Electric determined that SNCR as the sole control technology would not meet the presumptive emission rate of 0.23 lb/MMBtu. A preliminary evaluation of an SNCR system for Laramie River Station indicated that the controlled NO_x emission would be 0.24 lb/MMBtu. Therefore, SNCR was not further evaluated as the sole control technology.

In the initial BART permit application submitted by Basin Electric, the installation of OFA or new LNB individually were both listed with a control effectiveness of 0.23 lb/MMBtu. A combination of OFA with new LNB was listed with a control effectiveness of 0.15 lb/MMBtu. Subsequent submittals from Basin Electric described that the 0.15 lb/MMBtu control effectiveness was based entirely on computational fluid dynamics (CFD) modeling that was conducted in 2004. The value produced by the CFD modeling was described as the lowest theoretical NO_x level that could be achieved when operating conditions match the optimum conditions simulated in the modeling. Additionally, the 2004 CFD modeling included an error in the use of sea-level conditions and was described by Basin Electric's contractor (Black & Veatch) as representing optimum, steady-state conditions that could not be maintained during normal operation of the Laramie River Station boilers.

More current CFD modeling performed by Reaction Engineering at the request of Basin Electric for the Unit 1 OFA project indicated that the installation of OFA with new LNB would result in a control effectiveness of 0.18 lb/MMBtu (± 0.02 lb/MMBtu). As described by Burns & McDonnell on behalf of Basin Electric, the results of the more recent CFD modeling indicate that an appropriate emissions limit for OFA + new LNB that takes into account the normal operation variability would be 0.23 lb/MMBtu for a 30-day rolling average.

Basin Electric contracted with Black & Veatch to analyze the control effectiveness of other control technologies, including a SNCR/SCR Hybrid (Cascade) system, OFA + new LNB with SNCR, and SCR. Table 2 presents a summary of the effectiveness of the technically feasible control technologies for NO_x.

Table 2: NO_x Emission Rates Per Boiler

Control Technology	Control Effectiveness (lb/MMBtu)
Baseline	0.27
Overfire Air	0.23
New LNB	0.23
New LNB with OFA	0.23
SNCR/SCR Hybrid	0.20
New LNB with OFA and SNCR	0.12
SCR	0.07

Note: Baseline emissions based on continuous emissions monitoring (CEM) annual averages for 2001-2003.

NO_x: EVALUATE IMPACTS AND DOCUMENT RESULTS

Basin Electric quantified the costs of applying the remaining NO_x control technologies by considering the following types of impact:

- Cost of compliance
- Energy impacts
- Non-air quality environmental impacts
- Remaining useful life
- Visibility (described in a later section of the document)

Energy impacts, such as added auxiliary power consumption or the power associated with additional draft systems to overcome resistance to flue gas flow, were calculated for each control technology. Non-air quality environmental impacts were also considered, and for this analysis were limited to the costs associated with disposal of byproducts or waste generated by control technologies. Basin Electric anticipates operating the Laramie River Station Units 1-3 indefinitely and did not include life extension costs in the economic analysis. A standard control life of 20 years was used to calculate the capital recovery factor.

Basin Electric developed estimates for the cost of compliance, including Total Capital Investment (TCI) and annual operation and maintenance (O&M) costs, using the following sources of information:

- Coal Utility Environmental Cost (CUECost) workbook (Version 1.0)
- EPA Air Pollution Control Cost Manual (Sixth Edition)
- Budgetary quotes from equipment vendors
- Cost estimates from previous design/build projects or in-house engineering estimates

Several different metrics can be considered when evaluating the cost-benefit relationships of different emission control technologies. In 40 CFR part 51 Appendix Y, two metrics are specifically mentioned: cost effectiveness and incremental cost effectiveness. Through the application of BACT, the Division has extensive experience using cost effectiveness (i.e., dollars per ton of pollutant removed) to evaluate control technologies. Incremental cost effectiveness is also used extensively by the Division when comparing emission controls under the BACT process. While the BART process and the BACT process are not equivalent, control determinations from either process that are based on cost effectiveness and incremental cost effectiveness are indicative of the economic costs to control emissions.

In addition to providing cost effectiveness and incremental cost effectiveness results, Basin Electric provided cost information in terms of cost of applying emission controls and the level of visibility improvement achieved (i.e., dollars per deciviews). While this metric can illustrate the control cost and visibility improvement differences between control options, it is not commonly used to assess the overall effectiveness of pollution control equipment. When performing the presumptive BART levels analyses for NO_x and SO_2, EPA addressed cost effectiveness and incremental cost effectiveness separate from visibility improvement. EPA did not use the dollars per deciview metric to compare control options. Visibility improvements from the application of the control measures used to establish presumptive levels were addressed in a separate visibility analysis. As discussed in the comprehensive visibility analysis presented later in this analysis, the Division evaluated the amount of anticipated visibility improvement gained by the application of each proposed emission control technology. The Division considered cost effectiveness and incremental cost effectiveness in the evaluation of each proposed NO_x emission control.

Tables 3 through 5 present the economic and environmental costs associated with the remaining NO_x control technologies for Units 1 through 3.

Table 3: Unit 1 Economic and Environmental Costs for NO_x Control

Parameter	OFA	New LNB	New LNB with OFA	SNCR/SCR Hybrid	New LNB/OFA and SNCR	SCR
Capital Costs	$5,326,000	$15,631,000	$22,096,000	$44,969,000	$43,441,000	$123,101,000
Annualized Costs	$625,000	$1,360,000	$1,944,000	$7,429,000	$7,365,000	$15,787,000
NO_x Emissions (lb/MMBtu)	0.23	0.23	0.23	0.20	0.12	0.07
Annual NO_x Emission (tpy)	5,384	5,384	5,384	4,681	2,809	1,639
Annual NO_x Reduction (tpy)	936	936	936	1,639	3,511	4,681
Cost per ton of Reduction	$668	$1,453	$2,077	$4,534	$2,098	$3,372
Incremental Cost per ton of Reduction[1]	--	--	--	--	$2,105	$7,198
Energy Costs	$140,000	--	--	$77,000	$77,000	$414,000
Non-Air Quality Costs	--	--	--	--	--	$1,000

(1) Incremental costs for new LNB + OFA + SNCR calculated relative to new LNB + OFA. Incremental costs for SCR calculated relative to new LNB + OFA + SNCR. Incremental costs for SNCR/SCR Hybrid not calculated (considered an inferior technology and not considered further in this analysis).

Table 4: Unit 2 Economic and Environmental Costs for NO_x Control

Parameter	OFA	New LNB	New LNB with OFA	SNCR/SCR Hybrid	New LNB/OFA and SNCR	SCR
Capital Costs	$5,326,000	$15,631,000	$22,096,000	$44,969,000	$43,441,000	$123,101,000
Annualized Costs	$625,000	$1,360,000	$1,944,000	$7,429,000	$7,365,000	$15,787,000
NO_x Emissions (lb/MMBtu)	0.23	0.23	0.23	0.20	0.12	0.07
Annual NO_x Emission (tpy)	5,354	5,354	5,354	4,656	2,793	1,630
Annual NO_x Reduction (tpy)	931	931	931	1,630	3,492	4,656
Cost per ton of Reduction	$671	$1,461	$2,088	$4,559	$2,109	$3,391
Incremental Cost per ton of Reduction[1]	--	--	--	--	$2,117	$7,242
Energy Costs	$140,000	--	--	$77,000	$77,000	$414,000
Non-Air Quality Costs	--	--	--	--	--	$1,000

(1) Incremental costs for new LNB + OFA + SNCR calculated relative to new LNB + OFA. Incremental costs for SCR calculated relative to new LNB + OFA + SNCR. Incremental costs for SNCR/SCR Hybrid not calculated (considered an inferior technology and not considered further in this analysis).

Table 5: Unit 3 Economic and Environmental Costs for NO_x Control

Parameter	OFA	New LNB	New LNB with OFA	SNCR/SCR Hybrid	New LNB/OFA and SNCR	SCR
Capital Costs	$5,326,000	$15,631,000	$22,096,000	$44,969,000	$43,441,000	$123,101,000
Annualized Costs	$625,000	$1,360,000	$1,944,000	$7,429,000	$7,365,000	$15,787,000
NO_x Emissions (lb/MMBtu)	0.23	0.23	0.23	0.20	0.12	0.07
Annual NO_x Emission (tpy)	5,493	5,493	5,493	4,777	2,866	1,672
Annual NO_x Reduction (tpy)	955	955	955	1,672	3,582	4,777
Cost per ton of Reduction	$654	$1,424	$2,036	$4,444	$2,056	$3,305
Incremental Cost per ton of Reduction[1]	--	--	--	--	$2,064	$7,054
Energy Costs	$140,000	--	--	$77,000	$77,000	$414,000
Non-Air Quality Costs	--	--	--	--	--	$1,000

[1] Incremental costs for new LNB + OFA + SNCR calculated relative to new LNB + OFA. Incremental costs for SCR calculated relative to new LNB + OFA + SNCR. Incremental costs for SNCR/SCR Hybrid not calculated (considered an inferior technology and not considered further in this analysis).

The cost effectiveness and incremental cost effectiveness of the proposed BART technologies for NO_x are all reasonable. The SNCR/SCR Hybrid was eliminated from further consideration as an inferior technology as compared to New LNB/OFA/SNCR because of the higher costs/higher emissions associated with the Hybrid option. Basin Electric modeled the range of anticipated visibility improvement from the company-proposed BART controls (OFA) by modeling OFA/New LNB and OFA/New LNB/SCR. While OFA/New LNB/SNCR was not individually evaluated in Step 5: Evaluate visibility impact, the anticipated degree of visibility improvement from applying this control option lies within the range of visibility impacts that were modeled.

The final step in the BART NO_x determination process for Laramie River Station Units 1-3, Step 5: Evaluate visibility impacts, is addressed in a comprehensive visibility analysis covering all three visibility impairing pollutants and associate control options. The visibility analysis follows Steps 1-4 for PM_{10} emissions in this application analysis.

SO_2: IDENTIFY AVAILABLE RETROFIT CONTROL TECHNOLOGIES

Basin Electric identified three control technology configurations for reduction of SO_2 emissions from Units 1 and 2, which are currently equipped with back-end WFGD systems:

- Elimination of Stack Reheat System
- Improvements to Existing WFGD
- Sorbent Injection

1. Elimination of Stack Reheat System – Basin Electric routes a portion of the flue gas on Units 1 and 2 to a reheat system that decreases the moisture in the flues and avoids damage to the flues, which are brick-lined. The elimination of the reheat system would route more of the flue gas through the WFGD and reduce SO_2 emissions, but would place added strain on the scrubber and require a new stack with a liquid collection system.

2. Improvements to Existing WFGD – Units 1 and 2 are equipped with dual-loop, counter-flow absorber towers. Each unit has five absorber towers. Current operation of the system meets the permitted emission limit of 0.20 lb/MMBtu. One possible measure to improve the performance of the system would be the installation of an additional level of perforated tray below the existing perforated tray. This tray would serve to increase the contact time between the flue gas and the reagent liquid (L/G ratio) and increase overall SO_2 removal. This technique, however, would increase the pressure drop in the scrubber vessel, and would require an upgrade to draft system. Another option for enhanced SO_2 removal is to increase the slurry flow rate into the absorber section of the WFGD by adding an additional spray header. The disadvantage of this option is increased erosion on the vaning system in the tower, and the need to enhance the reagent preparation system. A third option for higher SO_2 removal is to upgrade the capacity of the recycle pumps, thus increasing the slurry flow rate. This would increase the L/G ratio. As a fourth option, an additional absorber tower could be installed to allow for the treatment of more flue gas and to increase the L/G ratio by allowing a rebalancing of the flue gas flow rates to a lower flow through each tower. A fifth option is the introduction of chemical additives that enhance the SO_2 capture rate. Three additives that are typically used are dolomitic lime, dibasic (DBA) or adipic acid, and formic acid. Basin Electric chose this option for further evaluation because it had the least plant impacts, outage time, and FGD operation procedure impacts.

3. Sorbent Injection – Components of a reagent injection system typically include an air compressor, sorbent storage tank, heat tracing, controls, injection system, injection platform, and slurry pump. Furnace and duct injection systems require a wet or dry reagent, and are capable of removing 10 to 20 percent of the SO_2 in the flue gas. A dry reagent such as powdered lime is preferred for furnace injection systems. For duct injection systems, a wet reagent such as lime slurry is preferred. Use of a wet reagent upstream of an existing ESP can help reduce the gas temperature, improve ESP performance, and eliminate the need for additional ID fans for draft control.

Basin Electric identified four control technology configurations for reduction of SO_2 emissions from Unit 3, which currently uses a DFGD system:

- Fabric Filter Retrofit into Unit 3 ESP Casing
- Replacement of Dry Scrubber Reactor with New Generation SDA Modules
- New WFGD System
- Sorbent Injection

1. Fabric Filter Retrofit into Unit 3 ESP Casing – Enhanced SO_2 removal can be achieved by retrofitting a fabric filter system into the existing Unit 3 ESP. Removal of SO_2 would occur from contact of the remaining SO_2 molecules in the flue gas with unreacted lime particles in the fly ash cake on the fabric filter bags. With a typical Spray Dryer Absorber (SDA) and pulse jet fabric filter (PJFF) system, additional SO_2 removal can be 10 to 20 percent.

2. Replacement of Dry Scrubber Reactor with New Generation SDA Modules – Existing dry scrubber equipment on Unit 3 was designed by B&W, and achieves an SO_2 removal rate of approximately 85 percent. Replacement of the existing four dry scrubber reactors with two SDA modules could achieve a small increase in SO_2 removal.

3. New WFGD System – A new wet FGD system similar to those used on Units 1 and 2 could be installed on Unit 3 to replace the existing dry scrubber. Unit 3's dry scrubber would be left in place with its internal equipment removed to reduce pressure drop. The Unit 3 ESP would remain in operation to remove fly ash, and the location of the new WFGD would be to the east of the existing chimney. A new stack with a liner capable of wet flue gas operation would be required. Outage time for the unit would only be required for tie-in with the new system. New booster fans would be needed to adjust for additional pressure drop from the scrubber, and the limestone reagent preparation system for Units 1 and 2 might have to be upgraded to accommodate additional material needed for Unit 3.

4. Sorbent Injection – The sorbent injection system described earlier for Units 1 and 2 is also a possibility for Unit3.

SO_2: ELIMINATE TECHNICALLY INFEASIBLE OPTIONS

All of the control technologies identified for Units 1 and 2 are technically feasible. For Unit 3, two of the listed technologies were deemed by Basin Electric as technically infeasible:

New Generation SDA Modules: Unit 3 is already equipped with a system that is essentially an SDA, and therefore it is not feasible to replace the existing system with a similar system.

Sorbent Injection – Sorbent injection is not technically feasible for Unit 3 because the expected controlled emission level would not meet the presumptive level.

SO_2: EVALUATE EFFECTIVENESS OF REMAINING CONTROL TECHNOLOGIES

The Division considers the control effectiveness of a proposed control technology to be equivalent to the BART-determined permit limit. The limit is based on continuous compliance when the control equipment is well maintained and operated in a manner consistent with good air pollution control practices. In order to demonstrate continuous compliance with the permit limit it is important to consider that even well maintained and operated equipment will have some emissions variability. Complex emission control equipment generally has inherent variability that must be considered when establishing the limit. Otherwise, the source will be out of compliance even though the equipment is operated and maintained as well as possible.

Tables 6 and 7 present the effectiveness of the remaining technically feasible control technologies for SO_2.

Table 6: Units 1 and 2 SO_2 Emission Rates Per Boiler

Control Technology	Control Effectiveness (lb/MMBtu)
Baseline	0.16
Sorbent Injection	0.15
FGD Chemical Additives	0.15
Elimination of Stack Reheat System	0.13

Note: Baseline emissions based on continuous emissions monitoring (CEM) annual averages for 2001-2003.

Table 7: Unit 3 SO_2 Emission Rates

Control Technology	Control Effectiveness (lb/MMBtu)
Baseline	0.17
Fabric Filter Retrofit into Unit 3 ESP	0.13
New WFGD	0.06

Note: Baseline emissions based on continuous emissions monitoring (CEM) annual averages for 2001-2003.

SO_2: EVALUATE IMPACTS AND DOCUMENT RESULTS

Basin Electric quantified the costs of applying the remaining SO_2 control technologies at the Laramie River Station by considering the following types of impact:

- Cost of compliance
- Energy Impacts
- Non-air quality environmental impacts
- Remaining useful life
- Visibility (described in later section of the document)

Basin Electric anticipates operating the Laramie River Station Units 1-3 indefinitely and did not include life extension costs in the economic analysis. A standard control life of 20 years was used to calculate the capital recovery factor.

Several different metrics can be considered when evaluating the cost-benefit relationships of different emission control technologies. In 40 CFR part 51 Appendix Y two metrics are specifically mentioned: cost effectiveness and incremental cost effectiveness. Through the application of BACT, the Division has extensive experience using cost effectiveness (i.e., dollars per ton of pollutant removed) to evaluate control technologies. Incremental cost effectiveness is also used extensively by the Division when comparing emission controls under the BACT process. While the BART process and the BACT process

are not equivalent, control determinations from either process that are based on cost effectiveness and incremental cost effectiveness are indicative of the economic costs to control emissions.

In addition to providing cost effectiveness and incremental cost effectiveness results, Basin Electric provided cost information in terms of cost of applying emission controls and the level of visibility improvement achieved (i.e., dollars per deciviews). While this metric can illustrate the control cost and visibility improvement differences between control options, it is not commonly used to assess the overall effectiveness of pollution control equipment. When performing the presumptive BART levels analyses for NO_x and SO_2, EPA addressed cost effectiveness and incremental cost effectiveness separate from visibility improvement. The dollars per deciview metric was not used to compare control options. Visibility improvements from the application of the control measures used to establish presumptive levels were addressed in a separate visibility analysis. The Division considered cost effectiveness and incremental cost effectiveness in the evaluation of each proposed emission control. Tables 8 through 10 present the economic and environmental costs associated with the remaining SO_2 control technologies for Units 1 through 3.

Table 8: Unit 1 Economic and Environmental Costs for SO_2 Control

Parameter	Sorbent Injection	FGD Chemical Additives	Eliminate Stack Reheat System
Capital Costs	$7,453,000	$2,363,000	$63,845,000
Annualized Costs	$906,000	$366,000	$6,664,000
SO_2 Emissions (lb/MMBtu)	0.15	0.15	0.13
Annual SO_2 Emission (tpy)	3,511	3,511	3,043
Annual SO_2 Reduction (tpy)	234	234	702
Cost per ton of Reduction	$3,871	$1,564	$9,490
Incremental Cost per ton of Reduction[1]	--	--	$13,453
Energy Costs	$62,000	$6,000	$459,000
Non-Air Quality Costs	--	--	--

(1) Incremental costs for Eliminate Stack Reheat System relative to FGD Chemical Additives

Table 9: Unit 2 Economic and Environmental Costs for SO_2 Control

Parameter	Sorbent Injection	FGD Chemical Additives	Eliminate Stack Reheat System
Capital Costs	$7,453,000	$2,363,000	$63,845,000
Annualized Costs	$906,000	$366,000	$6,664,000
SO_2 Emissions (lb/MMBtu)	0.15	0.15	0.13
Annual SO_2 Emission (tpy)	3,492	3,492	3,026
Annual SO_2 Reduction (tpy)	233	233	698
Cost per ton of Reduction	$3,892	$1,572	$9,542
Incremental Cost per ton of Reduction[(1)]	--	--	$13,527
Energy Costs	$62,000	$6,000	$459,000
Non-Air Quality Costs	--	--	--

(1) Incremental costs for Eliminate Stack Reheat System relative to FGD Chemical Additives

Table 10: Unit 3 Economic and Environmental Costs for SO_2 Control

Parameter	Fabric Filter Retrofit into Unit 3 ESP (peak rate for lost gen. costs)	Fabric Filter Retrofit into Unit 3 ESP (non-peak rate for lost gen. costs)	New WFGD
Capital Costs	$194,809,000	$134,934,000	$240,777,000
Annualized Costs	$19,585,000	$14,376,000	$31,243,000
SO_2 Emissions (lb/MMBtu)	0.13	0.13	0.06
Annual SO_2 Emission (tpy)	3,105	3,105	1,433
Annual SO_2 Reduction (tpy)	955	955	2,627
Cost per ton of Reduction	$20,501	$15,049	$11,893
Incremental Cost per ton of Reduction[(1)]	--	--	$10,089
Energy Costs	$242,000	$243,000	$3,858,000
Non-Air Quality Costs	--	--	$715,000

(1) Incremental costs for new WFGD for Unit 3 relative to Fabric Filter Retrofit

Several of the technically feasible control options for SO_2 are not cost effective, including all proposed options for Unit 3, and the elimination of the stack reheat system for Units 1 and 2. The remaining options for Units 1 and 2, Sorbent Injection and FGD Chemical Additives, were modeled by the applicant to determine Class I area visibility improvement. Results of the modeling showed that visibility improvement would be insignificant. For example, the predicted visibility improvement at Badlands National Park, based on the modeled 98th percentile result for all three units combined, would be (at most) 0.02 delta deciview. Therefore, none of the proposed control options for SO_2 were carried forward for further analysis.

PM/PM_{10}: IDENTIFY AVAILABLE RETROFIT CONTROL TECHNOLOGIES

Basin Electric identified four control technology configurations for control of PM emissions from Units 1 through 3:

- Flue Gas Treatment
- Existing ESP Performance Enhancements
- PJFF Retrofit into ESP (Unit 3 only)
- GE Max-9 Hybrid

1. Flue Gas Treatment – One option for flue gas treatment is flue gas "conditioning", for which flue gas is conditioned by adding ionic compounds such as sulfur trioxide and ammonia to improve the PM capture rate in the ESP. Moisture in the flue gas combines with the ionic compounds and the mixture is deposited on the surface of the fly ash particles. In this way, the conductivity of the fly ash is increased and the capture rate of the ESP is improved. Another option is in-duct humidification, for which moisture is added to the flue gas upstream of the ESP. This serves to reduce the temperature (and volume) of the flue gas, and a denser flue gas allows for an increase in the Specific Collection Area (SCA) of the ESP without a physical modification to the ESP. The humidification would have to be limited to avoid an outlet temperature that would promote the formation of H_2SO_4. Particle agglomeration is another option for flue gas treatment. For this process, the flue gas is pretreated with electrostatic charges upstream of the ESP to promote agglomeration of the particles. By agglomerating the particles into larger sizes and reducing the number of particles to be collected by the ESP, the overall removal efficiency of the ESP is improved.

2. Existing ESP Performance Enhancements – The ESP imparts an electrical charge to particles in the flue gas, and the particles adhere to metal plates inside the precipitator. Rapping on the plates removes the particles from the plates for disposal. One technology for improving rapping efficiency and preventing re-entrainment of the fly ash into the flue gas is the use of a computerized rapping system. This has already been implemented at the Laramie River Station. Another option for improving the ESP performance is to upgrade the electrical and control system. This type of upgrade can not only enhance the particle collection efficiency, but will also allow the ESP to operate more efficiently and therefore lower the auxiliary power use. This also has already been implemented at the Laramie River Station.

3. Pulse Jet Fabric Filter Retrofit into ESP – Retrofit of a PJFF into the existing Unit 3 ESP casing would require several physical modifications to the system, including the construction of a tubesheet to hold the fabric filter bags and the installation of a compressed air system for cleaning

the bags. A new booster fan system would be required to offset the added pressure drop from the filter bags. The additional auxiliary power consumption from the new booster fan would be offset by power savings from not operating the ESP. The PJFF retrofit is a viable option only for Unit 3. Units 1 and 2 utilize wet flue gas desulfurization (WFGD), and a PJFF is not feasible for use downstream of a WFGD system.

4. GE Max-9 Hybrid – The GE Max-9 Electrostatic Fabric Filter (ESFF) is an electrostatic precipitator/pulse-jet baghouse hybrid, using high-voltage discharge electrodes to charge flue gas particles, but with fabric filters instead of collecting plates in the casing. The system can provide high collection efficiency while operating at a lower system pressure drop. Pressure drop is lower because particles are charged positively and repel each other on the surface of the filter, making the dust cake very porous. Compressed air pulses are used to clean the filters.

PM/PM_{10}: ELIMINATE TECHNICALLY INFEASIBLE OPTIONS

Basin Electric identified three of the four potential control technologies for PM as technically infeasible:

Flue Gas Treatment: This option would not increase the level of emissions control to a higher level than is currently achieved with the existing ESP, and is therefore considered to be technically infeasible.

Existing ESP Performance Enhancement – The ESP performance enhancements, as described earlier, are already in use at the Laramie River Station.

GE Max-9 Hybrid – The GE Max-9 Hybrid has been recently installed in a smaller utility boiler, but not with a boiler of the size used at the Laramie River Station. Therefore, the GE Max-9 is not considered as a technically feasible technology.

PM/PM_{10}: EVALUATE EFFECTIVENESS OF REMAINING CONTROL TECHNOLOGIES

The Division considers the control effectiveness of a proposed control technology to be equivalent to the BART-determined permit limit. The limit is based on continuous compliance when the control equipment is well maintained and operated in a manner consistent with good air pollution control practices. In order to demonstrate continuous compliance with the permit limit, it is important to consider that even well maintained and operated equipment will have some emissions variability. Complex emission control equipment generally has inherent variability that must be considered when establishing the limit. Otherwise, the source will be out of compliance even though the equipment is operated and maintained as well as possible. Table 11 presents the control effectiveness associated with the remaining technically feasible PM controls.

Table 11: PM Emission Rates Per Boiler

Control Technology	Control Effectiveness (lb/MMBtu)
Baseline	0.030
Retrofit Fabric Filter into Unit 3 ESP	0.015

PM/PM_{10}: EVALUATE IMPACTS AND DOCUMENT RESULTS

Basin Electric quantified the costs of applying the remaining technologies at the Laramie River Station by considering the following types of impact:

- Cost of compliance
- Energy Impacts
- Non-air quality environmental impacts
- Remaining useful life
- Visibility (described in later section of the document)

Basin Electric anticipates operating each of the Laramie River Station units indefinitely and did not include life extension costs in the economic analysis. A standard control life of 20 years was used to calculate the capital recovery factor.

Several different metrics can be considered when evaluating the cost-benefit relationships of different emission control technologies. In 40 CFR part 51 Appendix Y two metrics are specifically mentioned: cost effectiveness and incremental cost effectiveness. Through the application of BACT, the Division has extensive experience using cost effectiveness (i.e., dollars per ton of pollutant removed) to evaluate control technologies. Incremental cost effectiveness is also used extensively by the Division when comparing emission controls under the BACT process. While the BART process and the BACT process are not equivalent, control determinations from either process that are based on cost effectiveness and incremental cost effectiveness are indicative of the economic costs to control emissions.

In addition to providing cost effectiveness and incremental cost effectiveness results, Basin Electric provided cost information in terms of cost of applying emission controls and the level of visibility improvement achieved (i.e., dollars per deciviews). While this metric can illustrate the control cost and visibility improvement differences between control options, it is not commonly used to assess the overall effectiveness of pollution control equipment. When performing the presumptive BART levels analyses for NO_x and SO_2, EPA addressed cost effectiveness and incremental cost effectiveness separate from visibility improvement. The dollars per deciview metric was not used to compare control options. Visibility improvements from the application of the control measures used to establish presumptive levels were addressed in a separate visibility analysis. As discussed in the comprehensive visibility analysis presented later in this analysis, the Division evaluated the amount of visibility improvement gained in relation to each proposed emission control technology. The Division considered cost effectiveness and incremental cost effectiveness in the evaluation of each proposed PM emission control. Table 12 present the economic and environmental costs associated with the remaining PM technologies.

Table 12: Unit 3 Economic and Environmental Costs for PM Control

Parameter	Fabric Filter Retrofit into Unit 3 ESP (peak rate for lost gen. costs)	Fabric Filter Retrofit into Unit 3 ESP (non-peak rate for lost gen. costs)
Capital Costs	$194,809,000	$134,934,000
Annualized Costs	$19,585,000	$14,376,000
PM Emissions (lb/MMBtu)	0.015	0.015
Annual PM Emission (tpy)	358	358
Annual PM Reduction (tpy)	358	358
Cost per ton of Reduction	$54,707	$40,156
Energy Costs	$242,000	$243,000

The remaining technically feasible PM_{10} control option for Unit 3 is not cost effective, and was not carried forward for further analysis.

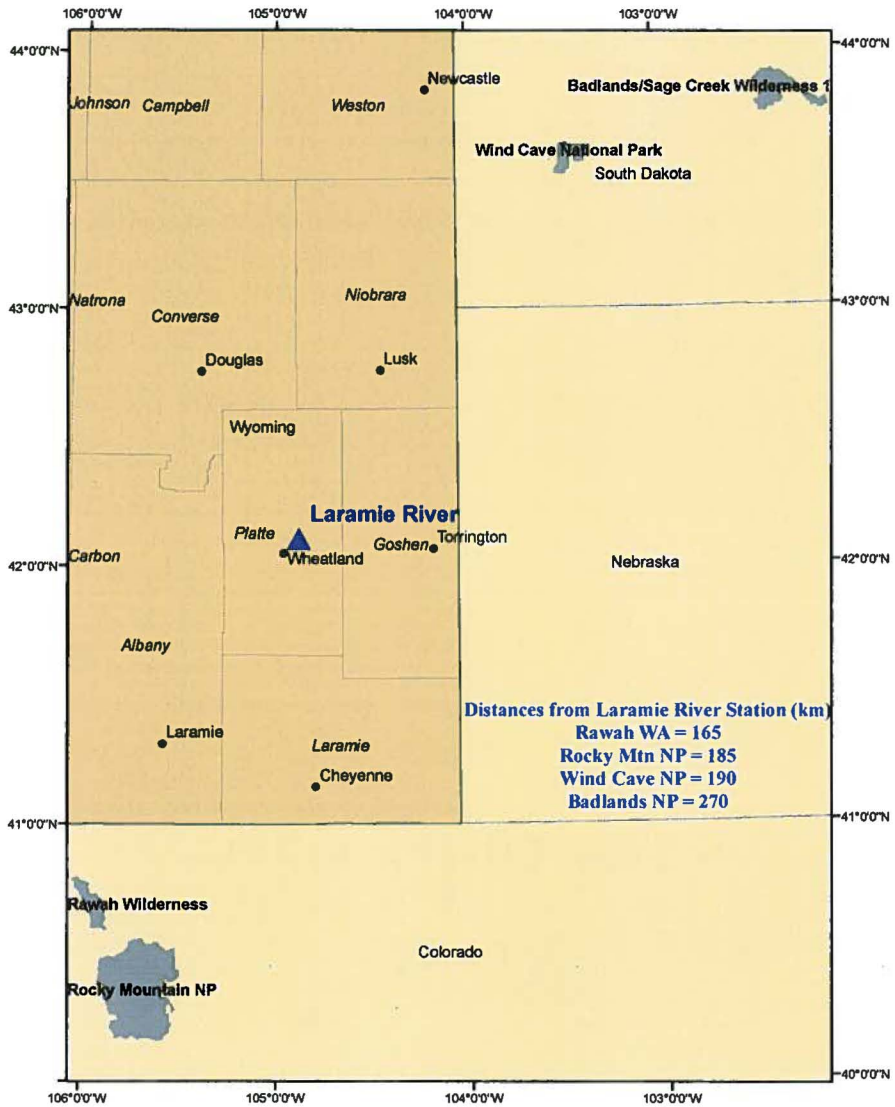
VISIBILITY IMPROVEMENT DETERMINATION:

The fifth of five factors that must be considered for a BART determination analysis, as required by 40 CFR part 51 - Appendix Y, is the degree of Class I area visibility improvement that would result from the installation of the various options for control technology. This factor was evaluated for the Basin Electric Power Cooperative (BEPC) Laramie River Station by using an EPA-approved dispersion modeling system (CALPUFF) to predict the change in Class I area visibility. The Division had previously determined that the Laramie River Station was subject to BART based on the results of initial screening modeling that was conducted using current (baseline) emissions from the facility. The screening modeling, as well as more refined modeling conducted by the applicant, is described in detail below.

Rocky Mountain National Park (NP) and Rawah Wilderness Area in Colorado are the closest Class I areas to the Laramie River Station, as shown in Figure 1 below. Rawah WA is located approximately 165 kilometers (km) to the southwest of the station and Rocky Mountain NP is located approximately 185 km to the southwest of the station. Wind Cave NP and Badlands NP are located to the northeast of the station, at distances of approximately 190 km and 270 km, respectively.

Only those Class I areas most likely to be impacted by the Laramie River sources were modeled, as determined by source/Class I area locations, distances to each Class I area, and professional judgment considering meteorological and terrain factors. It can be reasonably assumed that areas at greater distances and in directions of less frequent plume transport will experience lower impacts than those predicted for the two modeled areas.

Figure 1
Laramie River Station and Class I Areas



SCREENING MODELING

To determine if the Laramie River Station would be subject to BART, the Division conducted CALPUFF modeling using three years of meteorological data. These data, from 2001-2003, consisted of surface and upper-air observations and gridded output from the Mesoscale Model (MM5). Resolution of the MM5 data was 36-km for all three of the modeled years. Sources input to the modeling included the potential emissions (current operation) from the three coal-fired boilers at the facility. The Division chose to model the impacts at Wind Cave NP and Badlands NP for the screening, using the assumption that these areas would yield larger impacts than the Colorado Class I areas due to the predominant wind direction.

Results of the modeling showed that the 98th percentile value for the change in visibility (delta deciview [Δdv]) was above 0.5 Δdv at Wind Cave NP and Badlands NP for all three years of meteorology. As defined in EPA's final BART rule, a 98th percentile 0.5 Δdv impact or more from a given source indicates that the source contributes to visibility impairment, and therefore is subject to BART. The results of the screening modeling are shown in Table 13 below.

Table 13: Results of the Class I Area Screening Modeling

Year and Class I Area	Maximum Modeled Value (Δdv)	98th Percentile Value (Δdv)
2001		
Wind Cave NP	6.27	3.30
Badlands NP	5.50	3.68
2002		
Wind Cave NP	7.71	3.14
Badlands NP	5.88	2.78
2003		
Wind Cave NP	8.52	3.21
Badlands NP	5.44	2.67

Δdv = delta deciview
NP = National Park

REFINED MODELING

Because of the results of the Division's screening modeling for the Laramie River Station, BEPC was required to conduct a refined BART analysis that included CALPUFF visibility modeling for the facility. The modeling approach followed the requirements described in the Division's BART modeling protocol, *BART Air Modeling Protocol - Individual Source Visibility Assessments for BART Control Analyses (WDEQ-AQD, September 2006).*

CALPUFF System

Predicted visibility impacts from the Laramie River Station were determined with the EPA CALPUFF modeling system, which is the EPA-preferred modeling system for long-range transport. As described in the EPA Guideline on Air Quality Models (Appendix W of 40 CFR Part 51), long-range transport is defined as modeling with source-receptor distances greater than 50 km. Because all modeled areas are located more than 50 km from the sources in question, the CALPUFF system was appropriate for use.

The CALPUFF modeling system consists of a meteorological data pre-processor (CALMET), an air dispersion model (CALPUFF), and post-processor programs (POSTUTIL, CALSUM, CALPOST). The CALPUFF model was developed as a non-steady-state air quality modeling system for assessing the effects of time- and space-varying meteorological conditions on pollutant transport, transformation, and removal.

CALMET is a diagnostic wind model that develops hourly wind and temperature fields in a three-dimensional, gridded modeling domain. Meteorological inputs to CALMET can include surface and upper-air observations from multiple meteorological monitoring stations. Additionally, the CALMET model can utilize gridded analysis fields from various mesoscale models such as MM5 to better represent regional wind flows and complex terrain circulations. Associated two-dimensional fields such as mixing height, land use, and surface roughness are included in the input to the CALMET model. The CALMET model allows the user to "weight" various terrain influence parameters in the vertical and horizontal directions by defining the radius of influence for surface and upper-air stations.

CALPUFF is a multi-layer, Lagrangian puff dispersion model. CALPUFF can be driven by the three-dimensional wind fields developed by the CALMET model (refined mode), or by data from a single surface and upper-air station in a format consistent with the meteorological files used to drive steady-state dispersion models. All far-field modeling assessments described here were completed using the CALPUFF model in a refined mode.

CALSUM is a post-processing program that can operate on multiple CALPUFF output files to combine the results for further post-processing. POSTUTIL is a post-processing program that processes CALPUFF concentrations and wet/dry flux files. The POSTUTIL model operates on one or more output data files from CALPUFF to sum, scale, and/or compute species derived from those that are modeled, and outputs selected species to a file for further post-processing. CALPOST is a post-processing program that can read the CALPUFF (or POSTUTIL or CALSUM) output files, and calculate the impacts to visibility.

All of the refined CALPUFF modeling was conducted with the version of the CALPUFF system that was recognized as the EPA-approved release at the time of the development of the Division's modeling protocol. Version designations of the key programs are listed in the table below.

Table 14: Key Programs in CALPUFF System

Program	Version	Level
CALMET	5.53a	040716
CALPUFF	5.711a	040716
CALPOST	5.51	030709

Meteorological Data Processing (CALMET)

As required by the Division's modeling protocol, the CALMET model was used to construct the initial three-dimensional windfield using data from the MM5 model. Surface and upper-air data were also input to CALMET to adjust the initial windfield, but because of the relative scarcity of observations in the modeling domain, the influence of the observations was limited within CALMET. Because the MM5 data were afforded a high degree of influence on the CALMET windfields, the Division obtained MM5 data with 12-km resolution that spanned the years 2001-2003 for use in the analysis. The Division provided the BART applicants all of the raw meteorological inputs for the CALMET model Default settings were

used in the CALMET input files for most of the technical options.

The following table lists the key user-defined CALMET settings that were selected.

Table 15: Key User-Defined CALMET Settings

Variable	Description	Value
PMAP	Map projection	LCC (Lambert Conformal Conic)
DGRIDKM	Grid spacing (km)	4
NZ	Number of layers	10
ZFACE	Cell face heights (m)	0, 20, 40, 100, 140, 320, 580, 1020, 1480, 2220, 3400
RMIN2	Minimum distance for extrapolation	-1
IPROG	Use gridded prognostic model output	14 (MM5 data)
RMAX 1	Maximum radius of influence (surface layer, km)	30
RMAX 2	Maximum radius of influence (layers aloft, km)	50
TERRAD	Radius of influence for terrain (km)	15
R1	Relative weighting of first guess wind field and observations (km)	5
R2	Relative weighting aloft (km)	25

Two CALMET windfields were used for the Laramie River station BART modeling. The initial windfield was developed by BEPC to model the impacts at Wind Cave NP and Badlands NP, as directed by the Division and as specified in the Division's modeling protocol. A second, larger windfield was developed by the Division to model the impacts at Rawah WA and Rocky Mountain NP and to model an additional control scenario at Wind Cave NP and Badlands NP. Surface, upper-air, and precipitation data for the domains were incorporated into the CALMET windfields. Figures 2 and 3 below show the locations of surface, upper-air, and precipitation stations used for the two windfields.

Figure 2: Observations Input to CALMET (BEPC Windfield)

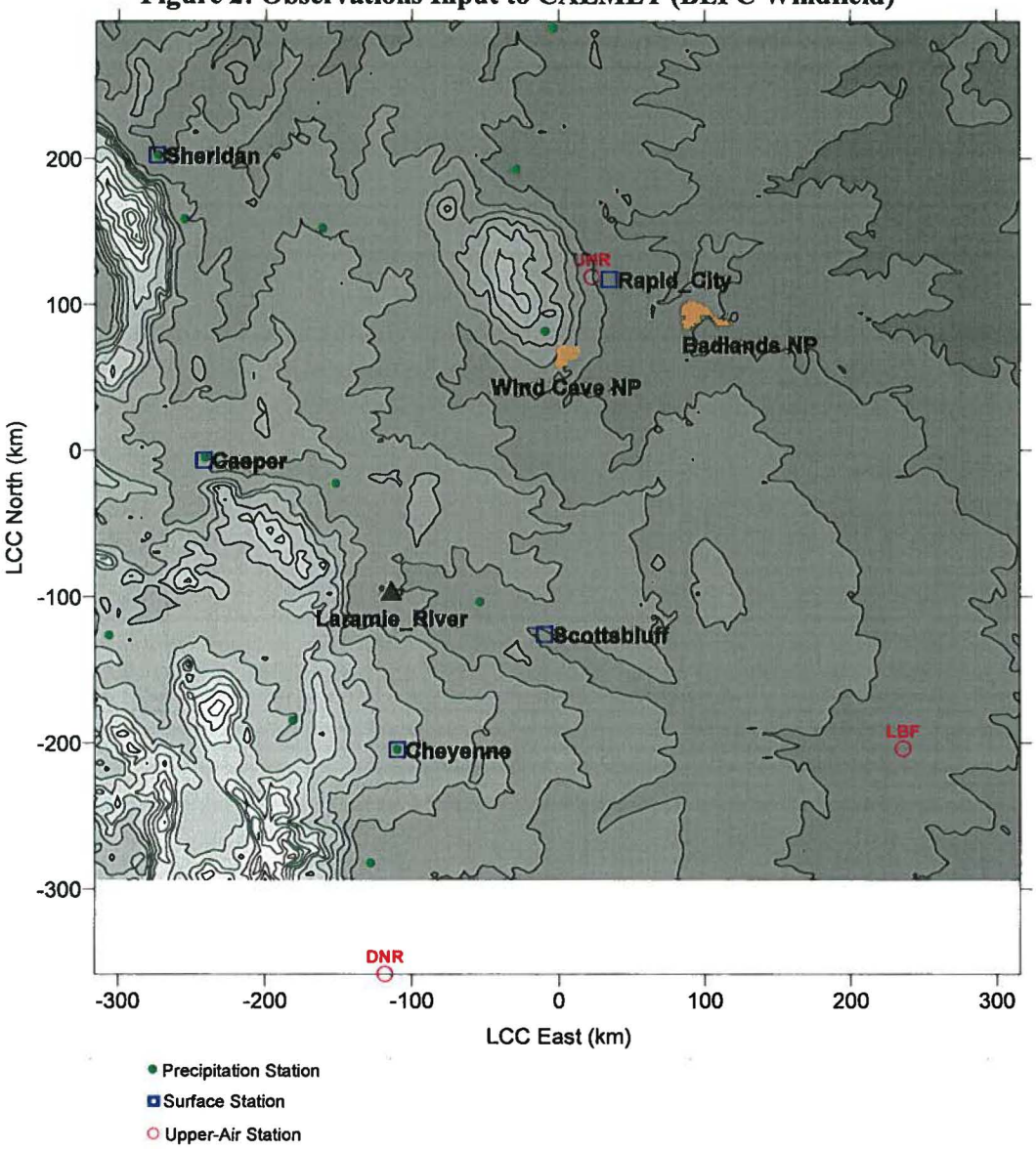
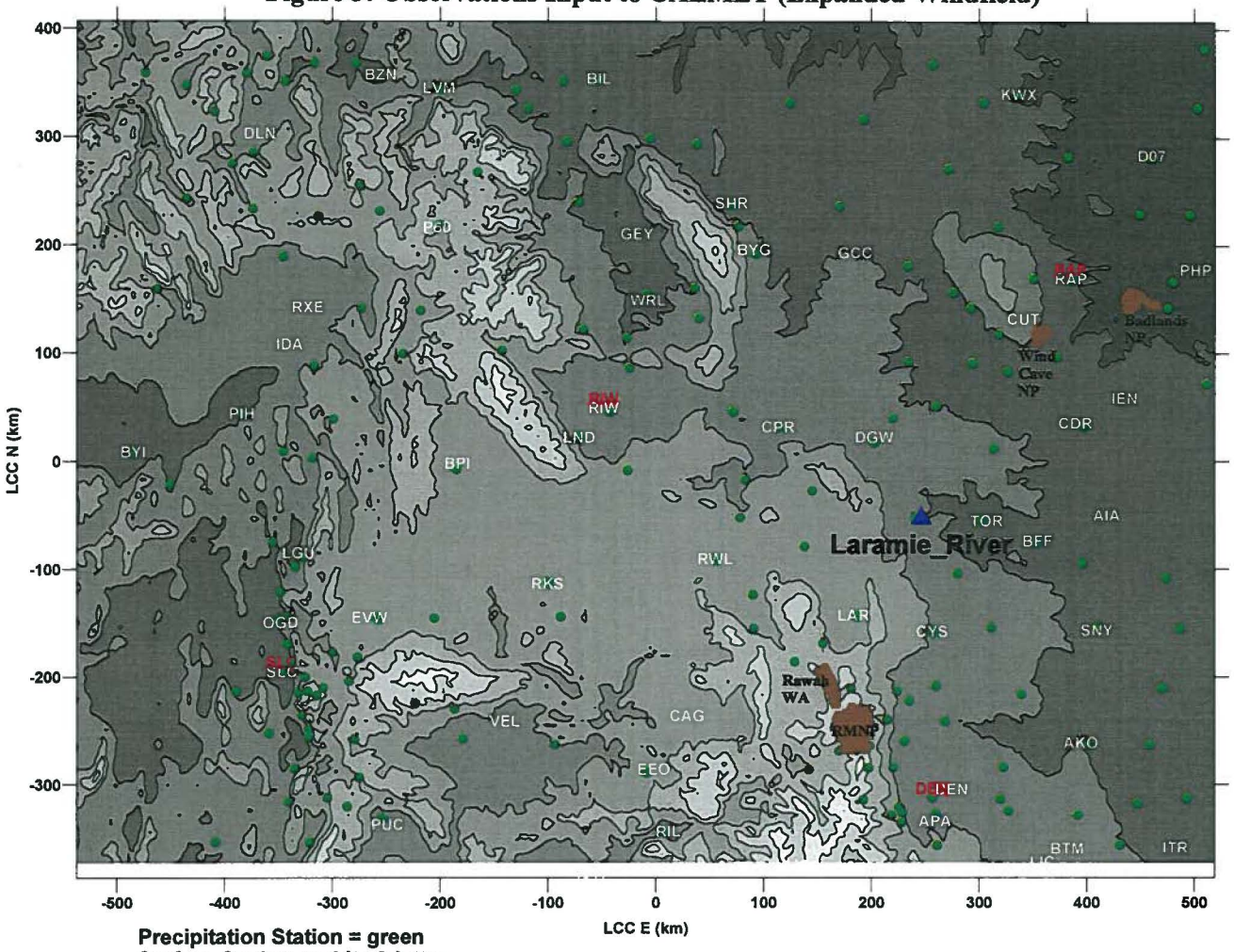


Figure 3: Observations Input to CALMET (Expanded Windfield)



Precipitation Station = green
Surface Station = white 3-letter
Upper-Air (+ surface) = red 3-letter

CALPUFF Modeling Setup

To allow chemical transformations within CALPUFF using the recommended chemistry mechanism (MESOPUFF II), the model required input of background ozone and ammonia. For ozone, hourly data collected from the following stations were used:

- Rocky Mountain National Park, Colorado (NP)
- Craters of the Moon National Monument, Idaho
- Highland, Utah
- Thunder Basin, Wyoming
- Yellowstone NP, Wyoming
- Centennial, Wyoming
- Pinedale, Wyoming

For any hour that was missing ozone data from all stations, a default value of 44 parts per billion (ppb) was used by the model as a substitute. For ammonia, a domain-wide background value of 2 ppb was used.

Latitude and longitude coordinates for Class I area discrete receptors were taken from the National Park Service (NPS) Class I Receptors database and converted to the appropriate Lambert Conformal Conic coordinates. Figures 4-7 show the receptor configurations that were used for Rawah WA, Rocky Mountain NP, Badlands NP, and Wind Cave NP. Receptor spacing within Wind Cave NP is approximately 0.7 km in the east-west direction and approximately 0.9 km in the north-south direction. For Rawah WA, Rocky Mountain NP, and Badlands NP, the receptor spacing is approximately 1.4 km in the east-west direction and approximately 1.8 km in the north-south direction.

Figure 4
Receptors for Rawah WA

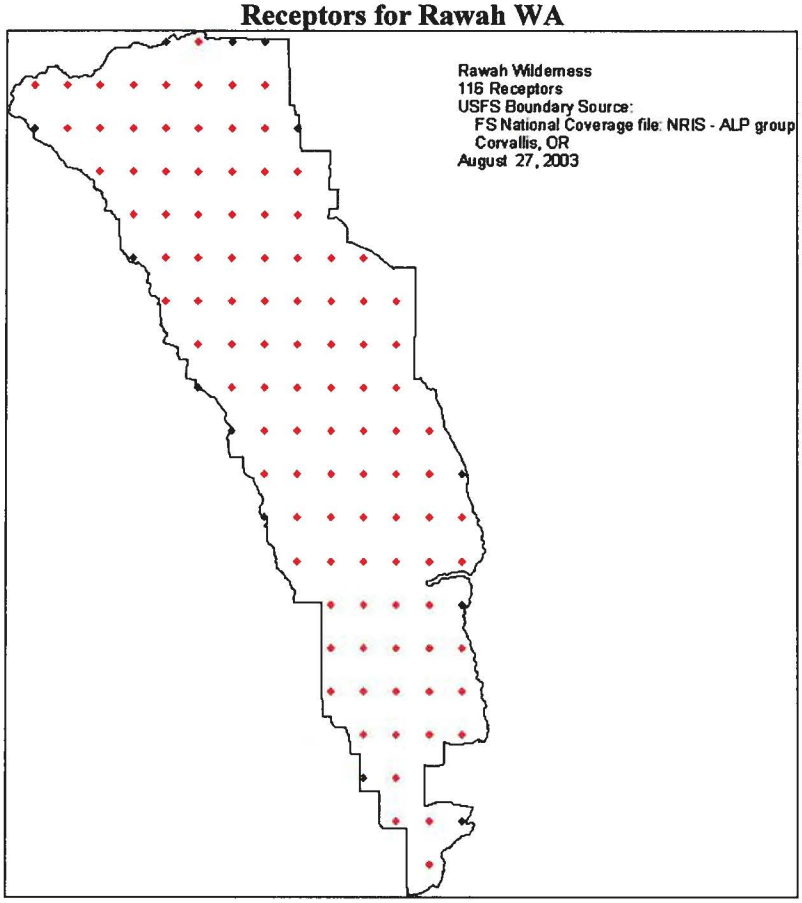


Figure 5
Receptors for Rocky Mountain NP

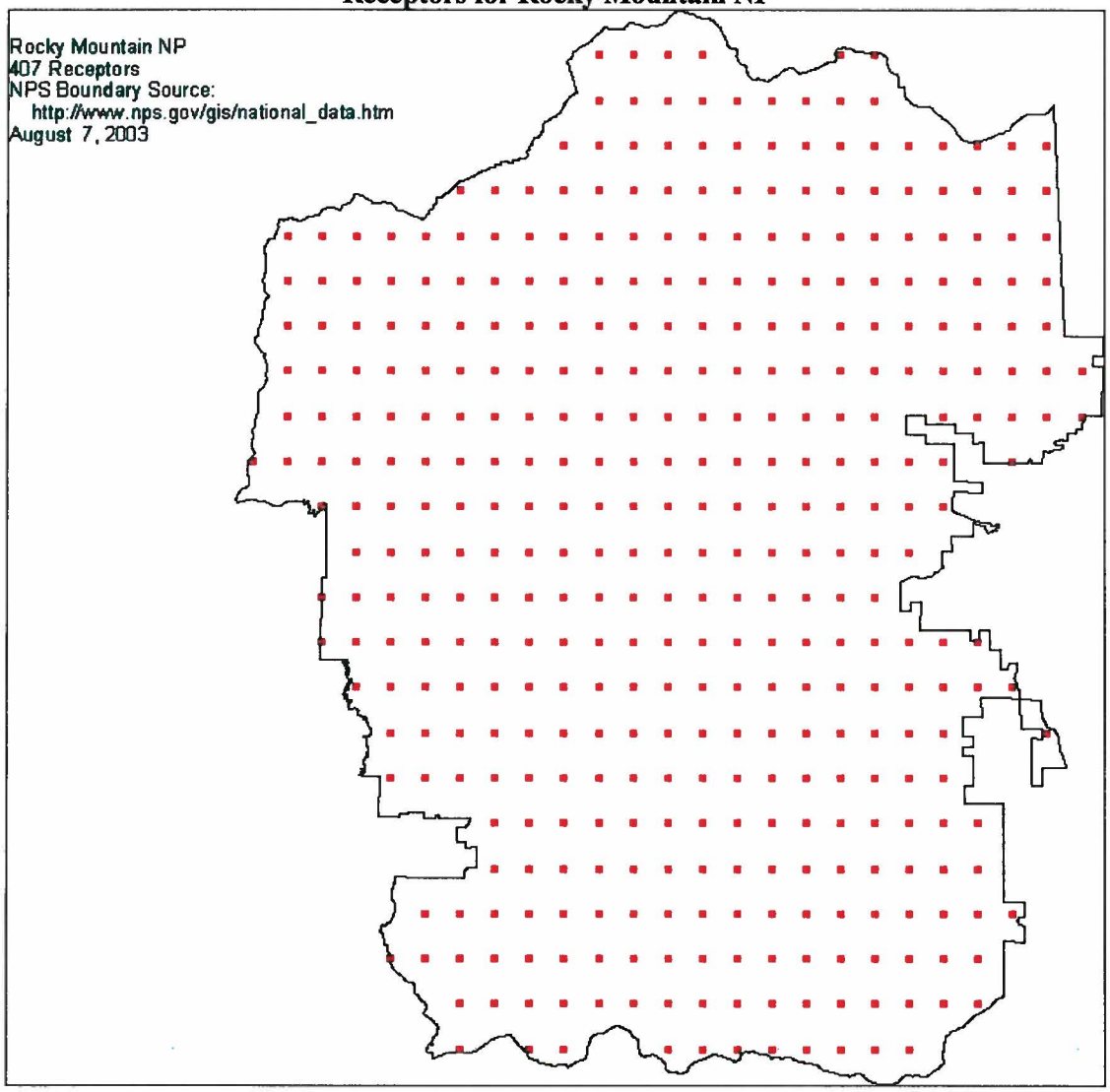


Figure 6
Receptors for Wind Cave NP

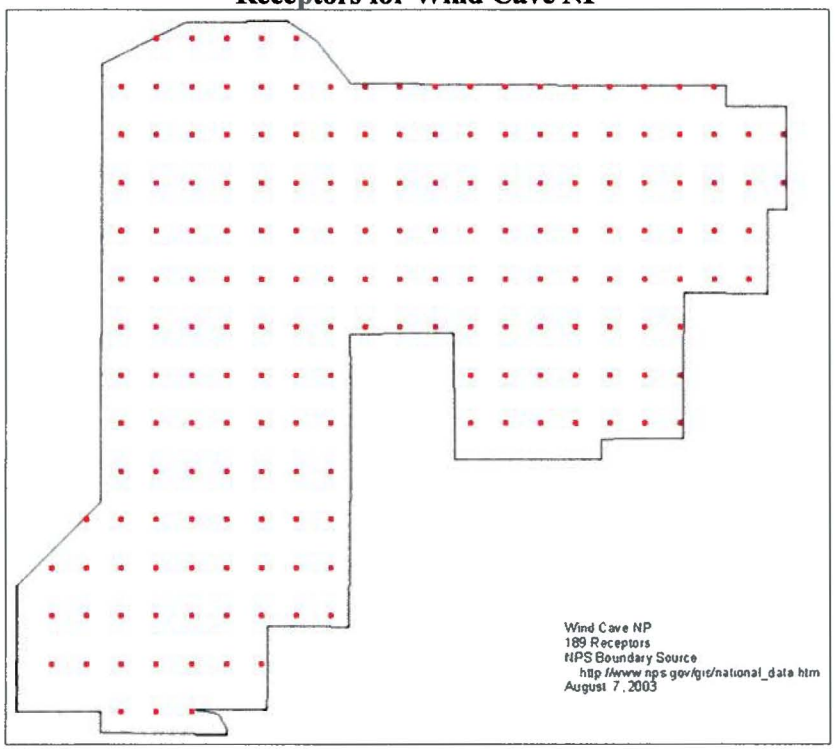
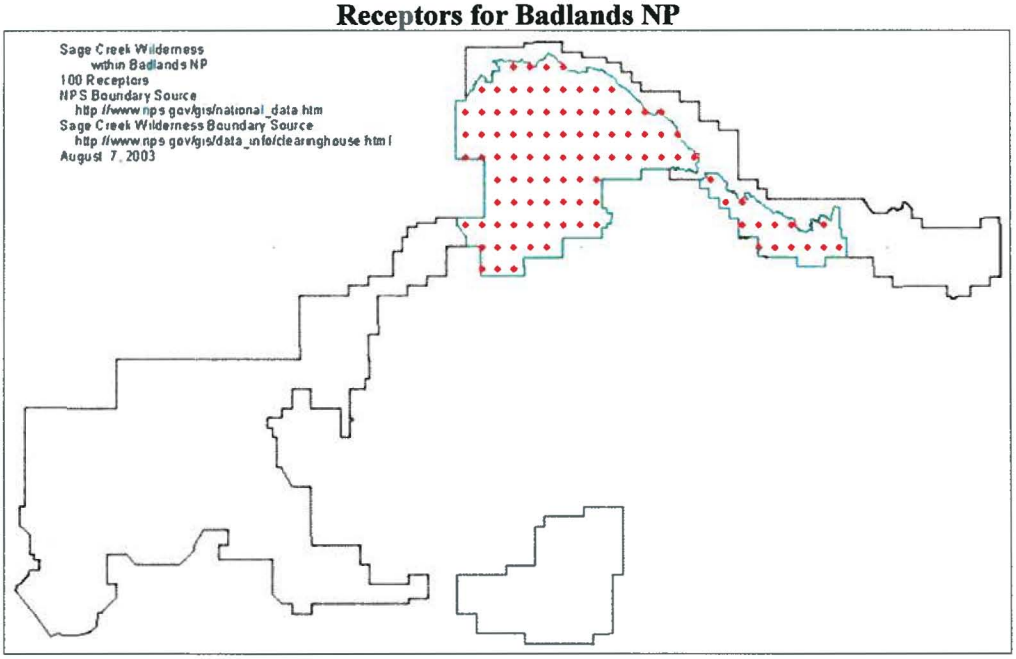


Figure 7
Receptors for Badlands NP



CALPUFF Inputs – Baseline and Control Options

The first step in the refined modeling analysis was to perform visibility modeling for current (baseline) operations at the facility. Emissions of NO_x and SO_2 for the baseline runs were established based on CEM annual emissions averages for years 2001 to 2003. All particulate emissions (PM) were based on an emission rate of 0.03 lb/MMBtu and were treated as $PM_{2.5}$ (fine PM) within CALPUFF and CALPOST. Direct emissions of sulfate were based on the values calculated for the Toxic Release Inventory (TRI) for the years modeled.

Baseline source release parameters and emissions are shown in the table below, followed by tables with data for the various control options. No attempt was made by the applicant to estimate the increase in sulfate emissions that would result from operation of SCR and SNCR/SCR hybrid controls, and as a result the visibility improvement for those scenarios may be overestimated by some undetermined amount.

Table 16: Baseline Source Parameters

	Baseline		
	Coal-Fired Unit 1 (P1)	**Coal-Fired Unit 2 (P2)**	**Coal-Fired Unit 3 (P3)**
Parameter	**LNB, WFGD, ESP**	**LNB, WFGD, ESP**	**LNB, DFGD, ESP**
Heat Input (MMBtu/yr)	46,814,433	46,557,738	47,765,529
Base Elevation (m)	1348	1348	1348
Stack Height (m)	184.4	184.4	184.40
Stack Diameter (m)	8.69	8.69	8.69
Stack Temperature (K)	338.7	338.7	352.0
Exit Velocity (m/s)	21.33	21.03	22.25
SO_2 Emissions (lb/MMBtu)	0.16	0.16	0.17
SO_2 Emissions (tpy)	3745	3725	4060
HS_2O_4 Emissions (tpy)	3.06	2.80	0.22
NO_x Emissions (lb/MMBtu)	0.27	0.27	0.27
NO_x Emissions (tpy)	6320	6285	6448
PM Fine Emissions (lb/MMBtu)	0.03	0.03	0.03
PM Fine Emissions (tpy)	702	698	716

Note: Boiler heat input and lb/MMBtu emissions for NO_x and SO_2 based on continuous emissions monitoring (CEM) annual averages for 2001-2003.

DFGD = dry flue gas desulfurization
ESP = electrostatic precipitator
H_2SO_4 = sulfuric acid
K = Kelvin
lb/MMBtu = pounds per million British thermal units
LNB = low-NO_x burners
m = meters
m/s = meters per second
MMBtu/yr = million British thermal units per year
NO_x = nitrogen oxides
PM = particulate matter
SO_2 = sulfur dioxide
tpy = tons per year
WFGD = wet flue gas desulfurization

Table 17: Source Parameters and Emissions for BART Control Options

Parameter	Control Option 1			Control Option 2		
	NO_x Control: Overfire Air (OFA) or New LNB			NO_x Control: New LNB with OFA		
	Coal-Fired Unit 1 (P1)	Coal-Fired Unit 2 (P2)	Coal-Fired Unit 3 (P3)	Coal-Fired Unit 1 (P1)	Coal-Fired Unit 2 (P2)	Coal-Fired Unit 3 (P3)
Base Elevation (m)	1348	1348	1348	1348	1348	1348
Stack Height (m)	184.4	184.4	184.4	184.4	184.4	184.4
Stack Diameter (m)	8.69	8.69	8.69	8.69	8.69	8.69
Stack Temperature (K)	338.7	338.7	352.0	338.7	338.7	352.0
Exit Velocity (m/s)	21.33	21.03	22.25	21.33	21.03	22.25
SO_2 Emissions (lb/MMBtu)	0.16	0.16	0.17	0.16	0.16	0.17
SO_2 Emissions (tpy)	3745	3725	4060	3745	3725	4060
H_2SO_4 Emissions (tpy)	3.18	3.25	0.22	3.18	3.25	0.22
NO_x Emissions (lb/MMBtu)	0.23	0.23	0.23	0.23	0.23	0.23
NO_x Emissions (tpy)	5384	5354	5493	5384	5354	5493
PM Fine Emissions (lb/MMBtu)	0.030	0.030	0.030	0.030	0.030	0.030
PM Fine Emissions (tpy)	702	698	716	702	698	716

H_2SO_4 = sulfuric acid
K = Kelvin
lb/MMBtu = pounds per million British thermal units
LNB = low NO_x burners
m = meters
m/s = meters per second
NO_x = nitrogen oxides
OFA = overfire air
PM = particulate matter
SCR = selective catalytic reduction
SO_2 = sulfur dioxide
tpy = tons per year

Table 17: Source Parameters and Emissions for BART Control Options (cont.)

	Control Option 4		
	NO_x Control: SCR		
Parameter	**Coal-Fired Unit 1 (P1)**	**Coal-Fired Unit 2 (P2)**	**Coal-Fired Unit 3 (P3)**
Base Elevation (m)	1348	1348	1348
Stack Height (m)	184.4	184.4	184.4
Stack Diameter (m)	8.69	8.69	8.69
Stack Temperature (K)	338.7	338.7	352.0
Exit Velocity (m/s)	21.33	21.03	22.25
SO_2 Emissions (lb/MMBtu)	0.16	0.16	0.17
SO_2 Emissions (tpy)	3745	3725	4060
H_2SO_4 Emissions (tpy)	3.18	3.25	0.22
NO_x Emissions (lb/MMBtu)	0.07	0.07	0.07
NO_x Emissions (tpy)	1639	1630	1672
PM Fine Emissions (lb/MMBtu)	0.030	0.030	0.030
PM Fine Emissions (tpy)	702	698	716

H_2SO_4 = sulfuric acid
K = Kelvin
lb/MMBtu = pounds per million British thermal units
LNB = low NO_x burners
m = meters
m/s = meters per second
NO_x = nitrogen oxides
OFA = overfire air
PM = particulate matter
SCR = selective catalytic reduction
SO_2 = sulfur dioxide
tpy = tons per year

Visibility Post-Processing (CALPOST) Setup

The changes in visibility were calculated using Method 6 within the CALPOST post-processor. Method 6 requires input of monthly relative humidity factors [f(RH)] for each Class I area that is being modeled. Monthly f(RH) factors that were used for this analysis are shown in the table below.

Table 18: Relative Humidity Factors for CALPOST

Month	Rocky Mountain NP	Rawah WA	Wind Cave NP and Badlands NP
January	1.7	2.1	2.65
February	1.9	2.1	2.65
March	1.9	2.0	2.65
April	2.1	2.1	2.55
May	2.3	2.3	2.70
June	2.0	2.0	2.60
July	1.8	1.8	2.30
August	2.0	2.0	2.30
September	1.9	2.0	2.20
October	1.8	1.9	2.25
November	1.8	2.1	2.75
December	1.7	2.0	2.65

According to the final BART rule, natural background conditions as a reference for determination of the modeled Δdv change should be representative of the 20 percent best natural visibility days in a given Class I area. EPA BART guidance provides the 20 percent best days deciview values for each Class I area on an annual basis, but does not provide the individual species concentration data required for input to CALPOST.

Species concentrations corresponding to the 20 percent best days were calculated for each Class I area by scaling back the annual average (natural background) concentrations given in Table 2-1 of the EPA document *Guidance for Estimating Natural Visibility Conditions Under the Regional Haze Rule.* A separate scaling factor was derived for each Class I area such that, when multiplied by the guidance table annual concentrations, the 20 percent best days deciview values for that particular Class I area would be calculated.

The scaling procedure is illustrated here for Badlands NP. From Appendix B in the EPA natural visibility guidance document, the deciview value for the 20 percent best days at Badlands NP is 2.18 dv. To obtain the speciated background concentrations representative of the 20 percent best days, the deciview value (2.18 dv) was first converted to light extinction. The relationship between deciviews and light extinction is expressed as follows:

$dv = 10 \ln (b_{ext}/10)$ or $b_{ext} = 10 \exp (dv/10)$
where: b_{ext} = light extinction expressed in inverse megameters (Mm^{-1}).

Using this relationship with the known deciview value of 2.18, one obtains an equivalent light extinction value of 12.44 Mm^{-1}. Next, the annual average natural visibility concentrations were set equal to a total extinction value of 12.44 Mm^{-1}. The relationship between total light extinction and the individual components of the light extinction is as follows:

b_{ext} = (3)f(RH)[ammonium sulfate] + (3)f(RH)[ammonium nitrate] + (0.6)[coarse mass] + (4)[organic carbon] + (1)[soil] + (10)[elemental carbon] + b_{ray}

where:

- bracketed quantities represent background concentrations in $\mu g/m^3$
- values in parenthesis represent scattering efficiencies
- f(RH) is the relative humidity adjustment factor (applied to hygroscopic species only)
- b_{ray} is light extinction due to Rayleigh scattering (10 Mm^{-1} used for all Class I areas)

Substituting the annual average natural background concentrations, the average f(RH) for Badlands NP, and including a coefficient for scaling, one obtains:

12.44 = (3)(2.55)[0.12]X + (3)(2.55)[0.1]X + (0.6)[3.0]X + (4)[0.47]X + (1)[0.5]X + (10)[0.02]X + 10

In the equation above, X represents a scaling factor needed to convert the annual average natural background concentrations to values representative of the 20 percent best days. Solving for X provides a value of 0.402. Table 19 presents the annual average natural background concentrations, the calculated scaling factor, and the calculated background concentrations for the 20 percent best days for Badlands NP.

Table 19: Calculated Background Components for Badlands NP

Component	Annual Average for West Region ($\mu g/m^3$)	Calculated Scaling Factor	20% Best Days for Badlands NP ($\mu g/m^3$)
Ammonium Sulfate	0.12	0.402	0.048
Ammonium Nitrate	0.10	0.402	0.040
Organic Carbon	0.47	0.402	0.189
Elemental Carbon	0.02	0.402	0.008
Soil	0.50	0.402	0.201
Coarse Mass	3.00	0.402	1.205

The scaled aerosol concentrations were averaged for Badlands NP and Wind Cave NP because of their geographical proximity and similar annual background visibility. The 20 percent best days aerosol concentrations for the Class I areas in question are listed in the table below.

Table 20: Natural Background Aerosol Concentrations (μg/m^3)

Aerosol Component	Rawah WA	Rocky Mountain NP	Wind Cave NP & Badlands NP
Ammonium Sulfate	0.045	0.045	0.047
Ammonium Nitrate	0.038	0.038	0.040
Organic Carbon	0.178	0.177	0.186
Elemental Carbon	0.008	0.008	0.008
Soil	0.189	0.189	0.198
Coarse Mass	1.135	1.132	1.191

The results of the visibility modeling for each of the three units for the baseline and control scenarios are shown in the tables below. Results for the Colorado Class I areas are presented for the baseline scenario only because the results for this scenario were well below 0.5 Δdv. For each scenario, the 98th percentile Δdv results are reported along with the total number of days for which the predicted impacts exceeded 0.5 dv. Following the tables are figures that present the results graphically for Wind Cave NP and Badlands NP.

Table 21: CALPUFF Visibility Modeling Results for Laramie River Unit 1

Class I Area	2001		2002		2003		3-Year Average	
	98th Percentile Value (Δdv)	No. of Days > 0.5 Δdv	98th Percentile Value (Δdv)	No. of Days > 0.5 Δdv	98th Percentile Value (Δdv)	No. of Days > 0.5 Δdv	98th Percentile Value (Δdv)	No. of Days > 0.5 Δdv
Baseline – LNB, Wet FGD, ESP								
Badlands NP	0.643	14	0.841	17	0.599	9	0.694	13
Wind Cave NP	0.732	17	0.700	16	0.542	9	0.658	14
Post-Control Scenario 1 – OFA								
Badlands NP	0.574	12	0.761	16	0.532	9	0.622	12
Wind Cave NP	0.662	15	0.619	11	0.496	7	0.592	11
Post-Control Scenario 2 – OFA + New LNB								
Badlands NP	0.574	12	0.761	16	0.532	9	0.622	12
Wind Cave NP	0.662	15	0.619	11	0.496	7	0.592	11
Post-Control Scenario 4 – SCR								
Badlands NP	0.322	4	0.402	4	0.303	5	0.342	4
Wind Cave NP	0.378	3	0.320	1	0.307	3	0.335	2

Table 22: CALPUFF Visibility Modeling Results for Laramie River Unit 2

Class I Area	2001		2002		2003		3-Year Average	
	98th Percentile Value (Δdv)	No. of Days > 0.5 Δdv	98th Percentile Value (Δdv)	No. of Days > 0.5 Δdv	98th Percentile Value (Δdv)	No. of Days > 0.5 Δdv	98th Percentile Value (Δdv)	No. of Days > 0.5 Δdv
Baseline – LNB, Wet FGD, ESP								
Badlands NP	0.642	14	0.842	17	0.594	10	0.693	14
Wind Cave NP	0.725	17	0.699	16	0.546	9	0.657	14
Post-Control Scenario 1 – OFA								
Badlands NP	0.573	12	0.762	16	0.530	9	0.622	12
Wind Cave NP	0.658	15	0.615	11	0.498	7	0.590	11
Post-Control Scenario 2 – OFA + New LNB								
Badlands NP	0.573	12	0.762	16	0.530	9	0.622	12
Wind Cave NP	0.658	15	0.615	11	0.498	7	0.590	11
Post-Control Scenario 4 – SCR								
Badlands NP	0.320	4	0.399	4	0.302	5	0.340	4
Wind Cave NP	0.384	3	0.319	1	0.310	3	0.338	2

Table 23: CALPUFF Visibility Modeling Results for Laramie River Unit 3

Class I Area	2001		2002		2003		3-Year Average	
	98th Percentile Value (Δdv)	No. of Days > 0.5 Δdv	98th Percentile Value (Δdv)	No. of Days > 0.5 Δdv	98th Percentile Value (Δdv)	No. of Days > 0.5 Δdv	98th Percentile Value (Δdv)	No. of Days > 0.5 Δdv
Baseline – LNB, Wet FGD, ESP								
Badlands NP	0.639	14	0.886	18	0.630	8	0.718	13
Wind Cave NP	0.680	17	0.717	16	0.553	10	0.650	14
Post-Control Scenario 1 – OFA								
Badlands NP	0.572	11	0.803	17	0.561	8	0.645	12
Wind Cave NP	0.609	14	0.643	13	0.502	8	0.585	12
Post-Control Scenario 2 – OFA + New LNB								
Badlands NP	0.572	11	0.803	17	0.561	8	0.645	12
Wind Cave NP	0.609	14	0.643	13	0.502	8	0.585	12
Post-Control Scenario 4 – SCR								
Badlands NP	0.336	4	0.446	4	0.323	4	0.368	4
Wind Cave NP	0.381	4	0.348	2	0.297	3	0.342	3

Table 24: CALPUFF Visibility Modeling Results for Laramie River Station: Rocky Mountain National Park & Rawah WA (Baseline Scenario)

Class I Area	2001		2002		2003		3-Year Average	
	98th Percentile Value (Δdv)	No. of Days > 0.5 Δdv	98th Percentile Value (Δdv)	No. of Days > 0.5 Δdv	98th Percentile Value (Δdv)	No. of Days > 0.5 Δdv	98th Percentile Value (Δdv)	No. of Days > 0.5 Δdv
Unit 1								
Rawah WA	0.308	3	0.425	7	0.287	2	0.340	4
Rocky Mtn. NP	0.414	6	0.447	7	0.441	5	0.434	6
Unit 2								
Rawah WA	0.309	3	0.422	7	0.279	2	0.337	4
Rocky Mtn. NP	0.415	6	0.455	7	0.437	5	0.436	6
Unit 3								
Rawah WA	0.295	3	0.440	6	0.301	2	0.345	4
Rocky Mtn. NP	0.433	7	0.481	7	0.448	4	0.454	6

Figure 8 – Modeled BART Impacts: Number of Days > 0.5 delta-dv

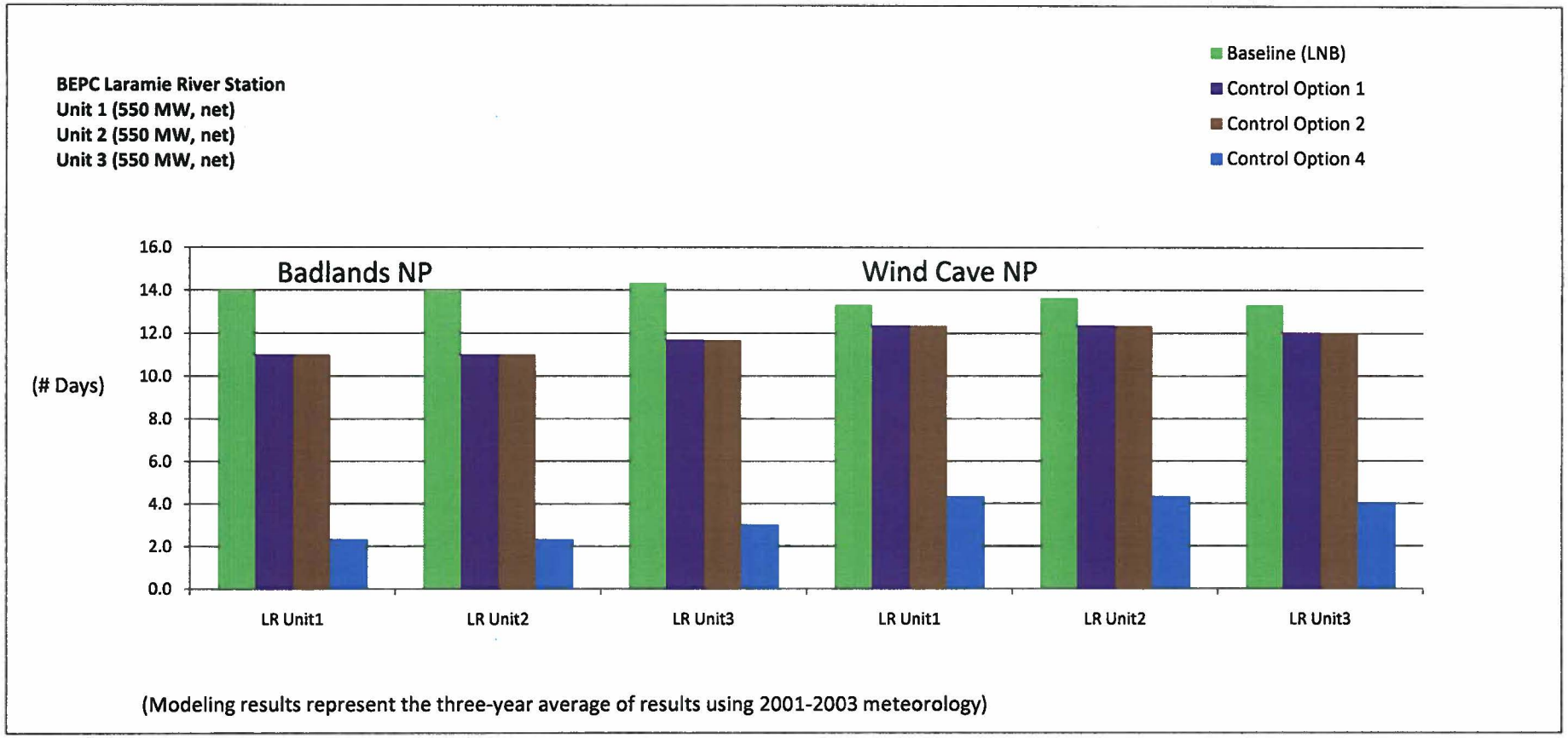
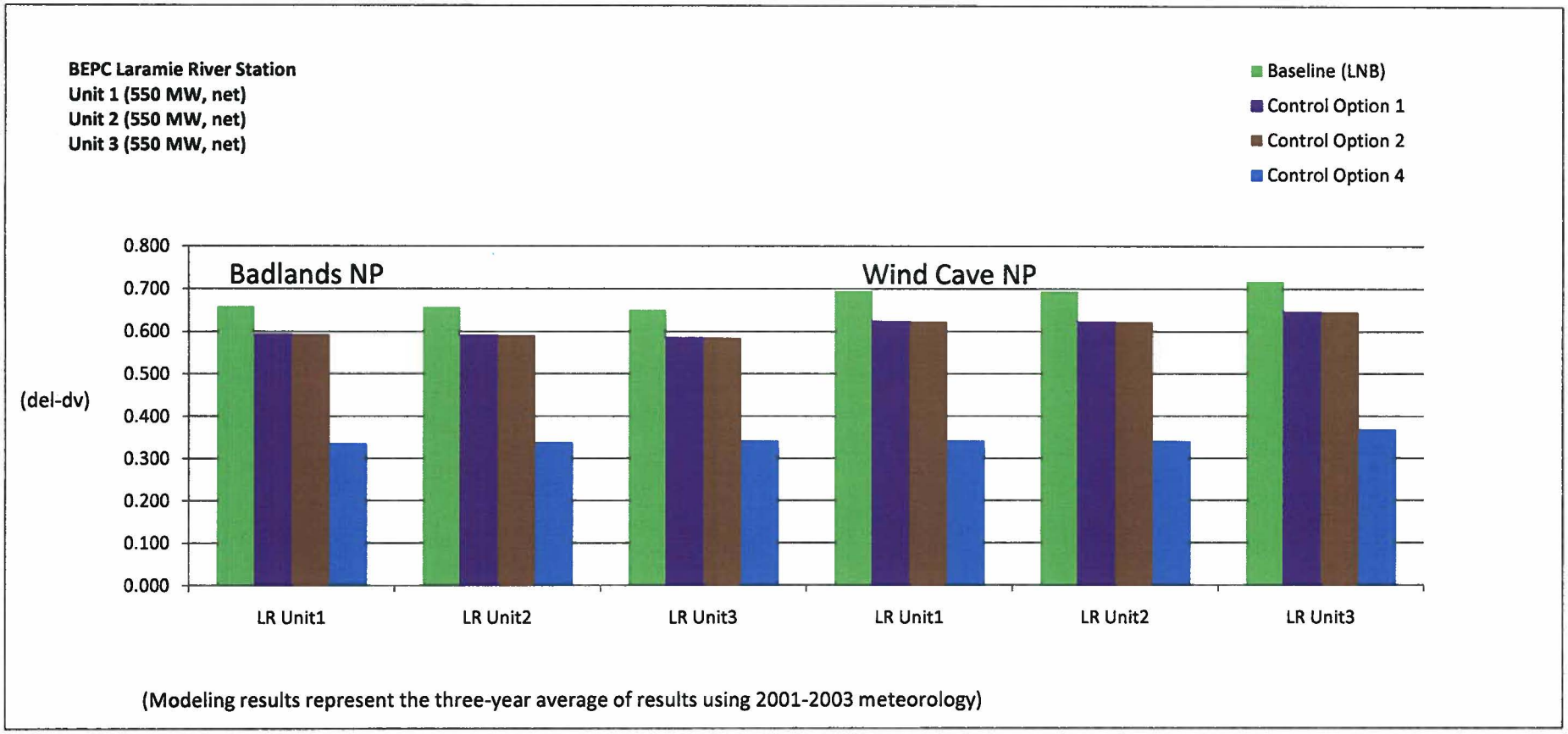


Figure 9 – Modeled BART Impacts: 98th Percentile (delta-dv)



BART CONCLUSIONS:

After considering: (1) the costs of compliance, (2) the energy and non-air quality environmental impacts of compliance, (3) any pollution equipment in use or in existence at the source, (4) the remaining useful life of the source, and (5) the degree of improvement in visibility (all five statutory factors) from each proposed control technology, the Division determined BART for the three units at the Laramie River Station.

NO_x

New LNB with OFA is determined to be BART for NO_x control for Units 1-3 based, in part, on the following conclusions:

1. Installation of new LNB with OFA was cost effective, with a capital cost of $22,096,000 per unit and $2,036-$2,088 per ton of NO_x removed based on the average cost effectiveness for each unit over a twenty year operational life.

2. Combustion control using LNB with OFA does not require non-air quality environmental mitigation for the use of chemical reagents (i.e., ammonia or urea) and there is a minimal energy impact.

3. After careful consideration of the five statutory factors, especially the costs of compliance and the existing pollution control equipment, a NO_x control level of 0.23 lb/MMBtu on a 30-day rolling average, equal to EPA's established presumptive limit for dry-bottom, wall-fired boilers burning sub-bituminous coal, is justified.

4. Visibility impacts were addressed in a comprehensive visibility analysis covering three visibility impairing pollutants and the associated control options. The cumulative visibility improvement as compared to the baseline across Wind Cave NP and Badlands NP achieved with new LNB with OFA at the 30-day limit of 0.23 lb/MMBtu (based on the 98th percentile modeled results) was 0.14 Δdv from each of the three units. The expected visibility improvement over the course of a full annual period would be even greater due to the annual BART limit that is based on 0.19 lb/MMBtu.

5. Annual NO_x emission reductions from new LNB with OFA on Units 1, 2, and 3 are 1,862-1,910 tons per unit for a total annual reduction of 5,645 tons.

LNB with OFA and SCR was not determined to be BART for NO_x control for Units 1-3 based, in part, on the following conclusions:

1. The cost of compliance for installing SCR on each unit is significantly higher than the cost for LNB with OFA. Additional capital costs for SCR on Units 1-3 are $101,005,000 per unit. Annual operating costs for SCR on Units 1-3 are $4,608,000 per unit.

2. Additional non-air quality environmental mitigation is required for the use of chemical reagents.

3. Operation of LNB with OFA and SCR is parasitic and requires an estimated 4.8 MW of power from each unit.

4. The cumulative visibility improvement for SCR, as compared to LNB/OFA, across Wind Cave NP and Badlands NP (based on the 98th percentile modeled results) was 0.52-0.54 Δdv for each of the three units.

The Division considers the installation and operation of the BART-determined NO_x controls, new LNB with OFA, to meet the statutory requirements of BART.

Unit-by-unit NO_x BART determinations:

Laramie River Unit 1: New LNB with OFA and meeting NO_x emission limits of 0.23 lb/MMBtu (30-day rolling average), 1,348 lb/hr (30-day rolling average), and 5,343 tpy (12-month rolling) as BART for NO_x.

Laramie River Unit 2: New LNB with OFA and meeting NO_x emission limits of 0.23 lb/MMBtu (30-day rolling average), 1,348 lb/hr (30-day rolling average), and 5,343 tpy (12-month rolling) as BART for NO_x.

Laramie River Unit 3: New LNB with OFA and meeting NO_x emission limits of 0.23 lb/MMBtu (30-day rolling average), 1,386 lb/hr (30-day rolling average), and 5,493 tpy (12-month rolling) as BART for NO_x.

The performance/efficiency-based, 30-day rolling average emission rate of 0.23 lb/MMBtu is set to allow for continuous compliance with proper operation of the control equipment, while taking into account the normal operational variability that is typical for a boiler. The 30-day limits that are expressed in terms of mass emissions (lb/hr) are based on 0.21 lb/MMBtu. Because reduced steam loads on a boiler can result in periods of increased emissions in terms of lb/MMBtu but lower emissions in terms of lb/hr, the Division has chosen to set the dual 30-day limits, one set at 0.23 lb/MMBtu and one expressed in lb/hr based on 0.21 lb/MMBtu. For the 12-month rolling emission limits, the Division considered the ability of the source to maintain a lower emission rate over a longer time period and set the long-term limit (expressed in tpy) based on 0.19 lb/MMBtu.

PM/PM_{10}

Existing ESP is determined to be BART for Units 1-3 for PM/PM_{10} based, in part, on the following conclusions:

1. The cost of compliance for the sole technically feasible control option, a retrofit fabric filter on the Unit 3 ESP, is not reasonable over a twenty year operational life. The cost effectiveness for installing the retrofit fabric filter is $40,156 per ton of PM/$PM_{10}$ removed. No additional control technologies were deemed to be technically feasible for Units 1 and 2.

2. Visibility impacts from the installation of controls on PM/PM_{10} emissions, in general, are not expected to produce significant visibility improvements. In particular for the Laramie River Station, Basin Electric modeled the fabric filter retrofit on Unit 3, and the predicted improvement in visibility as compared to baseline at Wind Cave NP or Badlands NP was at most 0.07 Δdv.

The Division considers the operation of the BART-determined PM/PM_{10} controls, existing ESP, to meet the statutory requirements of BART.

Unit-by-unit PM/PM_{10} BART determinations:

Laramie River Unit 1: Continuing to use the existing ESP to meet the established PM/PM_{10} emission limits of 0.030 lb/MMBtu, 193 lb/hr, and 844 tpy as BART for PM/PM_{10}.

Laramie River Unit 2: Continuing to use the existing ESP to meet the established PM/PM_{10} emission limits of 0.030 lb/MMBtu, 193 lb/hr, and 844 tpy as BART for PM/PM_{10}.

Laramie River Unit 3: Continuing to use the existing ESP to meet the established PM/PM_{10} emission limits of 0.030 lb/MMBtu, 198 lb/hr, and 867 tpy as BART for PM/PM_{10}.

SO_2: REGIONAL SO_2 MILESTONE AND BACKSTOP TRADING PROGRAM

Basin Electric evaluated SO_2 control technologies that can achieve a SO_2 emission rate of 0.15 lb/MMBtu or lower from the coal-fired boilers. Basin Electric proposed BART controls include using chemical additives in the Unit 1 and 2 WFGD systems.

Wyoming is a §309 state participating in the Regional SO_2 Milestone and Backstop Trading Program. §308(e)(2) provides States with the option to implement or require participation in an emissions trading program or other alternative measure rather than to require sources subject to BART to install, operate, and maintain additional control technology to meet an established emission limit on a continuous basis. However, the alternate program must achieve greater reasonable progress than would be accomplished by installing BART. A demonstration that the alternate program can achieve greater reasonable progress is prescribed by §308(e)(2)(i). Since the pollutant of concern is SO_2, this demonstration has been performed under §309 as part of the state implementation plan. §309(d)(4)(i) requires that the SO_2 milestones established under the plan "...must be shown to provide for greater reasonable progress than would be achieved by application of BART pursuant to §51.308(e)(2)."

Wyoming participated in creating a detailed report entitled **Demonstration that the SO_2 Milestones Provide Greater Reasonable Progress than BART** covering SO_2 emissions from all states participating in the Regional SO_2 Milestone and Backstop Trading Program. The document was submitted to EPA in support of the §309 Wyoming Regional Haze SIP in November of 2008.

As part of the §309 program, participating states, including Wyoming, must submit an annual Regional Sulfur Dioxide Emissions and Milestone Report that compares actual emissions to pre-established milestones. Participating states have been filing these reports since 2003. Each year, states have been

able to demonstrate that actual SO_2 emissions are well below the milestones. The actual emissions and their respective milestones are shown below:

Table 25: Regional Sulfur Dioxide Emissions and Milestone Report Summary

Year	Reported SO_2 Emissions (tons)	3-year Milestone Average (tons)
2003	330,679	447,383
2004	337,970	448,259
2005	304,591	446,903
2006	279,134	420,194
2007	273,663	420,637

In addition to demonstrating successful SO_2 emission reductions, §309 states have also relied on visibility modeling conducted by the WRAP to demonstrate improvement at Class I areas. The complete modeling demonstration showing deciview values was included as part of the visibility improvement section of the §309 SIP, but the SO_2 portion of the demonstration has been included as Table 26 to underscore the improvements associated with SO_2 reductions.

Table 26: Visibility - Sulfate Extinction Only

Class I Area Monitor (Class I Areas Represented)	20% Worst Visibility Days (Monthly Average, Mm^{-1})		20% Best Visibility Days (Monthly Average, Mm^{-1})	
	2018 [1] Base Case (Base 18b)	2018 [2] Preliminary Reasonable Progress Case (PRP18a)	2018 [1] Base Case (Base 18b)	2018 [2] Preliminary Reasonable Progress Case (PRP18a)
Bridger, WY (Bridger WA and Fitzpatrick WA)	5.2	4.3	1.6	1.3
North Absaroka, WY (North Absaroka WA and Washakie WA)	4.8	4.5	1.1	1.1
Yellowstone, WY (Yellowstone NP, Grand Teton NP and Teton WA)	4.3	3.9	1.6	1.4
Badlands, SD	17.8	16.0	3.5	3.1
Wind Cave, SD	13.0	12.1	2.7	2.5
Mount Zirkel, CO (Mt. Zirkel WA and Rawah WA)	4.6	4.1	1.4	1.3
Rocky Mountain, CO	6.8	6.2	1.3	1.1
Gates of the Mountains, MT	5.3	5.1	1.0	1.0
UL Bend, MT	9.7	9.6	1.8	1.7
Craters of the Moon, ID	5.8	5.5	1.5	1.5
Sawtooth, ID	3.0	2.8	1.2	1.1
Canyonlands, UT (Canyonlands NP and Arches NP)	5.4	4.8	2.1	1.9
Capitol Reef, UT	5.7	5.4	1.9	1.8

[1] Represents 2018 Base Case growth plus all established controls as of Dec 2004. No BART or $S0_2$ Milestone assumptions were included.

[2] Represents 2018 Preliminary Reasonable Progress growth estimates and established $S0_2$ limits.

All Class I areas in the surrounding states show a projected visibility improvement for 2018 with respect to SO_2 on the worst days and no degradation on the best days. More discussion on the visibility improvement of the §309 program can be found in the Wyoming §309 Regional Haze SIP submitted in November 2008.

Therefore, in accordance with §308(e)(2), Wyoming's §309 Regional Haze SIP, and WAQSR Chapter 6, Section 9, Basin Electric will not be required to install the company-proposed BART technology and meet the corresponding achievable emission limit. Instead, Basin Electric is required to participate in the Regional SO_2 Milestone and Backstop Trading Program authorized under Chapter 14 of the WAQSR.

LONG-TERM STRATEGY FOR REGIONAL HAZE:

In this BART analysis, the technology available, the costs of compliance, the energy and non-air quality environmental impacts of compliance, any pollution control equipment in use at the source, the remaining useful life of the source, and the degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology were taken into consideration when determining BART. When evaluating the costs of compliance, the Division recognized a time limitation to install BART-determined controls imposed by the Regional Haze Rule. When addressing the required elements, including documentation for all required analyses to be submitted in the State Implementation Plan, 40 CFR 51.308(e)(1)(iv) states: "A requirement that each source subject to BART be required to install and operate BART as expeditiously as practicable, but in no event later than 5 years after approval of the implementation plan revision." As a practical measure, the Division anticipates the requirement to install the BART-determined controls to possibly occur as early as 2015.

Based on the costs and visibility improvement presented by Basin Electric in the BART applications for Laramie River Station Units 1-3, and taking into consideration the logistical challenge of managing multiple pollution control installations within the regulatory timeframe allotted for BART installations by the Regional Haze Rule, the Division is requiring the installation of additional controls under the Long-Term Strategy of the Wyoming Regional Haze State Implementation Plan. The Division is requiring Basin Electric submit a permit application to install additional add-on NO_x control that includes an analysis of: (1) the costs of compliance; (2) the time necessary for compliance; (3) the energy and non-air quality environmental impacts of compliance; and (4) the remaining useful life of existing sources that contribute to visibility impairment (i.e., the four statutory factors taken into consideration when establishing reasonable progress goals[5]) and the associated visibility impacts from the application of each proposed NO_x control. Each proposed add-on NO_x control shall achieve an emission rate, on an individual unit basis, at or below 0.07 lb/MMBtu on a 30-day rolling average. Additional add-on controls shall be installed and operational on one of the Laramie River Station units by December 31, 2018 and on a second Laramie River Station unit by December 31, 2023.

CHAPTER 6, SECTION 4 – PREVENTION OF SIGNIFICANT DETERIORATION (PSD):

Basin Electric's Laramie River Station is a "major emitting facility" under Chapter 6, Section 4, of the Wyoming Air Quality Standards and Regulations because emissions of a criteria pollutant are greater than 100 tpy for a listed categorical source. Basin Electric should comply with the permitting requirements of Chapter 6, Section 4 as they apply to the installation of controls determined to meet BART.

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[5] 40 CFR 51.308(d)(1)(i)(A).

CHAPTER 5, SECTION 2 – NEW SOURCE PERFORMANCE STANDARDS (NSPS):

The installation of the controls determined to meet BART will not change New Source Performance Standard applicability for the coal-fired boilers at Laramie River Station.

CHAPTER 5, SECTION 3 – NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAPs) AND CHAPTER 6, SECTION 6 – HAZARDOUS AIR POLLUTANT (HAP) EMISSIONS AND MAXIMUM AVAILABLE CONTROL TECHNOLOGY (MACT):

The installation of the controls determined to meet BART will not change NESHAP/MACT applicability for the coal-fired boilers at Laramie River Station.

CHAPTER 6, SECTION 3 – OPERATING PERMIT:

The Laramie River Station is a major source under Chapter 6, Section 3 of the Wyoming Air Quality Standards and Regulations. Operating Permit 3-1-102-2 was issued for the facility on November 15, 2005. In accordance with Chapter 6, Section 3 of the Wyoming Air Quality Standards and Regulations (WAQSR), Basin Electric will need to modify their operating permit to include the changes authorized in this permitting action.

CONCLUSION:

The Division is satisfied that Basin Electric's Laramie River Station will comply with all applicable Wyoming Air Quality Standards and Regulations. The Division proposes to issue a BART Air Quality Permit for the Laramie River Station modification to install OFA and new LNB on Laramie River Station Units 1-3 to meet the statutory requirements of BART. Two (2) of the three (3) units must install add-on NO_x control that achieves an emission rate, on an individual unit basis, at or below 0.07 lb/MMBtu on a 30-day rolling average by December 31, 2018 and December 31, 2023, respectively, under the Long-Term Strategy of the Wyoming §308 Regional Haze State Implementation Plan.

PROPOSED PERMIT CONDITIONS:

The Division proposes to issue an Air Quality Permit to Basin Electric for the modification of the Laramie River Station with the following conditions:

1. Authorized representatives of the Division of Air Quality be given permission to enter and inspect any property, premise or place on or at which an air pollution source is located or is being constructed or installed for the purpose of investigating actual or potential sources of air pollution, and for determining compliance or non-compliance with any rules, standards, permits or orders.

2. All substantive commitments and descriptions set forth in the application for this permit, unless superseded by a specific condition of this permit, are incorporated herein by this reference and are enforceable as conditions of this permit.

3. That Basin Electric shall modify their Operating Permit in accordance with Chapter 6, Section 9(e)(iv) and Chapter 6, Section 3 of the WAQSR.

4. All notifications, reports and correspondence associated with this permit shall be submitted to the Stationary Source Compliance Program Manager, Air Quality Division, 122 West 25th Street, Cheyenne, WY 82002 and a copy shall be submitted to the District Engineer, Air Quality Division, at the same address.

5. Effective upon completion of the performance tests to verify the emission levels below, as required by Condition 6 of this permit, emissions from Laramie River Station Units 1 through 3 shall not exceed the levels below. PM/PM_{10} lb/hr and tpy limits shall apply during all operating periods. PM/PM_{10} lb/MMBtu limits shall apply during all operating periods except startup. Startup begins with the introduction of fuel oil into the boiler and ends no later than the point in time when the electricity generators are put online.

Pollutant	lb/MMBtu	lb/hr	tpy
PM/PM_{10}[(a)]	0.030	Unit 1: 193 Unit 2: 193 Unit 3: 198	Unit 1: 844 Unit 2: 844 Unit 3: 867

[(a)] Filterable portion only

6. That no later than 90 days after permit issuance PM/PM_{10} performance tests shall be conducted on Units 1-3 and a written report of the results be submitted. If a maximum design rate is not achieved within 90 days of permit issuance, the Administrator may require testing be done at the rate achieved and again when a maximum rate is achieved.

7. Effective upon completion of the initial performance tests to verify the emission levels below, as required by Condition 8 of this permit, emissions from Laramie River Station Units 1 through 3 shall not exceed the levels below. The NO_x limits shall apply during all operating periods.

Pollutant	lb/MMBtu	lb/hr	tpy
NO_x	0.23 (30-day rolling)	Unit 1: 1,348 Unit 2: 1,348 Unit 3: 1,386 (all 30-day rolling)	Unit 1: 5,343 Unit 2: 5,343 Unit 3: 5,493 (all 12-month rolling)

8. That initial NO_x performance tests be conducted, in accordance with Chapter 6, Section 2(j) of the WAQSR, within 30 days of achieving a maximum design rate but not later than 90 days following initial start-up, and a written report of the results be submitted. If a maximum design rate is not achieved within 90 days of start-up, the Administrator may require testing be done at the rate achieved and again when a maximum rate is achieved.

9. Performance tests shall consist of the following:

Coal-fired Boilers (Laramie River Station Units 1 through 3):

<u>NO_x Emissions</u> – Compliance with the NO_x 30-day rolling average shall be determined using a continuous emissions monitoring system (CEMS) certified in accordance with 40 CFR part 60.

<u>PM/PM_{10} Emissions</u> – Testing shall follow 40 CFR 60.46 and EPA Reference Test Methods 1-4 and 5.

Testing required by the WAQSR Chapter 6, Section 3 operating permit may be submitted to satisfy the testing required by this condition.

10. Prior to any performance testing required by this permit, a test protocol shall be submitted to the Division for approval, at least 30 days prior to testing. Notification should be provided to the Division at least 15 days prior to any testing. Results of the tests shall be submitted to this office within 45 days of completing the tests.

11. Basin Electric shall comply with all requirements of the Regional SO_2 Milestone and Backstop Trading Program in accordance with Chapter 14, Sections 2 and 3, of the WAQSR.

12. After the installation or upgrade of control equipment, compliance with the limits set forth in this permit for the coal-fired boilers (Laramie River Station Units 1 through 3) shall be determined with data from the existing continuous monitoring systems required by 40 CFR Part 75 as follows:

a. Exceedances of the NO_x limits shall be defined as follows:

i. Any 30-day rolling average of NO_x emissions which exceeds the lb/MMBtu limits calculated in accordance with the compliance provisions and monitoring

requirements of §60.48Da and §60.49Da. The definition of "boiler operating day" shall be consistent with the definition as specified in 40 CFR part 60, subpart Da.

ii. Any 30-day rolling average calculated using valid data (output concentration and average hourly volumetric flowrate) from the existing CEM equipment which exceeds the lb/hr NO_x limit established in this permit. Valid data shall meet the requirements of WAQSR, Chapter 5, Section 2(j) and follow the compliance provisions and monitoring requirements of §60.48Da and §60.49Da. The 30-day average emission rate shall be calculated as the arithmetic average of hourly emissions with valid data during the previous 30-day period. The definition of "boiler operating day" shall be consistent with the definition as specified in 40 CFR part 60, subpart Da.

iii. Any 12-month rolling emission rate which exceeds the tpy NO_x limit as calculated using the following formula:

$$E = \frac{\sum_{h=1} (C)_h}{2{,}000}$$

Where:

C = 1-hour average emission rate (lb/hr) for hour "h" calculated using data from the CEM equipment required by 40 CFR Part 75. For monitoring data not meeting the requirements of WAQSR, Chapter 5, Section 2(j), Basin Electric shall provide substituted data for an emissions unit according to the missing data procedures of 40 CFR, Part 75 during any period of time that there is not monitoring data.

E = 12-month rolling emission rate (tpy).

b. Basin Electric shall comply with all reporting and record keeping requirements as specified in WAQSR, Chapter 5, Section 2(g) and 40 CFR part 60, subpart D. All excess emissions shall be reported using the procedures and reporting format specified in WAQSR, Chapter 5, Section 2(g).

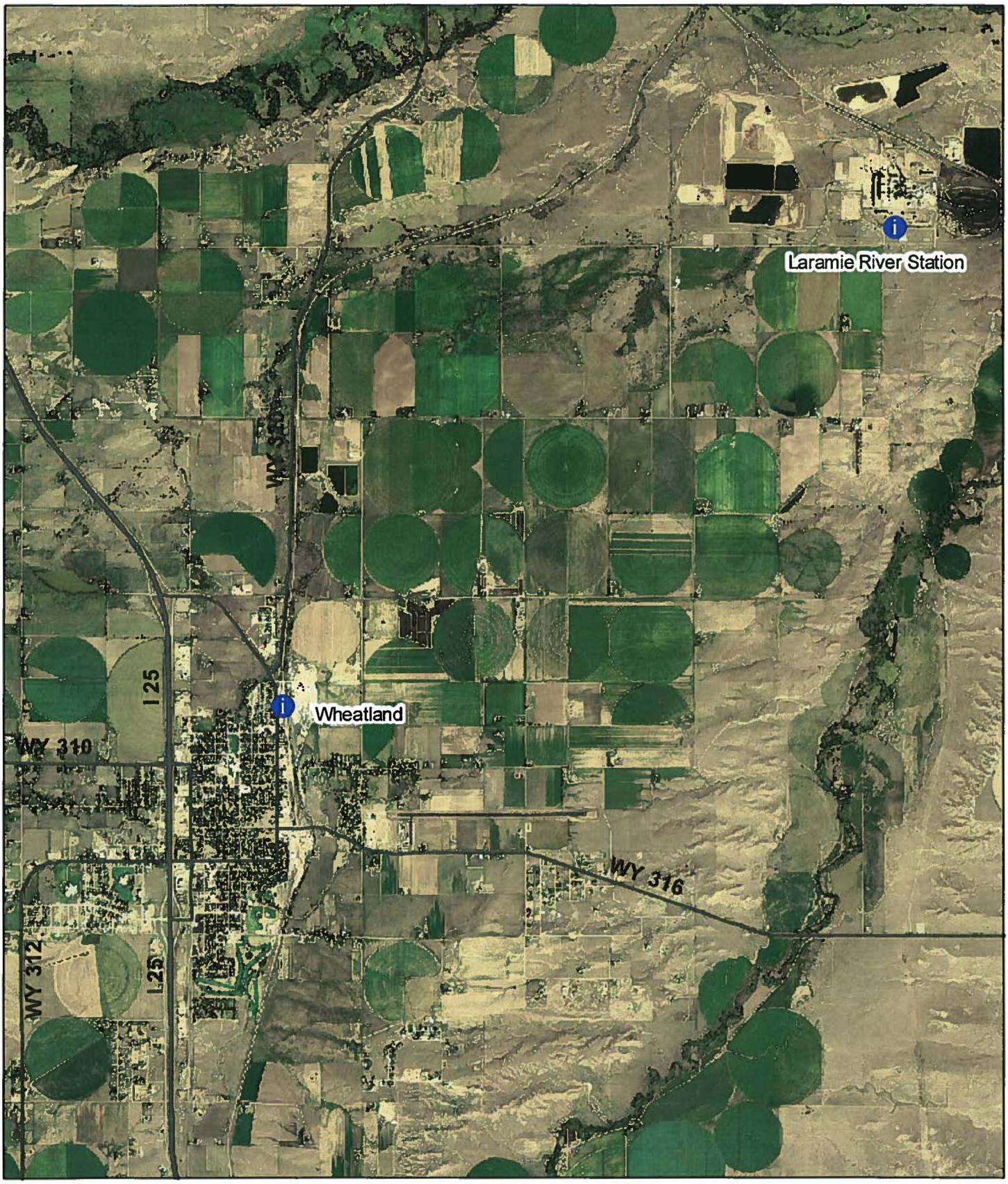
13. Compliance with the PM/PM_{10} limits set forth in this permit for the coal-fired boilers (Laramie River Units 1-3) shall be determined with data from testing for PM conducted annually, or more frequently as specified by the Administrator, following 40 CFR 60.46 and EPA Reference Test Methods 1-4 and 5. Testing required by the WAQSR Chapter 6, Section 3 operating permit may be submitted to satisfy the testing required by this condition.

14. Records required by this permit shall be maintained for a period of at least five (5) years and shall be made available to the Division upon request.

15. Basin Electric shall install new low NO_x burners with overfire air on Units 1 through 3, in accordance with the Division's BART determination, and conduct the initial performance tests required in Condition 8 no later than December 31, 2012 for Unit 1; December 31, 2013 for Unit 2; and December 31, 2014 for Unit 3.

16. Basin Electric shall submit permit applications for the installation of additional add-on NO_x control on two units at the Laramie River Station to the Division no later than six (6) years prior to installation, under the Long-Term Strategy of the Wyoming §308 Regional Haze State Implementation Plan. It shall include an analysis of the four statutory factors and the associated visibility impacts from the application of each proposed NO_x control and resulting emission levels. This application shall address each add-on NO_x control as a system of continuous emissions reduction achieving the lowest viable NO_x emission, not to exceed a maximum of 0.07 lb/MMBtu on a 30-day rolling average as measured by a certified CEM. Additional add-on NO_x control shall be installed and operational on one (1) unit by December 31, 2018 and on a second unit by December 31, 2023.

Appendix A
Facility Location



N
W E
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0 0.5 1 2 Miles

Basin Electric Power Cooperative
Laramie River Station
347 Grayrocks Road
Platte County, Wyoming

Department of Environmental Quality
WYOMING

EXHIBIT B

Department of Environmental Quality

To protect, conserve and enhance the quality of Wyoming's environment for the benefit of current and future generations.

Dave Freudenthal, Governor

John Corra, Director

December 31, 2009

RECEIVED
JAN 11 2009
PLANT OPERATIONS
RECORDS YES NO

Mr. Robert Eriksen
Sr. Environmental Compliance Administrator
Basin Electric Power Cooperative
1717 East Interstate Avenue
Bismarck, ND 58503-0564

Re: Air Quality Permit MD-6047
BART Permit: Laramie River Station

Dear Mr. Eriksen:

The Division of Air Quality of the Wyoming Department of Environmental Quality has enclosed a copy of the Best Available Control Technology (BART) permit for Basin Electric's Laramie River Station, dated December 31, 2009. Comments received during the public comment period and the public hearing were considered in the final permit. A copy of the decision document for the permit is also enclosed. One of the proposed permit conditions was modified in the final permit, as described below.

- Condition 16: The time for submitting a permit application for additional add-on NO_x control was changed from six years prior to installation to two years prior to installation.

If you have any questions, please feel free to contact this office.

Sincerely,

David A. Finley
Administrator
Air Quality Division

cc: Glen Spangler/AQD Cheyenne

Department of Environmental Quality

To protect, conserve and enhance the quality of Wyoming's environment for the benefit of current and future generations.

Dave Freudenthal, Governor

John Corra, Director

December 31, 2009

Mr. Robert Eriksen
Sr. Environmental Compliance Administrator
Basin Electric Power Cooperative
1717 East Interstate Avenue
Bismarck, ND 58503-0564

Permit No. **MD-6047**
(BART Permit for the Laramie River Station)

Dear Mr. Eriksen:

The Division of Air Quality of the Wyoming Department of Environmental Quality has completed final review of the application from Basin Electric Power Cooperative (Basin Electric) for a Best Available Retrofit Technology (BART) permit for the three coal-fired boilers at the Laramie River Station. The Laramie River Station is located at 347 Grayrocks Road, approximately five miles northeast of the town of Wheatland in Platte County, Wyoming.

Following the Division's proposed approval of the permit as published June 3, 2009, a 65-day public notice period ran from June 3, 2009 to August 6, 2009, and a public hearing was held on August 6, 2009 at 1 p.m. at the Platte County Library, located at 904 9th Street in Wheatland. Comments were received on the proposed permit and those comments have been considered by the Division in the final permit. Therefore, on the basis of the information provided to the Division, a BART permit is hereby granted pursuant to Chapter 6, Sections 2 and 9 of the Wyoming Air Quality Standards and Regulations (WAQSR) with the following conditions:

1. Authorized representatives of the Division of Air Quality be given permission to enter and inspect any property, premise or place on or at which an air pollution source is located or is being constructed or installed for the purpose of investigating actual or potential sources of air pollution, and for determining compliance or non-compliance with any rules, standards, permits or orders.

2. All substantive commitments and descriptions set forth in the application for this permit, unless superseded by a specific condition of this permit, are incorporated herein by this reference and are enforceable as conditions of this permit.

3. That Basin Electric shall modify their Operating Permit in accordance with Chapter 6, Section 9(e)(vi) and Chapter 6, Section 3 of the WAQSR.

4. All notifications, reports and correspondence associated with this permit shall be submitted to the Stationary Source Compliance Program Manager, Air Quality Division, 122 West 25th Street, Cheyenne, WY 82002 and a copy shall be submitted to the District Engineer, Air Quality Division, at the same address.

5. Effective upon completion of the performance tests to verify the emission levels below, as required by Condition 6 of this permit, emissions from Laramie River Station Units 1 through 3 shall not exceed the levels below. PM/PM_{10} lb/hr and tpy limits shall apply during all operating periods. PM/PM_{10} lb/MMBtu limits shall apply during all operating periods except startup. Startup begins with the introduction of fuel oil into the boiler and ends no later than the point in time when the electricity generators are put online.

Pollutant	lb/MMBtu	lb/hr	tpy
PM/PM_{10}[(a)]	0.030	Unit 1: 193 Unit 2: 193 Unit 3: 198	Unit 1: 844 Unit 2: 844 Unit 3: 867

[(a)] Filterable portion only

6. That no later than 90 days after permit issuance PM/PM_{10} performance tests shall be conducted on Units 1-3 and a written report of the results be submitted. If a maximum design rate is not achieved within 90 days of permit issuance, the Administrator may require testing be done at the rate achieved and again when a maximum rate is achieved.

7. Effective upon completion of the initial performance tests to verify the emission levels below, as required by Condition 8 of this permit, emissions from Laramie River Station Units 1 through 3 shall not exceed the levels below. The NO_x limits shall apply during all operating periods.

Pollutant	lb/MMBtu	lb/hr	tpy
NO_x	0.23 (30-day rolling)	Unit 1: 1,348 Unit 2: 1,348 Unit 3: 1,386 (all 30-day rolling)	Unit 1: 5,343 Unit 2: 5,343 Unit 3: 5,493 (all 12-month rolling)

8. That initial NO_x performance tests be conducted, in accordance with Chapter 6, Section 2(j) of the WAQSR, within 30 days of achieving a maximum design rate but not later than 90 days following initial start-up, and a written report of the results be submitted. If a maximum design rate is not achieved within 90 days of start-up, the Administrator may require testing be done at the rate achieved and again when a maximum rate is achieved.

9. Performance tests shall consist of the following:

Coal-fired Boilers (Laramie River Station Units 1 through 3):

<u>NO_x Emissions</u> – Compliance with the NO_x 30-day rolling average shall be determined using a continuous emissions monitoring system (CEMS) certified in accordance with 40 CFR part 60.

<u>PM/PM_{10} Emissions</u> – Testing shall follow 40 CFR 60.46 and EPA Reference Test Methods 1-4 and 5.

Testing required by the WAQSR Chapter 6, Section 3 operating permit may be submitted to satisfy the testing required by this condition.

10. Prior to any performance testing required by this permit, a test protocol shall be submitted to the Division for approval, at least 30 days prior to testing. Notification should be provided to the Division at least 15 days prior to any testing. Results of the tests shall be submitted to this office within 45 days of completing the tests.

11. Basin Electric shall comply with all requirements of the Regional SO_2 Milestone and Backstop Trading Program in accordance with Chapter 14, Sections 2 and 3, of the WAQSR.

12. After the installation or upgrade of control equipment, compliance with the limits set forth in this permit for the coal-fired boilers (Laramie River Station Units 1 through 3) shall be determined with data from the existing continuous monitoring systems required by 40 CFR Part 75 as follows:

    a. Exceedances of the NO_x limits shall be defined as follows:

        i. Any 30-day rolling average of NO_x emissions which exceeds the lb/MMBtu limits calculated in accordance with the compliance provisions and monitoring requirements of §60.48Da and §60.49Da. The definition of "boiler operating day" shall be consistent with the definition as specified in 40 CFR part 60, subpart Da.

        ii. Any 30-day rolling average calculated using valid data (output concentration and average hourly volumetric flowrate) from the existing CEM equipment which exceeds the lb/hr NO_x limit established in this permit. Valid data shall meet the requirements of WAQSR, Chapter 5, Section 2(j) and follow the compliance provisions and monitoring requirements of §60.48Da and §60.49Da. The 30-day average emission rate shall be calculated as the arithmetic average of hourly emissions with valid data during the previous 30-day period. The definition of "boiler operating day" shall be consistent with the definition as specified in 40 CFR part 60, subpart Da.

        iii. Any 12-month rolling emission rate which exceeds the tpy NO_x limit as calculated using the following formula:

$$E = \frac{\sum_{h=1} (C)_h}{2{,}000}$$

Where:

C = 1-hour average emission rate (lb/hr) for hour "h" calculated using data from the CEM equipment required by 40 CFR Part 75. For monitoring data not meeting the requirements of WAQSR, Chapter 5, Section 2(j), Basin Electric shall provide substituted data for an emissions unit according to the missing data procedures of 40 CFR Part 75 during any period of time that there is not monitoring data.

E = 12-month rolling emission rate (tpy).

b. Basin Electric shall comply with all reporting and record keeping requirements as specified in WAQSR, Chapter 5, Section 2(g) and 40 CFR part 60, subpart D. All excess emissions shall be reported using the procedures and reporting format specified in WAQSR, Chapter 5, Section 2(g).

13. Compliance with the PM/PM_{10} limits set forth in this permit for the coal-fired boilers (Laramie River Units 1-3) shall be determined with data from testing for PM conducted annually, or more frequently as specified by the Administrator, following 40 CFR 60.46 and EPA Reference Test Methods 1-4 and 5. Testing required by the WAQSR Chapter 6, Section 3 operating permit may be submitted to satisfy the testing required by this condition.

14. Records required by this permit shall be maintained for a period of at least five (5) years and shall be made available to the Division upon request.

15. Basin Electric shall install new low NO_x burners with overfire air on Units 1 through 3, in accordance with the Division's BART determination, and conduct the initial performance tests required in Condition 8 no later than December 31, 2012 for Unit 1; December 31, 2013 for Unit 2; and December 31, 2014 for Unit 3.

16. Basin Electric shall submit permit applications for the installation of additional add-on NO_x control on two units at the Laramie River Station to the Division no later than two (2) years prior to installation, under the Long-Term Strategy of the Wyoming §308 Regional Haze State Implementation Plan. It shall include an analysis of the four statutory factors and the associated visibility impacts from the application of each proposed NO_x control and resulting emission levels. This application shall address each add-on NO_x control as a system of continuous emissions reduction achieving the lowest viable NO_x emission, not to exceed a maximum of 0.07 lb/MMBtu on a 30-day rolling average as measured by a certified CEM. Additional add-on NO_x control shall be installed and operational on one (1) unit by December 31, 2018 and on a second unit by December 31, 2023.

It must be noted that this approval does not relieve you of your obligation to comply with all applicable county, state, and federal standards, regulations or ordinances. Special attention must be given to Chapter 6, Section 3 of the Wyoming Air Quality Standards and Regulations, which details the requirements for compliance with condition 3. Attention must be given to Chapter 14, Sections 2 and 3 of the Wyoming Air Quality Standards and Regulations, which detail the requirements for compliance with condition 11. Any appeal of this permit as a final action of the Department must be made to the Environmental Quality Council within sixty (60) days of permit issuance per Section 16, Chapter I, General Rules of Practice and Procedure, Department of Environmental Quality.

If we may be of further assistance to you, please feel free to contact this office.

Sincerely,

David A. Finley
Administrator
Air Quality Division

John V. Corra
Director
Dept. of Environmental Quality

cc: Glenn Spangler/AQD Cheyenne

IN THE MATTER OF A PERMIT APPLICATION (AP-6047) FROM BASIN ELECTRIC POWER COOPERATIVE FOR A BEST AVAILABLE RETROFIT TECHNOLOGY (BART) PERMIT FOR THE LARAMIE RIVER STATION

DECISION

I. Introduction:

The Air Quality Division received a BART permit application from Basin Electric Power Cooperative (Basin Electric) for the three coal-fired boilers (Units 1 through 3) that operate at their Laramie River Station in Platte County, Wyoming. Regulations governing the BART program have been established by the U.S. EPA in 40 CFR Part 51 - Appendix Y. As stated in the regulations, a source is eligible for BART if it belongs within a particular group of stationary source categories, was not in operation prior to August 7, 1962, was in existence on August 7, 1977, and has the potential to emit 250 tons per year (tpy) or more of any visibility impairing air pollutant. Fossil fuel boilers with more than 250 million Btu (MMBtu) per hour heat input are listed as an eligible source type. Units 1 through 3 at the Laramie River Station have heat inputs of 6,420-6,600 MMBtu per hour and were in existence on August 7, 1977. Potential emissions from each boiler for two visibility impairing air pollutants, nitrogen oxides (NO_x) and sulfur dioxide (SO_2), exceed 250 tpy and therefore the units are eligible for BART.

The Division conducted an analysis of the BART permit application for the Laramie River Station and on June 3, 2009, published in the Platte County Record Times a public notice and notice of public hearing of the proposed intent to issue BART determinations. Copies of the BART application and the Division's analysis were placed in the Platte County Clerk's office in Wheatland, Wyoming in accordance with regulations. A 65-day public notice period ran from June 3, 2009 to August 6, 2009, and a public hearing was held on August 6, 2009, at 1 p.m. at the Platte County Library, located at 904 9th Street in Wheatland.

The Division received numerous comment letters on the proposed permit during the public comment period: 1) a letter dated July 21, 2009 from the USDA Forest Service; 2) a letter dated August 3, 2009 from EPA Region 8; 3) a letter dated August 4, 2009 from PacifiCorp; 4) a letter dated August 4, 2009 from the National Park Service; 5) a letter dated August 4, 2009 from the Powder River Basin Resource Council, et al.; 6) a letter dated August 5, 2009 from the Powder River Basin Resource Council; 7) a letter received July 20, 2009 from Joanna Taylor; 8) a letter dated July 16, 2009 from Andrew H. Salter; 9) a letter received July 20, 2009 from Evelyn and Marvin Griffin; 10) a letter received July 23, 2009 from Mimi McMillen; 11) a letter received July 24, 2009 from William M. Anderson; 12) a letter received July 24, 2009 from Rebekah Smith; 13) a letter dated July 24, 2009 from Mike Shonsey; 14) a letter dated July 24, 2009 from Susie Mohrmann; 15) a letter dated July 28, 2009 from Janice H. Harris; 16) a letter dated July 28, 2009 from M. Christensen; 17) a letter dated July 27, 2009 from Clint Morrison; 18) a letter dated August 3, 2009 from Ann Fuller; 19) a letter dated August 3, 2009 from Mary Fenton; 20) 725 unsigned letters received under a signed cover letter dated July 28, 2009 from Brad Mohrmann, Sierra Club Associate Regional Representative; and 21) 89 signatures received under a signed cover letter dated July 24, 2009 from Brad Mohrmann, Sierra Club Associate Regional Representative. The Division also received a letter from Basin Electric dated August 5, 2009.

Due to the number of public comments with similar concerns, the Division grouped individual comments and developed summary comments and responses. Comments from the EPA, Forest Service, National Park Service, Powder River Basin Resource Council, et al., and PacifiCorp are addressed individually. The comments and responses are presented on the following pages. The

Division also received positive comments supporting this project. The Division appreciates these comments but they are not included in this document as no response is required.

The Division received numerous comments that were descriptive of environmental impacts other than the impacts from BART-eligible sources in Wyoming on Class I area visibility. The Division's responses are limited to the comments that dealt with the State's BART analyses.

The Division is also preparing a revised Wyoming State Implementation Plan (SIP) for Regional Haze, and has solicited comments on that SIP. Some comments have been received which were submitted as comments on the Regional Haze SIP, but were principally directed at the Division's BART analyses. These comments will be addressed by the Division as it prepares the response to comments on the Regional Haze SIP.

II. Analysis of Comments from the USDA Forest Service:

II.1 **NO_x Step 5: Visibility Improvement Determination (Class I areas modeled)** – The Forest Service commented that all Class I areas within 300 km of a given source should be modeled and the cost of each BART alternative divided by the sum of the deciview (dv) improvement at all impacted Class I areas. If modeling exists for Class I areas that yield impacts above 0.5 dv just beyond 300 km, those results should be considered also. Savage Run Wilderness Area should also be modeled and considered.

Response – Only those Class I areas most likely to be impacted by sources subject to BART at a given facility were modeled, as determined by source/Class I area locations, distances to each Class I area, and professional judgment considering meteorological and terrain factors. The Division recognizes that more distant Class I areas may yield modeled impacts of some magnitude, but the Division is also satisfied that Class I areas at a greater distance and in directions of less frequent plume transport would not yield modeled impacts greater than those yielded by the Class I areas chosen for BART modeling. The modeling results for the Class I areas chosen for analysis allowed the Division to make an informed decision on the effect on visibility from the various BART control options. Additionally, EPA's Appendix Y BART guidance does not include any requirements for modeling distance.

EPA's Appendix Y BART guidance does mention that "dollars per deciview" ($/dv) is a metric that could be used to evaluate the cost of BART compliance, but by no means identifies $/dv as an essential or required metric. The Division considered capital cost, annual cost, cost effectiveness, and incremental cost effectiveness in the cost evaluation of each proposed BART control option. The Division chose not to use a hybrid metric such as $/dv primarily because of the lack of historical precedent regarding reasonable/acceptable levels for such a metric. Additionally, the use of a hybrid cost metric such as $/deciview can introduce uncertainty as to how the value was calculated. The value of "/deciview" could be based on the highest modeled value in a given area or the 98th percentile modeled value. It could be based on the 98th percentile value for any one modeled year or it could be an average for multiple years. It could even be based on an average modeled value across an entire Class I area or the sum of deciview changes across multiple areas. The Division has found that $/dv values are often presented without explanation of the basis for the calculation. To avoid these confounding factors, the Division chose to evaluate and present the cost analyses and visibility analyses separately.

EPA's Regional Haze Rule affects sources that may cause or contribute to visibility impairment at any mandatory, federal Class I Area. Because Savage Run is a state-designated Class I area, the Division was not required to include it in the BART modeling. Additionally, the Division did not include Savage Run in any of its analyses for the State's Regional Haze Visibility SIP. For BART, the Division did model the impacts at several mandatory Class I areas that are located in the same general plume transport direction downwind of Savage Run, including Mt. Zirkel Wilderness, Rawah Wilderness, and Rocky Mountain National Park. Based on the modeling results for these Class I Areas in the proximity of Savage Run, the Division anticipates similar improvements in visibility from the analyzed emission reductions.

II.2 **NO_x Step 5: Visibility Improvement Determination (significant impact)** – The Forest Service commented that it is incorrect to dismiss a control strategy on the basis that the modeled visibility improvement is not perceptible or significant.

Response – The Division used 0.5 dv as the threshold level to exempt a source from BART or to deem modeled impacts as insignificant. EPA's *Regional Haze Regulations and Guidelines for Best Available Retrofit Technology (BART) Determinations* (Appendix Y to 40 CFR part 51), suggest that 0.5 dv can represent the level at which a source "contributes" to visibility impairment. This is also consistent with the rules which are being applied by most states in the Western Regional Air Partnership (WRAP) region.

II.3 **NO_x Controls: SCR** – The Forest Service commented that significant, cumulative visibility improvements modeled for SCR installations at the Jim Bridger and Naughton plants indicate that SCR should be BART for all units at those two plants. The Forest Service questions why DEQ chose SCR as BART only for Naughton Unit 3 when SCR costs for other Naughton units and all Jim Bridger units are similar. Also, environmental degradation from the operation of SCR should not be a factor in the BART determinations and energy impacts from SCR should not be a factor because they have already been considered in the cost analysis.

Response – The costs for SCR controls, as described in the Division's BART analyses, were deemed by the Division to be reasonable for all units at the Jim Bridger and Naughton plants, but the Division's BART determinations for the two plants were based on consideration of all five statutory BART factors, as required by EPA's Appendix Y BART guidance. PacifiCorp proposed a BART limit for NO_x emissions from Naughton Unit 3 of 0.37 lb/MMBtu, which would be achieved by tuning the existing LNB/OFA system. For Naughton Units 1 and 2, PacifiCorp proposed a BART limit for NO_x of 0.26 lb/MMBtu for each unit using new LNB/OFA. Visibility modeling showed that the NO_x emission level proposed by PacifiCorp for Naughton Unit 3 provided less in terms of modeled visibility reductions from baseline as compared to other units at the two plants. For example, Naughton Units 1 and 2 showed a 72% to 73% reduction in the number of days with predicted impacts of 0.5 dv or more at the nearest Class I area (Bridger Wilderness) for LNB/OFA as compared to baseline. The reduction for Naughton Unit 3 for LNB/OFA vs. baseline was only 31%. Appendix A includes graphs of the modeled results at the Class I area that yielded the highest modeled impacts for the Jim Bridger and Naughton plants (Bridger Wilderness) and the Class I area that yielded the highest modeled impacts for the Wyodak, Dave Johnston, and Laramie River Station plants (Wind Cave National Park). As shown in the graphs, the LNB/OFA option reduces the 98th percentile result to less than 1.0 dv for every unit with the exception of Naughton Unit 3 (1.4 dv). The predicted number of days above 0.5 dv for the LNB/OFA option was 40 for Naughton Unit 3, and 16 or less for each of the other twelve units. The Division determined that SCR would be required on

Naughton Unit 3 to bring about additional NO_x emissions reductions and modeled visibility improvement, and these factors differentiated the Naughton Unit 3 BART analysis from the others.

It was the full consideration of all five statutory BART factors, principally the pronounced visibility improvement for LNB/OFA as compared to baseline and the lack of non-air quality environmental impacts that led the Division to conclude that LNB/OFA would be BART for NO_x control at the Jim Bridger plant and for Units 1 and 2 at the Naughton Plant. Modeled visibility impacts for Naughton Unit 3 were reduced to levels comparable to those yielded by LNB/OFA controls on Naughton Units 1 and 2 only through the addition of SCR as BART on Naughton Unit 3. Potential energy losses and environmental impacts from the operation of SCR were mentioned in the Division's BART analysis for both the Naughton and Jim Bridger plants, but were only part of the larger evaluations that considered all five statutory factors.

II.4 **NO_x Controls: SCR Efficiencies** – The Forest Service commented that greater SCR control efficiencies should be factored into the cost and visibility analyses.

Response – The Division conducted a search of the EPA RACT/BACT/LAER Clearinghouse (RBLC) to find NO_x emission limits as BACT associated with SCR control in recently issued permits. Table 2 presents a summary of the Division's RBLC search. Two plants have limits of 0.05 lb/MMBtu NO_x with a 12-month rolling average, which is significantly longer than a 30-day averaging period. Because the 0.05 lb/MMBtu limits are based on a 12-month averaging period, they are not comparable to the 30-day limits established by the Division. The two plants with 30-day averaging periods will be subjected to either a 0.08 lb/MMBtu or 0.07 lb/MMBtu limit, and the limits established by the Division meet these lower limits. A spreadsheet compiled by the National Park Service with a summary of nationwide BART determinations shows that both units outside of Wyoming for which SCR is proposed as BART will be subject to a NO_x emission limit of 0.07 lb/MMBtu, and both will be based on a 30-day averaging period.

The RBLC search showed two plants that will be subject to 24-hour NO_x limits of less than 0.07 lb/MMBtu (0.067 lb/MMBtu), but these limits are for newly constructed plants which have been engineered to meet these levels. BART will require the retrofit of significant controls at plants that were not designed to meet these lower levels. Based on the Division's evaluation, the Division is satisfied that the NO_x emission limit of 0.07 lb/MMBtu (30-day rolling average) that was evaluated for SCR control under BART is the most stringent control level likely to be achieved in a retrofit.

Table 2: SCR Permit Limits from the RBLC

Facility/Location	Size of Source	Source Description	NO_x Permit Limit(s) for SCR Control	Permit Date
John W. Turk Power Plant/Arkansas	600 MW	6,000 MMBtu/hr PC Boiler (PRB Coal)	1) 0.067 lb/MMBtu (24-hr rolling) 2) 0.05 lb/MMBtu (12-month rolling) [SCR, BACT]	Nov 2008
Dry Fork Station/Wyoming	385 MW	PC Boiler	0.05 lb/MMBtu (12-month rolling) [SCR, BACT]	Oct 2007
WYGEN3/Wyoming	100 MW	1,300 MMBtu/hr PC Boiler	0.05 lb/MMBtu (12-month rolling) [SCR, BACT]	Feb 2007
Iatan Station/Missouri	--	PC Boiler	0.08 lb/MMBtu (30-day rolling) [SCR, BACT]	Jan 2006
Big Cajun II Power Plant/Louisiana	675 MW	PC Boiler	0.07 lb/MMBtu (annual average) [SCR, BACT]	Aug 2005
TS Power Plant/Nevada	200 MW	PC Boiler	0.067 lb/MMBtu (24-hour rolling) [SCR, BACT]	May 2005
OPPD – Nebraska City Station/Nebraska	--	--	0.07 lb/MMBtu (30-day rolling) [SCR, BACT]	Mar 2005

Note: "--" indicates that this value was not provided in the RBLC

II.5 **SO_2 Controls (Section 309)** – The Forest Service understands the role of Section 309 in exempting the State of Wyoming from making BART determinations for SO_2 controls based on the demonstration that the benefits from SO_2 emissions reductions under Section 309 exceed those that would have resulted from BART. Are the existing SO_2 controls in place at the Jim Bridger and Naughton plants at least equivalent to the control scenario used in the demonstration, i.e., are the existing controls needed to accomplish the "Better than BART" demonstration for Section 309? They also note that the 309 program sunsets in 2018 and added SO_2 controls may be needed for reasonable progress at that time.

Response – The State of Wyoming submitted a 309 SIP as is allowed by the Regional Haze Rule. Part of the SIP submittal is a "Better than BART" demonstration, required by rule, which does not require that each and every unit demonstrate emission controls that are "Better than BART". The demonstration is a regional demonstration. The Division is aware than the 309 program only establishes milestones through 2018, and that following 2018 another strategy may be necessary to reduce visibility-impairing pollutants. Additional strategies will be addressed in future SIP revisions.

III. Analysis of Comments from EPA Region 8:

III.1 **Background Ozone Concentration in CALPUFF** – EPA Region 8 commented that the Division's visibility modeling used 44 ppb as a background ozone concentration as the default value for periods when measured data was missing. This value appears to be too low based on the average annual concentrations at sites near the facilities (Thunder Basin = 50-55 ppb, Jonah = 55-58 ppb). DEQ should provide an analysis of how higher ozone background concentrations would affect results.

Response – The default ozone background concentration is used by CALPUFF as a domain-wide substitute for any hour for which all measured ozone concentrations are missing. For the Division's visibility modeling for BART, hourly ozone concentrations measured at seven monitoring stations spaced across the modeling domain were input to CALPUFF. A visual inspection of the ozone files that were input to CALPUFF reveals that at least one valid ozone observation was available for every hour of the modeled period (2001-2003), making it unnecessary for the model to use the default background of 44 ppb.

Although the model did not use the default background value for the BART analyses, the Division calculated annual average concentrations for recent years (2007-2008) and all available data for 2009 for many of the stations that were used for input to CALPUFF, including Thunder Basin, Jonah, Rocky Mountain National Park, Centennial, and Pinedale. Annual average values for these stations ranged from 35 ppb to 49 ppb, with an overall average of approximately 40 ppb. The Division is confident that the default background value of 44 ppb was appropriate for the BART modeling, and that there is no need for additional analyses to explore alternate background concentrations.

III.2 **Weight of Visibility Modeling Results in BART Determinations** – EPA Region 8 commented that DEQ should provide an explanation of how modeled visibility improvements were weighed in making BART determinations.

Response – The Division's BART determinations were based on consideration of all five statutory factors, as required by EPA's Appendix Y BART guidance. The modeled visibility improvements for a given control strategy were one of the five factors that were considered. No single factor was weighted as being more important than another, because the Division looked at all five statutory factors in their entirety. EPA guidance did not provide a quantification of the amount of modeled visibility improvement that would be acceptable or significant. The Division used two metrics that were mentioned in the EPA BART guidance, the 98th percentile result for a given year and the level at which a source "contributes" to visibility degradation (0.5 Δdv), to present the results of the BART visibility modeling. Also see the response to USDA Forest Service comment II.3.

III.3 **Cumulative Modeled Impacts** – EPA Region 8 commented that cumulative, modeled Class I impacts from all units at a facility (or combined impacts from multiple facilities) should be presented in addition to the results for individual units.

Response – The visibility impacts from BART-eligible sources are to be modeled separately. As stated in the EPA's Appendix Y guidance, relative to the use of the CALPUFF model for BART determinations, "*We believe that CALPUFF is an appropriate application for States to use for the particular purposes of this rule, to determine if an individual source is reasonably anticipated to*

cause or contribute to impairment of visibility in Class I areas, and to predict the degree of visibility improvement which could reasonably be anticipated to result from the use of retrofit technology ***at an individual source****. We encourage States to use it for these purposes.*" [emphasis added]

III.4 **Language from BART Determinations** – EPA Region 8 commented that the Division should clarify the statements of "3-year average visibility improvements". Are dv improvements calculated for each Class I area added together? If so, what is the meaning of the number? Are three Class I areas sufficient to quantify cumulative impacts? Were all Class I areas within 300 km considered?

Response – To arrive at the "3-year average visibility improvements" that were reported in the Division's BART analyses, the modeled 98th percentile dv change or the number of days above 0.5 dv predicted for a given year of meteorology was averaged with the similar result from the other two years of meteorology. These 3-year average values were determined for each modeled Class I area separately, and were devised to allow a straightforward, direct comparison of one control option to another. Regarding the sufficiency of the number of modeled Class I areas and the question of other Class I areas within 300 km, see response to USDA Forest Service comment II.1.

III.5 **NO_x Controls** – EPA Region 8 commented that the most stringent emission control levels for NO_x controls have not been evaluated, resulting in inflated calculated cost effectiveness values. Lower emission limits should be evaluated for selective non-catalytic reduction (SNCR) and SCR.

Response – The Division has analyzed the most stringent levels for SNCR and SCR, and does not agree that the cost effectiveness numbers have been inflated. See response to USDA Forest Service comment II.4. Furthermore, the Division has deemed the costs associated with all analyzed BART NO_x control options, including SNCR and SCR, to be reasonable (see the conclusions listed under the section: **NOx: EVALUATE IMPACTS AND DOCUMENT RESULTS** in each of the five BART Application Analyses).

III.6 **PM Controls: Averaging Periods** – EPA Region 8 commented that the BART conclusions and the permit conditions should include associated averaging periods for all PM/PM_{10} limits.

Response – The averaging periods for the PM/PM_{10} limits are dictated by the performance test requirements in the BART permits. Compliance with the lb/MMBtu and lb/hr PM/PM_{10} limits is based on the average of three 1-hour tests per 40 CFR 60.46.

III.7 **PM Controls: Control Effectiveness** – EPA Region 8 commented that the Division should explain why 0.015 lb/MMBtu for baghouse/fabric filter control effectiveness is acceptable, when 0.012 lb/MMBtu has been approved by the Division for other permits and 0.010 lb/MMBtu was approved for the Desert Rock project. The BART determinations should include analyses of electrostatic precipitators (ESPs) and baghouses at lower control levels.

Response – Recent Prevention of Significant Deterioration (PSD) permits issued by the Division did include PM/PM_{10} limits of 0.012 lb/MMBtu for fabric filter controls, but those limits (and PM/PM_{10} limits established for the Desert Rock Project in New Mexico) were determined through Best Available Control Technology (BACT) analyses for new sources. The BART

process deals with retrofit controls on existing units, and therefore is not directly comparable to BACT determinations. Additionally, visibility modeling described in the Division's BART analysis for the Jim Bridger Plant showed that the addition of a fabric filter to replace an Electrostatic Precipitator (ESP) provided very little in the way of visibility improvement, with predicted cumulative improvements across three Class I areas of only 0.03 to 0.1 Δdv for Units 1-4. These results indicate that requiring more stringent control levels for a fabric filter would not provide significant visibility improvement. As described on page 18 of the Division's BART analysis, ESP performance enhancements are already in use at the Laramie River Station.

III.8 **PM Controls: Permit Exemption** – EPA Region 8 commented that Condition 5 in the proposed EGU BART permits contains an inappropriate exemption for startup. The exemption from the lb/MMBtu PM limit during startup should be removed or it may be appropriate to analyze the need for a startup BART limit.

Response – For each EGU subject to BART in Wyoming, only the BART limits for PM/PM_{10} that are expressed in lb/MMBtu will not apply during startup. The BART limits for PM/PM_{10} that are expressed in lb/hr and tpy (as based on the lb/MMBtu limits) will apply during all operating periods including startup.

The Division considers the BART limits expressed in terms of lb/hr and tpy to be appropriate limits for startup. For the four units at the Jim Bridger plant, PacifiCorp calculated that the particulate emissions from the startup fuel (fuel oil) would be no greater than 10.9 lb/hr per unit, conservatively assuming that the ESP controls had zero control efficiency during the startup process. As a comparison, the BART limit that would apply for each unit during startup is 180 lb/hr. Further, PacifiCorp has agreed to minimize startup emissions from the four units at the plant by placing the ESPs in service prior to the introduction of coal to the boilers, which is contrary to the manufacturer's recommendation to energize the ESP only after the unit is at full operating temperature and combustion of fuel oil has ceased.

Similarly for Unit 1 at Wyodak, particulates are controlled by an ESP and startup is accomplished with fuel oil. The maximum emissions estimated for startup (8.9 lb/hr) would be well below the BART limit of 71 lb/hr. The three units at LRS are also started on fuel oil and controlled with ESPs, and the particulate emissions during startup are expected to be well below the BART limits, which are set at 193 lb/hr to 198 lb/hr for the three units.

For units with baghouse controls for particulate matter such as Dave Johnston Units 3 and 4, emissions from fuel oil during the startup process are also estimated to be well below the allowable lb/hr BART limits.

In the case of the Naughton plant, particulate controls will include a mixture of ESPs (Units 1 and 2) and a fabric filter/baghouse (Unit 3). Natural gas is the startup fuel for each of these units, and particulate emissions during startup are expected to be well below the established lb/hr BART limits.

III.9 **SO_2 Controls: Reasonable Progress** – EPA Region 8 commented that the Division must evaluate the visibility impacts of SO_2 controls and demonstrate reasonable progress for the Class I areas away from the Colorado Plateau.

Response – Wyoming, along with other 309 states in the WRAP region, evaluated the impact of the 309 program on all Class I areas in the west, even though the requirement by rule was to demonstrate improvement in Class I areas on the Colorado Plateau. The WRAP modeling for sulfates shows that all Class I areas in and around Wyoming are benefiting from the sulfur dioxide emission reductions instituted in the 309 program. Sulfate extinction levels show improvement on the 20% worst days and improvement or at least no degradation on the 20% best days. Furthermore, the Regional Haze rule allows a state to take full credit for strategies implemented under 309 when addressing Class I Areas away from the Colorado Plateau (51.309(g)(4)(i)).

III.10 **FGC for PM Control at Laramie River Station** – EPA Region 8 commented that no additional PM controls were considered for Laramie River Station (LRS). The Division should evaluate if flue gas conditioning (FGC) would be a suitable low-cost option.

Response – The commenter was incorrect, because FGC was evaluated. Page 18 of the Division's BART analysis includes a description of FGC at the LRS. The Division concluded that FGC would not substantially reduce PM emissions, so FGC was eliminated from consideration in the BART review.

III.11 **Control Levels for LNB, OFA, and LNB/OFA** – EPA Region 8 questions why separate evaluations of multiple potential NO_x controls for Units 1-3 at the Laramie River Station all arrived at the same control level (0.23 lb/MMBtu) for different technologies. LNB, OFA, and a LNB/OFA combo are all listed with the same controlled rate. Also, LNB/OFA cost is much higher than for PacifiCorp units, why?

Response – Computational Fluid Dynamics (CFD) modeling of the LRS boilers conducted for Basin Electric indicated that the addition of new LNB would not be capable of reducing NO_x emissions to levels any lower than could be achieved with the proposed OFA alone. However, the LRS boilers would benefit from new LNB because of the ability to operate the burners at the proper stoichiometric ratio and to maintain a stable flame. As described in a letter to the Division from Basin Electric dated September 10, 2009, LRS already is equipped with early versions of LNB. The burners were modified in the mid-1990's, which lowered NO_x emissions from about 0.45 lb/MMBtu to about 0.27 lb/MMBtu. Due to existing boiler geometries, the addition of OFA with the existing low NO_x burners has the potential of reducing NO_x emissions to 0.23 lb/MMBtu. This would only be possible with the existing burners if they were able to be staged down to a 0.90 stoichiometric ratio and have stable flames. New burners are primarily designed for the ability to stage down to a 0.90 stoichiometric ratio and to maintain stable flames.

Because the Division has deemed the costs associated with LNB/OFA to be reasonable for the LRS and for all of the PacifiCorp plants, an explanation for differences in cost estimates by Basin Electric and PacifiCorp is not relevant.

III.12 **SCR for NO_x Control** – EPA Region 8 commented that the Division's BART analysis for LRS requires that add-on NO_x controls at or below 0.07 lb/MMBtu be installed on one of the LRS boilers by December 31, 2018, and on a second LRS unit by December 31, 2023. If such a limit is achievable at LRS, it should be required as BART. Also, greater levels of control should be examined for NO_x.

Response – The Division's BART determinations for the Laramie River Station were based on consideration of all five statutory BART factors in their entirety, as required by EPA's Appendix Y BART guidance. A BART determination does not rely on a single factor such as the level of control that can be achieved.

Regarding greater levels of NO_x control for SCR, a letter to the Division from Basin Electric dated September 10, 2009 states that an emission rate of 0.07 lb/MMBtu is the best performance that can be expected from retrofitting an SCR on the existing LRS boilers. These boilers, which were built in the late 1970's, were not designed to accommodate the addition of an SCR between the reheat superheater and the air heater. Thus, the spacing and the temperature of flue gas are not optimum for an SCR. New power plants can be designed with a taller boiler and spacing appropriate for an SCR and with the specific temperature distribution through the boiler to provide more effective reduction of NO_x. The design of an SCR is much different for a retrofit than for a new facility. Also see response to USDA Forest Service Comment II.4.

IV. Analysis of Comments from PacifiCorp:

IV.1 **General Comments: Cost Metrics** – PacifiCorp commented that EPA's Appendix Y BART guidance states that a proper BART evaluation should include "other cost-effectiveness measures (such as $/deciview)". Thus, any BART determination that is limited to use only cost effectiveness and incremental cost effectiveness may be unacceptably narrow.

Response – EPA's Appendix Y BART guidance does mention that "dollars per deciview" ($/dv) is a metric that could be used to evaluate the cost of BART compliance, but by no means identifies $/dv as an essential or required metric. The Division considered capital cost, annual cost, cost effectiveness, and incremental cost effectiveness in the cost evaluation of each proposed BART control option. The Division chose not to use a hybrid metric such as $/dv primarily because of the lack of historical precedent regarding reasonable/acceptable levels for such a metric. Additionally, the use of a hybrid cost metric such as $/deciview can introduce uncertainty as to how the value was calculated. The value of "/deciview" could be based on the highest modeled value in a given area or the 98th percentile modeled value. It could be based on the 98th percentile value for any one modeled year or it could be an average for multiple years. It could even be based on an average modeled value across an entire Class I area or the sum of deciview changes across multiple areas. The Division has found that $/dv values are often presented without explanation of the basis for the calculation. To avoid these confounding factors, the Division chose to evaluate and present the cost analyses and visibility analyses separately.

IV.2 **General Comments: Cost Effectiveness** – PacifiCorp commented that any BART determination requiring a source to install post-combustion controls like SCR or spend more than $1,500 per ton of NO_x removed would be contrary to EPA Appendix Y BART guidance.

Response – The EPA's Appendix Y guidance describes the EPA's selection of presumptive NO_x limits for coal-fired EGUs, and provides approximate cost levels for meeting the presumptive limits with current combustion controls and a somewhat higher cost level for a subset of units that would require advanced combustion controls such as rotating opposed fire air (ROFA). The EPA guidance does not attempt to establish cost thresholds that would be considered unreasonable for a given control technology, nor does it present the approximate costs associated with the presumptive levels as absolute limits above which cost should be deemed unreasonable. The

guidance also states that states may in specific cases find that the use of SCR is appropriate. As stated previously, the Division established NO_x emission limits for BART based on consideration of all five statutory factors in their entirety, as required by the Appendix Y guidance.

IV.3 **General Comments: Power Plants More Than 750 MW** – PacifiCorp commented that Appendix Y indicates that states must follow Appendix Y guidelines in making BART determinations on a source-by-source basis for 750 MW plants. Wyoming rules impose similar requirements for power plants greater than 750 MW.

Response – The Division followed EPA and State of Wyoming rules for the BART analyses. Specifically, the Division followed WAQSR Chapter 6, §9(c)(ii), which states that power plants with generating capacities greater than seven hundred fifty megawatts shall comply with EPA Appendix Y, and that Appendix Y should be used as guidance for preparing BART analyses for all other facilities.

IV.4 **General Comments: Post-Combustion Controls** – PacifiCorp commented that EPA never contemplated the use of post-combustion controls to meet BART limits for tangentially-fired boilers, and that it is nearly impossible under Appendix Y guidance to show that anything other than combustion controls should be required as BART.

Response – See response to PacifiCorp comment IV.2.

IV.5 **General Comments: Visibility Improvement** – PacifiCorp commented that a BART determination that only relied on the 98th percentile, three-year average results from CALPUFF may be too narrow to satisfy Appendix Y.

Response – The Division did not rely solely on the three-year average of the 98th percentile CALPUFF results to evaluate the expected visibility changes for the BART control options. The 98th percentile values and the number of days with predicted results above 0.5 dv were presented in the Division's BART analyses for each of three modeled years, for each Class I area, and for each control option. The three-year average of the 98th percentile results and the number of days above 0.5 dv were chosen for graphical representation and were mentioned prominently in the Division's conclusions because they offered the clearest comparison of one control option to another (see graphs in Appendix A).

IV.6 **General Comments: Modeling** – PacifiCorp commented that visibility modeling contains inherent bias or exaggeration because it assumes that a particular source will operate at its maximum capacity 100% of the time and that each unit at a facility operates in the same way.

Response – The results from BART visibility modeling, as required by EPA guidance, are based on daily (24-hour) averages. Reported results for a given control scenario, expressed in units of deciviews, represent the predicted change in visibility as compared to natural background over the course of 24-hour periods of meteorology. The modeled emission rates for a given unit at a power plant should reflect the highest rate that could be achieved over a 24-hour period, and therefore the assumption that a given unit is operating at its maximum operating capacity is appropriate for each unit at a base-load power plant such as Jim Bridger or Laramie River Station. Additionally, the conclusions drawn from BART visibility modeling primarily involve comparisons between control scenarios for which the emissions are determined similarly.

IV.7 **General Comments: NO_x Emissions** – PacifiCorp commented that emissions of NO_x during the 20% best and 20% worst days at Class I areas in Wyoming are not a significant contributor to regional haze as compared to other emissions, and therefore the Division should consider this before requiring extreme NO_x control measures such as SCR as BART.

Response – For the 20% worst days during the years 2000-2004 at the Bridger Wilderness Area, 6.21% of the total visibility degradation was attributable to nitrates. Source apportionment modeling provided by the WRAP showed that 19% of the nitrates come from Wyoming sources. The Division recognizes that pollutants other than nitrates contribute more toward the total visibility degradation at the Bridger Wilderness Area, but the Division has concluded that the contribution from Wyoming sources toward the formation of nitrates at the Bridger Wilderness Area and other Class I areas warrants a full consideration of prospective NO_x controls under the BART process.

IV.8 **Perceptibility** – PacifiCorp commented that credible studies indicate that only changes in visibility as high as 1.5-2.0 dv are perceptible to the human eye. The Division should consider this while drawing conclusions based on the results of the visibility modeling and before requiring extreme NO_x control measures such as SCR.

Response – The Division did not attempt to endorse a particular threshold for human eye "perceptibility" since the level of perceptibility has long been disputed. Instead, the Division has relied on EPA's Appendix Y BART guidance, which suggests a value of 0.5 dv as the level that a source "contributes" to visibility impairment. One of the metrics used by the Division to evaluate the relative benefit of a given BART control option was the number of days yielding a modeled impact of 0.5 dv or more.

V. Analysis of Comments from the National Park Service:

V.1 **NO_x Step 1: Identify Available Retrofit Control Technologies** – The NPS commented that Basin Electric's cost analysis is flawed because they omitted the most effective NO_x control technology (LNB-OFA-SCR).

Response – Basin Electric's BART analysis did include the combination of OFA, new LNBs, and SCR. The performance of the SCR was based on installation after OFA/LNB.

V.2 **NO_x Step 3: Evaluate Effectiveness of Remaining Control Technologies (SCR capabilities)** – The NPS commented that the Division underestimated the ability of SCR to reduce emissions. The proposed NO_x limit for SCR (0.07 lb/MMBtu) is not low enough. SCR can achieve greater reductions. NPS suggests 0.06 lb/MMBtu for 30-day limit, 0.05 lb/MMBtu or lower for an annual limit.

Response – See response to USDA Forest Service comment II.4.

V.3 **NO_x Step 4: Evaluate Impacts and Document Results (SCR costs)** – The NPS commented that SCR costs were generally overestimated because the OAQPS Control Cost Manual was not used for cost estimates.

Response – Basin Electric developed cost estimates for SCR control using a combination of Coal Utility Environmental Cost (CUECost) estimates, vendor-obtained cost data, and estimates from

previous in-house design/build projects. The degree to which the SCR costs may have been overestimated does not require further review because the Division has concluded that the estimated costs are reasonable and that costs alone would not preclude the use of SCR.

V.4 **NO_x Step 4: Evaluate Impacts and Document Results (incremental costs for SCR)** – The NPS commented that the Division over-emphasized the incremental costs for the addition of SCR in the BART determinations. The Division should consider the average costs calculated for combustion controls plus SCR.

Response – See response to PacifiCorp comment IV.1 and NPS comment V.3.

V.5 **NO_x Step 4: Evaluate Impacts and Document Results (basis for costs)** – The NPS commented that cost estimates should be documented by vendor or by the EPA Control Cost Manual.

Response – See response to NPS comment V.3.

V.6 **NO_x Step 5: Visibility Improvement Determination (Class I Areas Modeled)** – The NPS commented that the Division should consider visibility impacts at all Class I areas within 300 kilometers (km) of a source.

Response – See response to USDA Forest Service comment II.1.

V.7 **NO_x Step 5: Visibility Improvement Determination (incremental benefits of SCR)** – The NPS commented that the Division placed too much emphasis on the incremental improvement in visibility that was predicted for the addition of SCR. The total predicted visibility improvement resulting from a combination of control options should have been presented.

Response – The incremental improvement in modeled visibility with the addition of SCR was mentioned prominently in the summary of the Division's BART conclusions, but all visibility modeling results were considered. For more information on the presentation of the visibility modeling results in the Division's BART analyses, see the response to EPA Region 8 comment III.2 and PacifiCorp's comment IV.5.

V.8 **BART Conclusions for NO_x Controls: $/dv** – The NPS commented that the Division should use $/dv as an additional metric for evaluating BART controls.

Response – See response to PacifiCorp response IV.1.

V.9 **BART Conclusions for NO_x Controls: Cost Benchmarks** – The NPS commented that the Division determined that the costs for SCR were reasonable, yet rejected SCR for BART control. DEQ should explain why and provide the cost benchmarks used to determine reasonable costs.

Response – The Division established NO_x emission limits for BART based on consideration of all five statutory factors (as required by EPA's Appendix Y BART guidance) and not merely based on cost. The Division relied on past experience with BACT determinations for similar sources/control options to determine the range of control costs that were reasonable.

V.10 **BART Conclusions for NO_x Controls: Non-Air Quality Impacts** – The NPS commented that the Division mentioned non-air quality impacts as reasons to reject SCR for BART controls. Recent PSD permits issued by DEQ and requiring SCR did not mention such impacts. Why were such impacts mentioned in these particular cases? SCR has been used at many facilities with minimal problems with transport and storage of ammonia, why would this be a particular problem for SCR as BART control?

Response – The Division's BART determinations were based on consideration of the five statutory factors, including the cost of compliance and the energy and non-air quality environmental impacts of compliance. Potential energy losses and environmental impacts from the operation of SNCR and SCR were mentioned in the Division's BART analysis, but were only part of the larger evaluation that considered all five statutory factors.

V.11 **BART Conclusions for NO_x Controls: Non-Air Quality Impacts (continued)** – The NPS commented that the Division mentioned parasitic power loss in association with the operation of OFA and SCR. Parasitic power loss associated with SCR has already been accounted for in the cost analysis for NO_x and should not be "double-counted" by using it to draw conclusions for BART control unless it would cause a power shortage. The NPS commented that the Division stated that the operation of SCR could impact the "salability" of fly ash. Evidence should be presented and the economic impact quantified. The NPS also commented that the Division stated that SCR could create "blue plume" if the ammonia injection rate is not well controlled. NPS states that it assumes that a plant operator can properly control the injection rate.

Response – See response to NPS comment V.10.

V.12 **BART Conclusions for PM_{10} Controls: Control Effectiveness** – The NPS commented that the Division should explain why 0.015 lb/MMBtu was acceptable to the Division as a control effectiveness for a ESP/polishing fabric filter combination, when 0.012 lb/MMBtu has been approved by the Division for other recent permits involving fabric filters and limits as low as 0.010 lb/MMBtu have recently been approved for fabric filters (e.g., Desert Rock Project).

Response – See response to EPA Region 8 comment III.7.

V.13 **BART Modeling: Baseline NO_x and SO_2 Emission Rates** – The NPS commented that the Division should provide confirmation of the basis for the modeled emission rates for the baseline scenario.

Response – As shown in Table 16 (page 32) of the Division's BART analysis for the Laramie River Station, NO_x and SO_2 emissions for the baseline modeling scenario were based on annual averages for 2001-2003. If the baseline emissions had been based on 24-hour maximum rates or permit limits, the modeled visibility impacts for baseline would have been higher, and the modeled visibility improvement with the BART controls chosen by the Division would have been more pronounced. The Division's BART determinations for the Laramie River Station were based on all five statutory factors in their entirety, and higher modeled visibility impacts for the baseline scenario would not have changed the determinations.

VI. Analysis of Comments from the Powder River Basin Resource Council:

VI.1 **SCR as BART** – The Powder River Basin Resource Council commented that SCR is the best available retrofit technology and should be required as BART at all of the Wyoming power plants under consideration.

Response – The Division determined BART for the control of NO_x emissions from power plants in Wyoming based on a full consideration of all five statutory factors in their entirety, as required by EPA's Appendix Y BART guidance. The BART guidance does not dictate that a state require the control technology with the highest level of control in all cases.

VII. Analysis of Comments from the Powder River Basin Resource Council, et al.:

VII.1 **Modeled Class I Areas** – The Powder River Basin Resource Council, et al. commented that all Class I areas within 300 km of a given source should be modeled for visibility impacts.

Response – See response to USDA Forest Service comment II.1.

VII.2 **SCR as BART** – The Powder River Basin Resource Council, et al. commented that SCR is BART and must be required for all units at all coal-fired power plants.

Response – See response to USDA Forest Service comments and II.3.

VII.3 **Section 309 Milestone Program** – The Powder River Basin Resource Council, et al. commented that DEQ should impose BART limits for SO_2 because participation in the Section 309 program only excuses DEQ from setting BART limits if the State's 309 SIP is approved by the EPA and if the 309 SIP demonstrates that emissions levels would result in greater visibility improvement than source-specific BART limits.

Response – The Regional Haze Rule allows the State of Wyoming to submit a 309 SIP in lieu of establishing BART limits for SO_2. The 309 SIP submittal includes a "Better than BART" demonstration. The entire submittal is currently undergoing EPA review and the State has no control over how long the EPA takes to review the SIP. The State, however, does not wait for EPA to complete its review before implementing a SIP. All of the 309 states have been participating in the 309 program, collecting SO_2 inventories, allowing independent audits of the information, comparing the regional totals to the milestones, and taking public comment on the regional figures and the comparisons with the milestone figures. The SO_2 levels have shown compliance with the milestones and continue to demonstrate declining SO_2 emissions levels. Also see responses to USDA Forest Service comment II.5 and EPA comment III.9.

VII.4 **Reasonably Attributable Visibility Impairment** – The Powder River Basin Resource Council, et al. commented that because of the magnitude of modeled visibility impacts, DEQ should certify that Wyoming power plants are causing reasonably attributable visibility impairment, and establish more stringent BART controls. A single source that is responsible for a 1.0 deciview change or more should be considered to "cause" visibility impairment, according to WAQSR Chapter 6, §9(d)(i)(A). Because of the reasonably attributable visibility impairment, BART must be determined under WAQSR Chapter 9, §2(d)(ii) and 40 CFR §51.302(c)(4)(iii). These regulations provide that BART is presumed to be at least at NSPS levels. This would require at least 0.11 lb/MMBtu for NO_x limits, but SCR should be required at 0.07 lb/MMBtu.

Response – WAQSR Chapter 6, §9(d)(i)(A) applies to the determination of which sources in Wyoming are subject to BART under the regional haze program, and is not relevant to the determination of *reasonably attributable visibility impairment*. Since adoption of Wyoming's Visibility SIP and visibility regulations to address *reasonably attributable visibility impairment*, neither the Federal Land Managers of any Class I area nor the Division has certified that visibility impairment, attributable to a source or small group of sources, exists in any Wyoming Class I area pursuant to provisions in Chapter 9, Section 2 of the WAQSR. The provisions of Chapter 9, Section 2 of the WAQSR are therefore not relevant to the Division's BART analyses.

VII.5 **SCR for Long-Term Strategy** – The Powder River Basin Resource Council, et al. commented that the BART limits determined by the Division for the three units at the Laramie River Station (0.23 lb/MMBtu) meet presumptive BART, but further reductions are warranted to reduce Class I impacts. The Division will require SCR to be installed on two of the LRS units under Long-Term Strategy by 2023, but no explanation is given for the extension beyond the 5-year deadline for BART.

Response – The Division determined BART for NO_x control at the Laramie River Station based on consideration of all five statutory BART factors, as required by EPA's Appendix Y BART guidance. No single factor was weighted as being more important than another, because the Division looked at all five statutory factors in their entirety. The BART determination for NO_x control on all three units included low NO_x burners (LNB) with overfire air (OFA). The Division's BART analysis provides the basis for the BART determination of LNB with OFA as well as why SCR was not determined to be BART.

The BART permit conditions that are associated with Long-Term Strategy have been included in the August 25, 2009 draft of Wyoming's Regional Haze SIP without modification. The particular Long-Term Strategy requirements, in this case add-on NO_x controls for two units at the Laramie River Station, are established as enforceable on the source by the Division through inclusion in the BART permit.

VIII. Analysis of Comments from the Sierra Club and Citizens Associated with the Sierra Club:

VIII.1 **Air Quality Laws and Regulations** – The Sierra Club commented that it is important that air quality laws and regulations are strictly complied with to preserve park resources for present and future generations.

Response – The Division followed federal regulations and guidance as well as state regulations in assessing the BART applications and for making the BART determination for all sources eligible for BART in the State of Wyoming. The BART rules and guidance used by the Division included:

- Section 308 of the Regional Haze Rule [40 CFR 51.308(e)]
- *Guidelines for BART Determinations Under the Regional Haze Rule* [Appendix Y to part 51]
- Chapter 6, Section 9 of the Wyoming Air Quality Standards and Regulations (WAQSR), *Best Available Retrofit Technology*

VIII.2 **Regional Haze Rule** – The Sierra Club commented that the State of Wyoming can and should do more to protect air quality as the Regional Haze Rule is implemented.

Response – The Division's BART determinations for Wyoming sources, as well as additional air pollution controls that will be required to further reduce regional haze, will be addressed in the Wyoming State Implementation Plan (SIP) for regional haze. The SIP incorporates the emissions reductions associated with the Long-Term Strategy for regional haze.

VIII.3 **Control of Nitrogen Oxide Emissions** – The Sierra Club commented that the State of Wyoming should require the coal plants to install devices that reduce nitrogen oxide emissions.

Response – All of the Division's BART determinations for coal-fired power plants in the State of Wyoming include pollution control equipment that will substantially reduce nitrogen oxide emissions.

VIII.4 **20-Year Trend** – A commenter stated that the amount of air and water pollution has clearly escalated in the past 20 years, with little relief for citizens or for the health of forests and the environment.

Response – The Division's BART determinations and other requirements under the regional haze program will result in large, state-wide emission reductions for three visibility-impairing pollutants; nitrogen oxides (NO_x), particulate matter (PM/PM_{10}), and sulfur dioxide (SO_2). As an example, BART controls at the Jim Bridger plant will result in a total annual reduction in potential NO_x emissions of approximately 13,500 tons per year.

VIII.5 **Wind Power** – A commenter stated that Wyoming can readily replace aging coal-fired power plants with wind power to protect public health and to protect our national parks and wilderness areas.

Response – The BART program is designed to assess Best Available Retrofit Technology on existing sources of air pollution, including the existing power plants in the State. The Division's BART determinations will result in significant reductions in air pollutants from several power plants in Wyoming, but complete replacement of the power plants with an alternate source of energy is well beyond the scope of the BART program.

VIII.6 **Pollution Reduction from Power Plants** – A commenter stated that Wyoming has an obligation to protect treasured public spaces by adhering to federal air quality laws. The State must reduce air pollutants from the old coal plants that are federally required to utilize the most advanced technical developments in ensuring that air pollution is minimized.

Response – The Division determined BART controls based on the five statutory factors developed by the EPA. Various control technologies were evaluated for each source subject to BART, including the "most advanced technical developments", but the ultimate BART determinations were made based on a full consideration of all five statutory factors in their entirety.

VIII.7 **SCR Controls** – Several commenters stated that BART for NO_x control should be SCR for all plants.

Response – See responses to USDA Forest Service comments II.3.

IX. Analysis of Public Comments:

IX.1 **SCR Controls** – Several commenters stated that BART for NO_x control should be SCR for all plants.

Response – See responses to USDA Forest Service comments II.3.

X. Analysis of Comments from Basin Electric Power Cooperative:

X.1 **Permit Condition 16** – Basin Electric requested that the Division revise BART Permit Condition 16 for the LRS to change the time for submitting a permit application for additional add-on NO_x control from six years prior to installation to two years prior to installation.

Response – The Division will make the requested change in the final BART permit for the LRS.

XI. Decision:

On the basis of comments received during the public comment period, an analysis of those comments, and representations made by Basin Electric, the Department of Environmental Quality has determined that the permit application filed by Basin Electric complies with all applicable Wyoming Air Quality Standards and Regulations and that a BART permit will be issued for the Laramie River Station. All of the conditions proposed in the Division's analysis will be included in the permit with the following changes (in bold):

16. Basin Electric shall submit permit applications for the installation of additional add-on NO_x control on two units at the Laramie River Station to the Division no later than **two (2)** ~~**six (6)**~~ years prior to installation, under the Long-Term Strategy of the Wyoming §308 Regional Haze State Implementation Plan. It shall include an analysis of the four statutory factors and the associated visibility impacts from the application of each proposed NO_x control and resulting emission levels. This application shall address each add-on NO_x control as a system of continuous emissions reduction achieving the lowest viable NO_x emission, not to exceed a maximum of 0.07 lb/MMBtu on a 30-day rolling average as measured by a certified CEM. Additional add-on NO_x control shall be installed and operational on one (1) unit by December 31, 2018 and on a second unit by December 31, 2023.

Dated this 31st day of December, 2009.

David A. Finley
Administrator
Wyoming Air Quality Division

John V. Corra
Director
Wyoming Department of Environmental Quality

APPENDIX A

VISIBILITY MODELING RESULTS (Baseline vs. LNB and SCR)

Figure 1
Modeled BART Impacts in Bridger Wilderness Area
Naughton and Jim Bridger Power Plants: 98th Percentile (delta-dv)

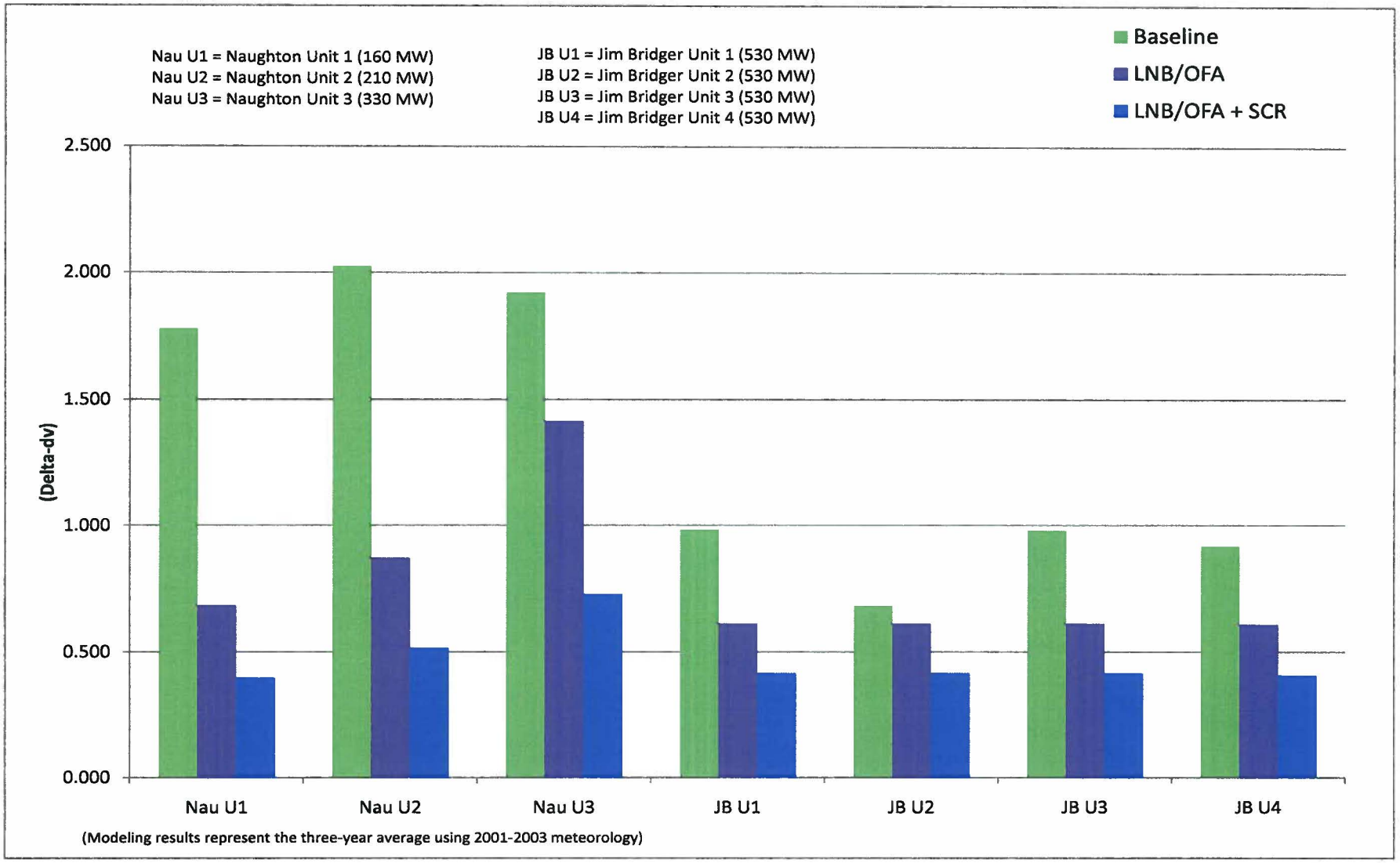

Figure 2
Modeled BART Impacts in Wind Cave National Park
Wyodak, Dave Johnston, and Laramie River Station Power Plants: 98th Percentile (delta-dv)

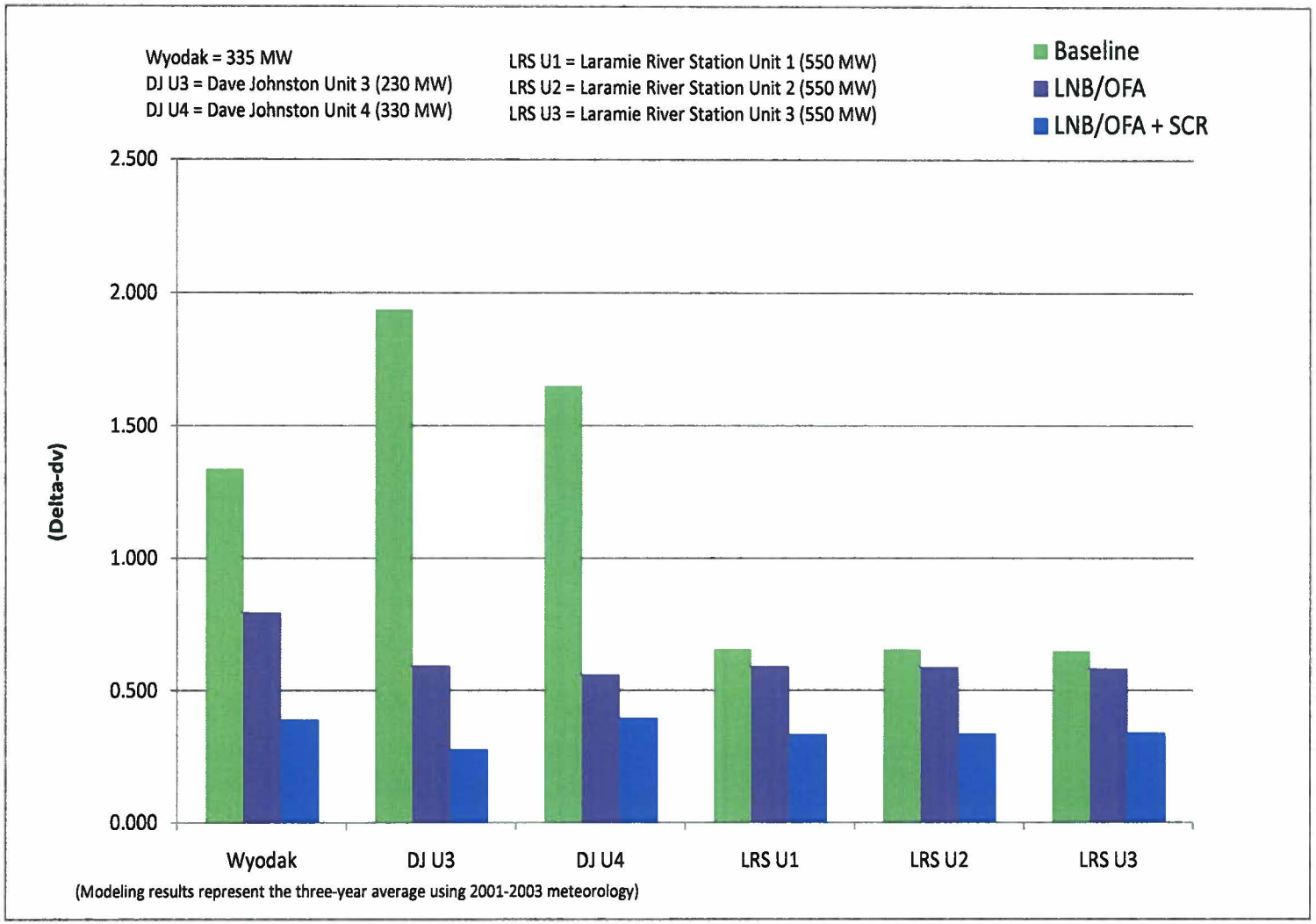

Figure 3
Modeled BART Impacts in Bridger Wilderness Area
Naughton and Jim Bridger Power Plants: # Days > 0.5 delta-dv

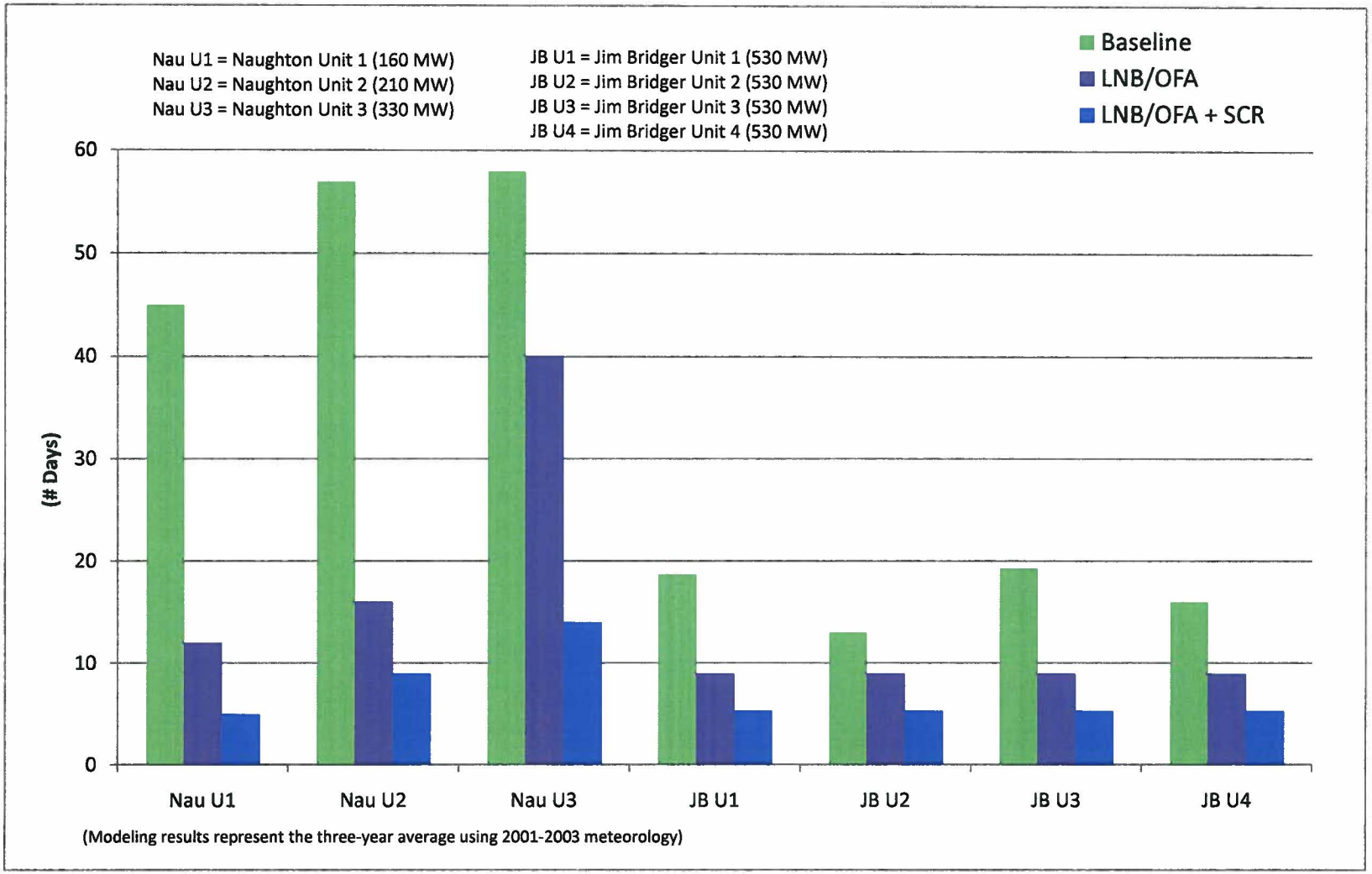

Figure 4
Modeled BART Impacts in Wind Cave National Park
Wyodak, Dave Johnston, and Laramie River Station Power Plants: # Days > 0.5 delta-dv

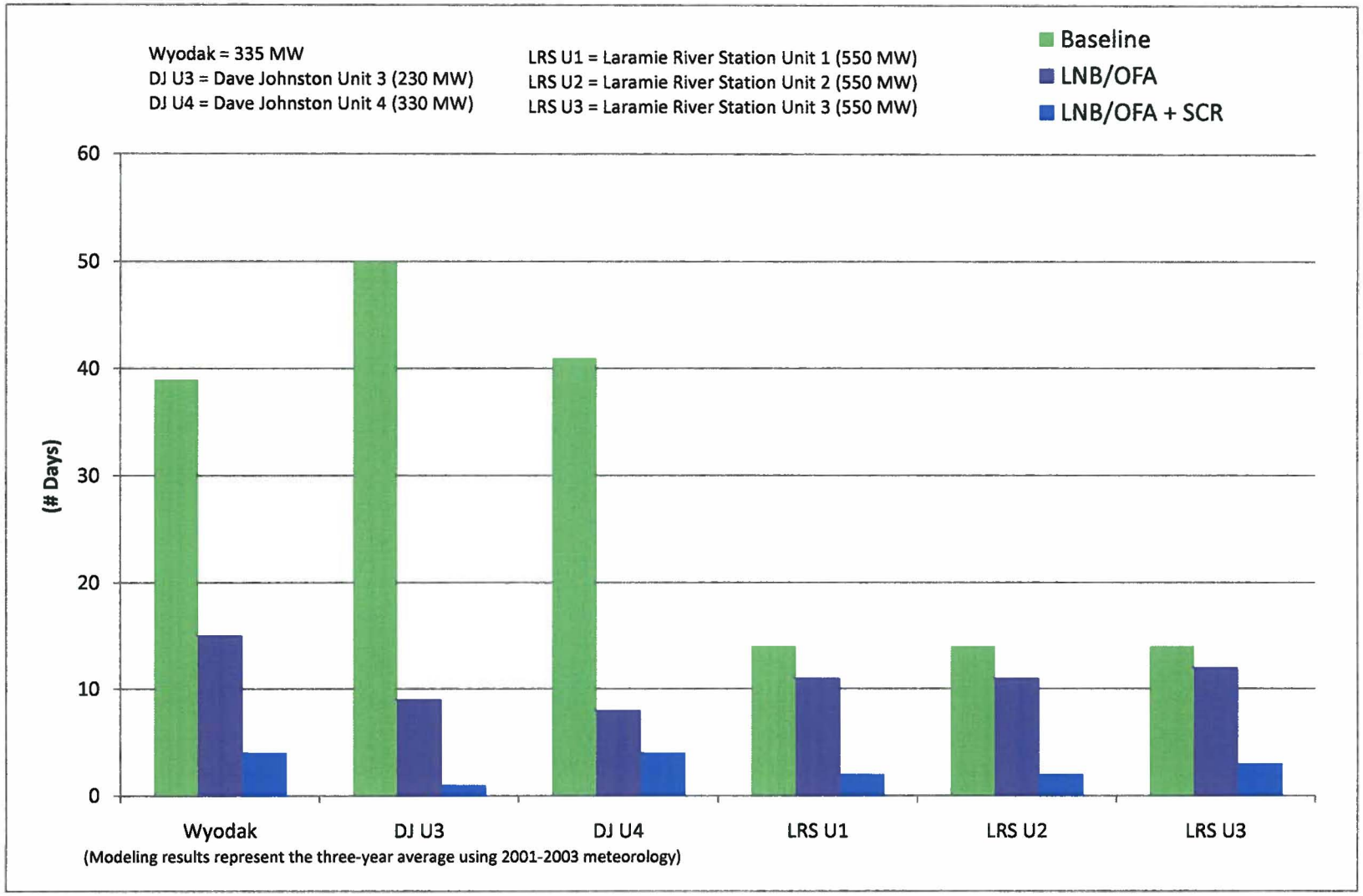

EXHIBIT C

FILED

OCT 10 2006

Terri A. Lorenzon, Director
Environmental Quality Council

BEFORE THE
ENVIRONMENTAL QUALITY COUNCIL
STATE OF WYOMING

IN THE MATTER OF THE ADDITION OF SECTION NINE TO CHAPTER SIX OF THE WYOMING AIR QUALITY STANDARDS AND REGULATIONS	)))	STATEMENT OF PRINCIPAL REASONS FOR ADOPTION

1. The Environmental Quality Council, pursuant to the authority vested in it by the Wyoming Statutes 35-11-112 (a) (i), has added Section 9, Best available retrofit technology (BART) to Chapter 6, Permitting Requirements, of the Wyoming Air Quality Standards and Regulations.

2. Section 35-11-202 (a) of the Environmental Quality Act states that the Administrator, after consultation with the Advisory Board, shall recommend to the Director such ambient air standards and regulations that may be necessary to prevent, abate, or control pollution.

   Section 35-11-202 (b) of the Act states that in recommending such standards the Administrator shall consider all facts and circumstances bearing upon the reasonableness of the emissions involved including:

   (A) The character and degree of injury to, or interference with the health and physical well being of the people, animals, wildlife and plant life;

   (B) The social and economic value of the source of pollution;

   (C) The priority of location in the area involved;

   (D) The technical practicability and economic reasonableness of reducing or eliminating the pollution; and

   (E) The social welfare and aesthetic value.

3. Chapter 6, Permitting Requirements, Section 9, Best available retrofit technology (BART) is a new section which is being proposed to meet the BART requirements established under the Regional Haze Rule, 40 CFR part 51. The Regional Haze Rule requires Wyoming to submit a State Implementation Plan (SIP) to address visibility impairment in the seven Federally-protected parks and wilderness areas in the state as well as impacted surrounding Class I areas. The Federal rule specifically directs states to examine visibility impairment resulting from large, older emission sources, i.e., BART sources. This rule continues to allow Wyoming participation in emission trading programs with other Western states. All changes to Chapter 6, Section 9 will be considered changes to the Wyoming State Implementation Plan.

4. Chapter 6, Section 9(c) "Guidelines for BART Determinations", allows the Air Quality Division to incorporate by reference 40 CFR part 51, Appendix Y. Appendix Y establishes the procedure for implementing BART requirements under the Regional Haze Rule. Operators must use Appendix Y in establishing BART emission limitations for power plants with a total capacity exceeding 750 MW. All other facility owners will use Appendix Y as guidance in preparing BART determinations.

5. Chapter 6, Section 9(d) "Identification of Sources Subject to BART", identifies the air quality modeling procedure for determining which sources are subject to BART, and the requirement that the Air Quality Division provide written notice to each source subject to BART.

6. Under Chapter 6, Section 9(e) "BART Requirements", BART requirements are established including: submission of a BART permit application; administrative procedures for review of the permit; proposal of a permit; opportunity for public

comment; modifications to a BART permit; operating permit requirements; fees associated with permitting; timing requirements for installation of BART technology; and operation and maintenance of the BART technology.

7. Chapter 6, Section 9(f) "BART Alternative", allows the Air Quality Division to require participation in an emission trading program or other measures as an alternative to installing, operating and maintaining BART.

8. Chapter 6, Section 9(g) "Monitoring, Recordkeeping and Reporting", establishes monitoring, recordkeeping and reporting requirements for BART sources.

The Council finds that these regulations are reasonable and necessary to accomplish the policy and purpose of the ACT, as stated in W.S. 35-11-102, and that they have been promulgated in accordance with rulemaking provisions of the Wyoming Administrative Procedures Act.

Dated this 9th day of October, 2006.

Hearing Examiner
Wyoming Environmental Quality Council