BEFORE THE WYOMING PUBLIC SERVICE COMMISSION

IN THE MATTER OF THE APPLICATION OF ROCKY MOUNTAIN POWER FOR APPROVAL OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY TO CONSTRUCT THE SELECTIVE CATALYTIC REDUCTION SYSTEM, PULSE JET FABRIC FILTER SYSTEM AND RELATED ENVIRONMENTAL UPGRADES AT NAUGHTON UNIT NO. 3 LOCATED NEAR KEMMERER, WYOMING	)))))))))))	Docket No. 20000-400-EA-11 (RECORD NO. 12953)

DIRECT TESTIMONY OF

Leo H. Stander, PE, BCEE

On behalf of the Wyoming Office of Consumer Advocate

Filed January 30, 2012
Hearing March 19, 2012

Q. PLEASE STATE YOUR NAME, ADDRESS AND OCCUPATION.

A. My name is Leo H. Stander. My business address is 1117 Fernlea Court, Cary, NC, 27511. I am an environmental engineering consultant working for the Wyoming Office of Consumer Advocate (OCA).

Q. PLEASE DESCRIBE YOUR EDUCATIONAL BACKGROUND AND OCCUPATIONAL EXPERIENCE.

A. I received a Bachelor of Science degree in civil engineering from the University of Nebraska – Lincoln in 1970 and a Master of Science degree in civil engineering from the University of Colorado - Boulder in 1977. I am a professional engineer in Wyoming, Nebraska, North Carolina, and Florida and am a Board Certified Environmental Engineer in the American Academy of Environmental Engineers.

After graduating from the University of Nebraska, I was commissioned as an officer in the US Public Health Service and was subsequently detailed to the US Environmental Protection Agency where I served till my retirement in 2000. During my career in the Public Health Service at EPA, I held several positions, including:

- From 1970 to 1974, I served as a Program Advisor in the Air and Water Programs Division, EPA Region IV, Atlanta, Georgia. There my duties included assisting states in developing the original State implementation plans, air permits programs, and control strategies.
- From 1974 to 1978, I served as a Technical Advisor in the Air and Hazardous Materials Division, EPA Region VIII, Denver, Colorado. There my duties included providing technical assistance in implementing and revising SIPs and providing assistance to State and local planning groups in areas affected by the Prevention of Significant Air Quality Deterioration requirements. I also prepared environmental planning guidelines for municipalities affected by energy development. Between 1976 and 1977 I attended the University of Colorado – Boulder on a long term training assignment where I received a Master of Science in Civil Engineering. While at the University I completed my Master's report entitled, "The Impact of Coal Mining in Northern Colorado on Ambient Air Quality."

- From 1978 to 1983, I served as Environmental Engineer Specialist, in the Control Programs Development Division, Office of Air Quality Planning and Standards, EPA, Research Triangle Park, NC. My duties involved providing assistance to EPA regional offices in developing regulatory actions and coordinating activities in developing the Emission Trading Policy.
- From 1983 to 1991, I served as the Program Officer - University Activities in the Air Quality Management Division, Office of Air Quality Planning and Standards, EPA, Research Triangle Park, NC. There some of my duties included: managing the development of self study materials, course manuals, workbooks, and instructor's materials.
- From 1991 to 1993, I served as the Special Assistant to the Director, Air Quality Management Division, Office of Air Quality Planning and Standards, Research Triangle Park, NC. While there my duties included: designing and implementing an employee development program for individuals involved with preparing, reviewing, and approving air permit applications; providing expert guidance and consultation on air pollution training; and conducting training courses on air pollution control activities.
- From 1993 to 2000, I served as Assistant to Chief, Operating Permits Group, Information Transfer and Program Integration Division, Office of Air Quality Planning and Standards, EPA, Research Triangle Park, NC. My duties included: managing the operation of the Operating Permits Task Force in identifying and resolving permitting issues; providing technical assistance on operating permit and new source review activities; participating in Agency-wide work groups responsible for developing policy for implementing requirements of the Civil Rights Act through permitting programs, for undertaking efforts to reform environmental permitting activities, and for implementing a presidential executive order on a Customer Service Initiative for permits.

Since my retirement from US Public Health Service, I have been an Independent Consultant. Some of my projects have included: assisting North Carolina Department of Environment and Natural Resources in drafting Title V operating permits; assisting clients to apply for and secure construction permits; developing a 3-day air pollution training course on Permit Writing for California Air Resources Board; and conducting air pollution training courses on basic air pollution issues, air pollution inspections, MACT standards, boilers and air pollution control, and air permitting for staffs of state environmental agencies and for staffs in industry in the US and other countries.

I am actively involved in the Air and Waste Management Association where I have served as chair of the South Atlantic States Section and the Education Council and was elected a member of the Board of Directors and Board Vice President. I have also been actively involved in the Carolinas Air Pollution Control Association (CAPCA), the National Society of Professional Engineers (specifically at the state level in the Professional Engineers of North Carolina [PENC]), and the American Academy of Environmental Engineers. I have co-authored a book entitled *Environmental Regulatory Calculations Handbook*, and have written papers and articles and provided presentations on a variety of air pollution control topics including air permitting for the Air and Waste Management Association, CAPCA, and PENC.

Q. HAVE YOU TESTIFIED BEFORE THIS COMMISSION IN PREVIOUS PROCEEDINGS?

A. No.

Q. ON WHOSE BEHALF DO YOU APPEAR HERE TODAY?

A. I appear here today on behalf of the OCA, which is an independent party in this proceeding, separate and apart from the Commission or its advisory staff.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A. As discussed in the testimony from Mr. Bryce Freeman,

"In this proceeding the Commission must answer three basic questions in order to determine whether issuance of the Certificate of Public Convenience and Necessity (CPCN) sought by Rocky Mountain Power (RMP) for the Naughton 3 environmental upgrades is in the public interest and are necessary pursuant to W.S. 37-2-205. Those questions are:

1. Is it prudent and cost effective for customers to fund the investments in the Naughton 3 environmental upgrades or would customers be better served if the Naughton 3 plant were retired and replaced with some other generation resource, market purchases or a combination thereof?

2. If it is prudent to upgrade the Naughton 3 generation unit to comply with current and reasonably anticipated federal and state emission control requirements, has RMP proposed the least cost, least risk technology solutions for compliance?

3. Is the cost of compliance proposed by RMP in this application reasonable or, if lower cost compliance technologies are available, what is the estimated cost of compliance using those technologies?"

Mr. Freeman addressed the issues associated with questions one and three above. In my testimony I will attempt to provide an answer to question number 2. In this testimony I will provide an assessment of current and anticipated compliance requirements for various hazardous and non-hazardous emissions from Naughton 3 as well as a recommendation regarding how compliance should be accomplished going forward. In short, my analysis concluded that the upgrades of Naughton 3 are both prudent and cost effective based on known and reasonably anticipated compliance requirements.

Q. WHAT UPGRADES HAVE BEEN PROPOSED BY RMP?

A. The upgrades that are being proposed have been described in the application documents and are reiterated as follows:

An application was submitted to the Wyoming Public Service Commission ("Commission" or "PSC"), by RMP requesting an Order granting a Certificate of Public Convenience and Necessity (CPCN). This certificate will enable RMP to construct two major "environmental projects" at Unit 3 of its Naughton Power Plant ("Naughton Unit 3"), located in Lincoln County, Wyoming, near Kemmerer. These environmental projects consist of

- a selective catalytic reduction (SCR) unit including a dry or solution urea to ammonia system and
- a pulse jet fabric filter ("PJFF" or "full-scale fabric filter" or "baghouse") system. This system includes interconnecting ductwork, replacement induced draft ("ID") fans, the addition of a 13.8 kV auxiliary power system, and a 138 kV switchyard addition at RMP's Naughton Substation.

Both projects were identified as necessary in the application in order for RMP to continue to operate Naughton Unit 3 beyond December 31, 2014.

As indicated in the application, the Naughton Power Plant is comprised of three (3) pulverized coal-fired units with a total net generating capacity of 700 megawatts (MW). Naughton Unit 1 generates a nominal 160 MW and commenced operation in 1963. Naughton Unit 2 generates a nominal 210 MW and commenced operation in 1968. Naughton Unit 3 generates a nominal 330 MW and commenced operation in 1971.

The unit in question, Naughton Unit 3, is comprised of a forced-circulation tangential fired boiler and a steam turbine-generator. The unit's current configuration includes a closed loop cooling system with a mechanical draft cooling tower, an electrostatic precipitator to control emissions of particulate matter, and a wet flue gas desulfurization (FGD) system for controlling emissions of sulfur dioxide (SO_2) that was retrofit in the flue gas path in 1981. The boiler was retrofitted with low NOx burners (LNB) in 1999.

Q. WHAT IS DRIVING THE NEED FOR THE ENVIRONMENTAL UPGRADES PROPOSED BY RMP IN THIS CASE AS WELL AS MORE GENERALLY FOR ALL OF ITS COAL FIRED PLANTS?

A. These investments are being driven by various rules and regulations issued by the U.S. Environmental Protection Agency (EPA) and subsequently the Wyoming Department of Environmental Quality which are in various stages of adoption. Broadly speaking these rules, at the USEPA level, are 1) the Regional Haze Rule which is meant to restore natural visibility in national parks and wilderness areas by requiring the limitation and control of emissions of particulate matter (PM), oxides of nitrogen (NO_x), and sulfur dioxides (SO_2), 2) Mercury and Air Toxics Standard (MATS), which limits the amount of mercury, non-mercury hazardous metals, and acid gases that can be emitted by coal and oil-fired power plants, 3) Cooling water intake and discharge regulations which will require modification of cooling water intake structures and closed loop cooling systems, and 4) the Coal Combustion Residuals (CCR) rule which may classify coal combustion byproducts (captured ash) as hazardous materials and significantly change the way that those materials are disposed of and monitored.

Though there may be many reasons to build a structure or add on equipment, in this case the installation of pollution control devices is required by law for Naughton Unit 3. This conclusion was reached after reviewing the requirements of the Clean Air Act, EPA and Wyoming air quality regulations and requirements, and RMP's responses in the application and supporting documents.

In the Clean Air Act sections 169A and 169B, the US Congress declared as a national goal the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory Federal class I areas (Class I areas) which impairment results from manmade air pollution. Areas designated as mandatory Federal Class I areas include those national parks exceeding 6,000 acres, wilderness areas and national memorial parks exceeding 5,000 acres, and all international parks which were in existence on August 7, 1977. Visibility has been identified as an important value in the areas of Wyoming listed in the following table:

Area name	Acreage	Federal land manager
Bridger Wilderness	392,160	USDA-FS
Fitzpatrick Wilderness	191,103	USDA-FS
Grand Teton National Park	305,504	USDI-NPS
North Absaroka Wilderness	351,104	USDA-FS
Teton Wilderness	557,311	USDA-FS
Washakie Wilderness	686,584	USDA-FS

Yellowstone National Park	2,020,625	USDI-NPS

The US Environmental Protection Agency's (EPA's) visibility regulations, codified at 40 CFR 51.300–51.309, require states to develop regional haze state implementation plans (SIPs) with measures necessary to make reasonable progress towards remedying visibility. These SIP elements apply to those states with one or more Class I areas and include:

- the establishment of reasonable progress goals for each Class I area;
- calculations of baseline and natural visibility conditions for each Class I area located in the state
- the development of long term strategies addressing visibility impairment;
- a monitoring strategy for the Class I areas within the state;
- implementation of Best Available Retrofit Technology (BART) requirements; and
- a description of how the state will address comments provided by Federal Land Managers.

The Regional Haze Rule (40 CFR 51.308) provides specific details regarding the overall requirements to improve visibility and sets forth the goals of the regional haze program. The rule mandates that states develop SIPs to ensure that reasonable progress is made towards achieving natural conditions by 2064.

One of the strategies provided in the Regional Haze Rule 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 (NOx), particulate matter (PM), and sulfur dioxide (SO_2). As provided in EPA definitions in 40 CFR 51.301:

- *BART eligible source* means an *existing stationary facility* as defined in this section.

- *Existing stationary facility* means any of the following stationary sources of air pollutants, including any reconstructed source, which was not in operation prior to August 7, 1962, and was in existence on August 7, 1977, and has the potential -

- to emit 250 tons or more per year of any air pollutant. . . .
- Fossil-fuel fired steam electric plants of more than 250 million British thermal units per hour heat input, . . .
- Fossil-fuel boilers of more than 250 million British thermal units per hour heat input . . .

- *Best Available Retrofit Technology (BART)* means an emission limitation based on the degree of reduction achievable through the application of the best system of continuous emission reduction for each pollutant which is emitted by an existing stationary facility. The emission limitation must be established, on a case-by-case basis, taking into consideration the technology available, the costs of compliance, the energy and non-air quality environmental impacts of compliance, any pollution control equipment in use or in existence 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.

The Regional Haze Program Requirements allow States, including Wyoming, to participate in an optional program under 40 CFR 51.309(g). This program primarily addresses SO_2 impacts on visibility in the 16 Colorado Plateau Wilderness areas, and also allows for Wyoming to take full credit for SO_2 reductions at all Wyoming Class I areas. In addition to addressing SO_2 reductions, this SIP also focuses on emissions of nitrogen oxides (NOx) and particulate matter (PM).

Wyoming has been developing federally-required Regional Haze SIPs in response to these requirements over the past decade. These plans were completed and submitted to EPA in 2003, revised, and submitted again in 2008 and 2011.

- The Wyoming State Implementation Plan which was adopted to comply with the requirements of 40 CFR 51.309 can be viewed at http://deq.state.wy.us/aqd/downloads/RegionalHaze/WY_RegionalHaze309SIP%201-7-11_With%20Appendices2_CLEAN%20FINAL.pdf

- The Wyoming State Implementation Plan which was adopted to comply with the requirements of 40 CFR 51.309(g) can be viewed at http://deq.state.wy.us/aqd/308%20SIP/309(g)%20SIP%201-7-11%20Clean%20Final.pdf.

Although the prescribed State Implementation Plans, including those adopted by the State of Wyoming, have been submitted to EPA for approval, no final decisions have been provided by EPA. On November 9, 2011, the EPA announced that it has entered into a Consent Agreement to take action on such SIPs in accordance with a court ordered schedule.

To implement the previously discussed SIP provisions and other SIP requirements and in accordance with the Environmental Quality Act, WS 35-11-101 *et seq.*, Air Quality Standards and Regulations were promulgated by the Wyoming Environmental Quality Council. The regulations applicable to facilities such as Naughton Unit 3 are included in "Chapter 3 - General Emission Standards" which can be viewed at http://deq.state.wy.us/aqd/stnd/Chapter3_10-26-09_CLEAN_FINAL.pdf; "Chapter 6 – Permitting Requirements" which can be viewed at http://deq.state.wy.us/aqd/stnd/Chap6_3-9-10_FINAL_CLEAN.pdf; and "Chapter 9 – Visibility Impairment/PM Fine Control" which can be viewed at http://deq.state.wy.us/aqd/stnd/chap9.pdf.

Descriptions of these requirements are as follows:

- *Chapter 3 - General Emission Standards* established limits on the quantity, rate, or concentration of emissions of air pollutants. These standards include requirements which limit the level of opacity, prescribe equipment specifications, set fuel specifications, and prescribe operation or maintenance procedures. These general emission standards may be superseded by specific emission standards required in other Chapters of the Wyoming Air Quality Standards and Regulations.

- *Chapter 6 – Permitting Requirements* established permitting requirements for all sources constructing and/or operating in the State of Wyoming. Section 2 covers general air quality permitting requirements for construction and modification and include requirements for the issuance of permits to operate for minor sources.

Section 3 includes the requirements for the state operating permit program required under Title V of the Clean Air Act. In Section 4 the requirements for the prevention of significant deterioration (PSD) program are provided. Section 5 covers permitting requirements for major sources of hazardous air pollutants for which a MACT (maximum achievable control technology) standard has been established under section 112 of the Clean Air Act. Section 6 covers permitting requirements for major sources of hazardous air pollutants for which a MACT standard has not been established under section 112 of the Clean Air Act. Section 7 establishes the terms under which clean air resource allocations expire. Section 8 is reserved. Section 9 establishes Best Available Retrofit Technology (BART) requirements and provides guidelines for identifying sources subject to BART.

- *Chapter 9 – Visibility Impairment/PM Fine Control* established regulations to protect visibility and ensure reasonable progress towards the national goal of preventing future, and remedying existing, visibility impairment in Class I areas.

As part of the material submitted by RMP, the company emphasized that being in compliance with existing and anticipated emission control requirements is an important part of doing business. This statement was discussed specifically in the application, in support testimony, and in responses to inquiries by interveners. The following examples are indicative of this emphasis:

- On page 6 of the application, RMP stated that it is required to operate Naughton Unit 3 in compliance with environmental permits and emissions requirements. Non-compliance would force mandated idling of the plant by the Wyoming Department of Environmental Quality ("WDEQ") Air Quality Division ("AQD"). To continue operation of Naughton Unit 3, RMP must install the SCR and PJFF systems described in the application to control emissions of criteria pollutants in response to EPA's Regional Haze Rules, the State of Wyoming's 40 CFR 51.309(g) State Implementation Plan, the State of Wyoming's Best Available Retrofit Technology ("BART") review and permit (MD-6042) issued on December 31, 2009, and the amended BART permit MD-6042A issued on December 23, 2010. The BART permit requires that the emissions control equipment, under consideration, be installed and operating with the results of the emissions performance tests showing compliance with emissions limits on or before December 31, 2014.

- In response to OCA Data Request 1.9, the Company provided the following: "The Company believes the proposed environmental upgrades in this case are necessary to continue to operate Naughton Unit 3. The Company does not have any viable options under the Regional Haze Rules, the facility permit, or otherwise to simply not install (or to delay installation of) the SCR and /or PJFF required by the State of Wyoming's Regional Haze SIP and continue to operate the unit beyond December 31, 2014."

- Also, in response to OCA Data Request 1.9, the Company provided the following: "... The Company believes the environmental upgrades proposed in this docket are necessary to continue to operate Naughton Unit 3 beyond December 31, 2014, and present the least-cost/lowest-risk option for its customers."

- In testimony presented by Mr. Chad Teply on Page 3: "The Company's projects are required to comply with existing Regional Haze Rules, Regional SO_2 Milestone and Backstop Trading Programs, National Ambient Air Quality Standards, and New Source Review requirements. The projects are also required to comply with stand-alone requirements in state implementation plans ("SIPs"), Best Available Retrofit Technology ("BART") permits and construction permits enforceable by the laws of the respective states. The projects completed to date and/or currently permitted also position the Company well to comply with the EPA's proposed Utility hazardous air pollutants ("HAPs") maximum achievable control technology ("MACT") rulemaking [the Mercury and Air Toxics Standards (MATS) were signed by the EPA Administrator or December 16, 2011]."

Q. WHAT PROCEDURES WERE UTILIZED TO IDENTIFY AND EVALUATE THE CONTROL MEASURES SELECTED BY RMP TO MEET THE REGIONAL HAZE REQUIRMENTS?

A. To choose the control measures that were identified to comply with the "Regional Haze Requirements" for Naughton Unit 3 an extensive and detailed BART analysis process was utilized. The process involved consideration of alternative control options, development of cost estimates, and submittal of an application for a BART air quality permit to the Wyoming Department of Environmental Quality. Information on the procedures utilized was obtained from EPA guidance, Wyoming air quality regulations and requirements, Wyoming permit documents for Naughton Unit 3, and RMP's responses in the application and supporting documents.

Q. BEFORE WE DISCUSS THE CHANGES THAT NEED TO BE MADE, WHAT ARE THE CURRENT EMISSION LIMITATIONS FOR NAUGHTON UNIT 3?

A. As a starting point, the emission limitations for the existing facility (that is, prior to implementation of BART), are as shown in the following table. This table was provided in the BART application analysis for Naughton Unit 3 which was completed by the Wyoming Department of Environmental Quality on May 28, 2009.

Naughton Unit 3 Pre-2005 Emission Limits[a]					
Source	Firing Rate (MMBtu/hour)	Existing Controls	NOx (lb/MMBtu)	SO_2(lb/MM Btu)	PM/PM10 (lb/MMBtu)[c][d]
Unit 3	3,700	LNB, ESP, FGC, WFGD	0.75 (3-hour block) 0.49 (annual)[b]	0.5 (2-hour block)	0.21

(a) Emissions taken from Operating Permit 31-121.

(b) Limit established through the 40 CFR part 76 (Acid Rain Program).

(c) Based on the equation: $0.8963/I^{0.1743}$ lb/MMBtu of heat input where I = boiler heat input in MMBtu/hr.

(d) Averaging period is 1 hour as determined by the appropriate test method.

Q. WHAT ANALYSES WERE COMPLETED TO EVALUATE THE IMPACT OF EMISSIONS FROM NAUGHTON UNIT 3?

A. As prescribed by the EPA Regional Haze Rule (40 CFR 51.308), the Wyoming Division of Air Quality (WDAQ) required RMP to conduct a detailed Best Available Retrofit Technology (BART) review to analyze the effects to visibility in nearby Class I areas (notably Bridger Wilderness Area and Fitzpatrick Wilderness Area) from plant emissions, both for baseline and for reasonable control technology scenarios.

The BART review consisted of two parts, a BART determination and a BART analysis. 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

- the costs of compliance,
- the energy and non-air quality environmental impacts of compliance,
- any pollution equipment in use or in existence 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."

A BART analysis is a comprehensive evaluation of potential retrofit technologies with respect to the five criteria above. At the conclusion of the BART analysis, a technology and corresponding emission limit is chosen for each pollutant for each unit subject to BART.

Q. DESCRIBE THE METHOLOLOGY THAT WAS UTILIZED TO EVALUATE THE VARIOUS CONTROL OPTIONS.

A. Visibility control options presented in a BART application for each source are reviewed using the EPA methodology, as prescribed in Appendix Y to 40 CFR Part 51 [Guidelines for BART Determinations under the Regional Haze Rule], as required in WAQSR Chapter 6 Section 9(c)(i). This methodology is comprised of five basic steps:

- Step 1: Identify "all" available retrofit control technologies
    - Footnote 12 of 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."
- 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 Air Quality Division applied all five steps to each visibility impairing pollutant emitted from the coal-fired boiler (Unit 3) at the Naughton Power Plant. That is, a comprehensive BART analysis was completed for NOx, SO_2 and PM/PM_{10}. [As the discussions regarding a BART analysis for SO_2 and associated control measures are not part of this review, they are not discussed in this testimony.]

Q. DISCUSS THE PROCESS UTILIZED AND THE DECISIONS THAT WERE MADE CONCERNING THE VARIOUS CONTROL OPTIONS FOR EMISSIONS OF BOTH OXIDES OF NITROGEN AND PARTICULATE MATTER.

A. The following is a discussion of the BART analysis process utilized by the Wyoming Division of Air Quality for both NOx and PM and the decisions that were made:

- Step 1: Identify all available retrofit control technologies for NOx.

  RMP identified four control technologies to control NOx emissions which are proven emissions controls and which are commonly used on coal-fired electric generating units:

  - low NOx burners (LNB) with advanced OFA,
  - low NOx burners (LNB) with rotating opposed fire air (ROFA),
  - selective non-catalytic reduction (SNCR), and
  - selective catalytic reduction (SCR)

- LNB with advanced OFA and ROFA are two combustion control technologies that reduce NOx emissions by controlling the combustion process within the boiler. They have been demonstrated to effectively control NOx emissions by reducing the amount of oxygen directly accessible to the fuel during combustion creating a fuel-rich environment and by enhancing control of air-fuel mixing throughout the boiler's combustion zone. Low NOx Burners with Advanced Overfire Air – rely on a combination of fuel staging and combustion air controls to suppress the formation of thermal NOx. A LNB limits NOx formation by controlling the stoichiometric and temperature profiles of the combustion process. This control is achieved by design features that regulate the mixing of the fuel and air, resulting in one or more of the following conditions: (1) reduced oxygen in the primary flame zone, which limits both thermal and fuel NOx formation; (2) reduced flame temperature, which limits thermal NOx formation; and (3) reduced residence time at peak temperature, which limits thermal NOx formation. In general, LNBs attempt to delay the complete mixing of fuel and air as long as possible within the constraints of combustion chamber design. Fuel staging occurs in the beginning of combustion, where the pulverized coal is injected through the burner into the furnace. Careful control of the fuel-air mixture at the burner limits the amount of oxygen available to the fuel during combustion. The addition of advanced overfire air allows for a more complete combustion of the fuel while reducing both thermal and chemical NOx formation.

- Rotating Opposed Fire Air – ROFA can be used with LNB technology to control the combustion process inside the boiler. Similar to the advanced overfire air technology discussed above, ROFA manipulates the flow of combustion air to enhance fuel-mixing and the air-flow characteristics within the boiler. By inducing rotation of the combustion air within the boiler, ROFA can reduce the temperature variation and the number of high temperature combustion zones in the boiler, reduce the amounts of excess air needed for combustion, and increase the effective heat absorption. This in turn reduces the formation of NOx caused by fuel combustion within the boiler.

- SCR and SNCR are add-on controls that provide a chemical conversion mechanism for NOx to form molecular nitrogen (N_2) in the flue gas after combustion occurs. Selective Catalytic Reduction (SCR) is a post combustion control technique in which vaporized ammonia or urea is injected into the flue gas upstream of a catalyst. In this process, NOx in the flue gas is reduced to molecular nitrogen (N_2) and water. The use of a catalyst facilitates the reaction at an exhaust temperature ranging from 300° to 1,100° F, depending on the application and type of catalyst used. 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. A well controlled SCR system typically emits less ammonia than a comparable SNCR control system. Selective Non-Catalytic Reduction (SNCR) is similar to SCR in that it involves the injection of a reducing agent such as ammonia or urea into the flue gas stream. The reduction chemistry, however, takes place without the aid of a catalyst. SNCR systems rely on appropriate injection temperatures, proper mixing of the reagent and flue gas, and prolonged retention time in place of the catalyst. SNCR operates at higher temperatures than SCR. The effective temperature range for SNCR is 1,600° to 2,100° F. SNCR systems are very sensitive to temperature changes and typically have lower NOx emissions reduction (up to fifty or sixty percent) and may emit ammonia out of the exhaust stack when too much ammonia is added to the system.

In addition to applying these control technologies separately, they can be combined to increase overall NOx reduction.

On page 52 of the application, RMP noted that five technical studies were completed to evaluate NOx, PM, and SO_2 emission control technology alternatives for Naughton Unit 3. Those relevant for NOx controls are

- a coal fleet-wide *Multi-Pollutant Control Report* completed in October 2002 by Sargent and Lundy ("SL");
- the *NOx Emission Reduction Technologies Study* completed in January 2005 by SL;
- the *BART Analysis for the Naughton Unit* 3 completed in February of 2007 by CH2M Hill; and
- the *SCR and Baghouse Study Report* completed in December 2009 by SL

In the *"NOx Emission Reduction Technologies Study,"* sixteen emission control technologies were compared. For each technology, the study evaluated

- the status of technology development,
- their performance,
- the approximate initial capital costs, and
- the approximate fixed and variable operational and maintenance costs.

Relevant points from this study, and related information from other sources, are represented in commentary as provided on pages 54 to 56 of the application.

- Step 1: Identify all available retrofit control technologies for PM/PM_{10} emissions.

In his written testimony, Mr. Chad Teply, Vice President of Resource Development and Construction for RMP Energy, stated that the performance of the existing electrostatic precipitator on Unit 3 has deteriorated over time and that it is providing only marginal results with respect to current emissions compliance obligations. As a result maintaining the status quo was not considered an option.

In the BART application analysis for Naughton Unit 3, completed by the Wyoming Department of Environmental Quality on May 28, 2009, three PM control technologies were analyzed for application on Naughton Unit 3: fabric filters or baghouses, ESPs, and flue gas conditioning. In the application for a CPCN, under review, RMP identified four control technologies to control PM/PM10 emissions: (l) install a standalone PJFF to replace the existing ESP; (2) install a polishing fabric filter (Compact Hybrid Particulate Collector or ("COHPAC")) to operate in series with the existing ESP; (3) rebuild the existing ESP; and (4) ESP replacement with a Reversing Gas Fabric Filter (RGFF), which is a PM cleaning device currently not often selected for use in steam electric plants.

- Fabric filter (FF). FF utilizes technology similar to vacuum cleaner bags. The filters, which are shaped like long socks or leggings, consist of woven or felted material that collect particles with sizes ranging from submicron to several hundred microns in diameter at capture efficiencies generally in excess of 99%. The layer of dust which is trapped on the surface of the fabric (commonly referred to as dust cake or filter cake) is primarily responsible for the high particulate capture efficiencies. Joined pores within the dust cake act as barriers which trap particles that are too large to flow through the pores as the gas stream travels through the filter cake. To facilitate the flow of gas through all the bags in a baghouse, the filter cake must be removed periodically. Depending on the filter cake removal method, two basic types of FF exist, a reverse-air FF and pulse-jet FF. The selection of filter cake removal method is dependent on whether the fly ash particles are collected on the inside or outside of the bag. For designs in which the dust is collected on the inside of the bags, the dust is most often removed by blowing air through the bag from the opposite side (reverse-air FF or reverse gas FF (RGFF). For designs with the dust collected on the outside of the bags, a jet of compressed air is used to displace the filter cake from the bag (pulse-jet FF (PJFF)). For both designs, the displaced dust particles fall into a hopper at the base of the baghouse. Limitations are imposed by the temperature and corrosivity of the gas and by adhesive properties of the particles. Typically, other than routine replacement of worn out bags in the FF, less maintenance is required for the FF than for the ESP. FFs are the best commercial PM control technology for high-efficiency collection of fine particles, especially submicron particles.

- Polishing fabric filter (Compact Hybrid Particulate Collector or ("COHPAC")). COHPAC incorporates a small, pulse-jet fabric filter which is installed downstream of a particulate capturing device (for example an electrostatic precipitator) to act as a particulate polishing unit. This is designed to enable the combined ESP/fabric filter system to successfully meet federal or state mandated particulate emission limits without major ESP retrofits or rebuilds. This type fabric filter system helps to overcome the sensitivity of electrostatic precipitator particulate collection efficiency to variations in particulate and flue gas properties.

- Electrostatic precipitators (ESPs). ESPs use electrical forces (charge) to move particulate matter out the gas stream onto collection plates. The particles are electrically charged when the gas stream is directed through a corona, or region of gaseous ion flow. The corona results from an induced electrical field produced by high voltage electrodes. The particles in the gas stream receive their negative charge as they flow through the corona. They are removed from the gas stream as they migrate to positively charged walls or collection plates. Once the particles couple with the collection plates, they must then be removed without being re-entrained in the gas stream. In dry ESP applications, this is usually accomplished by physically knocking clumps of particles loose from the collection plates and into a hopper for disposal. The efficiency of an ESP is primarily determined by the resistivity of the particle, which is dependent on chemical composition, and also by the ability to clean the collector plates without reintroducing the particles back into the flue gas stream.

- Flue Gas Conditioning (FGC). FGC is accomplished by injecting a conditioning medium, typically SO_3, into the flue gas to lower the resistivity of the fly ash. This improves the particles' ability to gain an electric charge. If the material is injected upstream of an ESP the flue gas particles more readily accept charge from the corona and are drawn to the collection plates. Adding FGC can account for large improvements in PM collection efficiency for existing ESPs that are constrained by space and flue gas residence time.

As was previously indicated, RMP completed five technical studies of note to evaluate NOx, PM and SO_2 emission control technology alternatives for Naughton Unit 3. Those relevant for PM controls are:

- o a coal fleet-wide *Multi-Pollutant Control Report* completed in October 2002 by Sargent and Lundy ("SL");
- o the *Conceptual Design of Replacement Baghouse RMP Naughton* 3 completed in March 2006 by SL;
- o the *BART Analysis for the Naughton Unit* 3 completed in February of 2007 by CH2M Hill; and
- o the *SCR and Baghouse Study Report* completed in December 2009 by SL

Relevant points from these studies, and related information from other sources, are represented in commentary as provided on pages 56 to 58 of the application.

- Step 2: Eliminate technically infeasible options.

None of the four control technologies proposed to control NOx emissions were deemed technically infeasible by RMP.

RMP did not eliminate any of the control technologies listed above for PM/PM_{10} as technically infeasible.

- Step 3: Evaluate control effectiveness of remaining control technologies (NOx).

As discussed in the BART application analysis for Naughton Unit 3, completed by the Wyoming Department of Environmental Quality on May 28, 2009, the Air Quality Division considered 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 for minimizing emissions. 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 and devices, such as LNB with advanced OFA, generally have 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.

RMP contracted with Sargent and Lundy (SL) to conduct a study of applicable NOx control technologies for the Naughton units and to collect data from boiler vendors. Based on results from the study, RMP indicated that Naughton Unit 3 was equipped with LNB and has demonstrated compliance with a 0.40 lb/MMBtu NOx emission rate. RMP reviewed the option of tuning the existing LNB to further reduce NOx emissions and indicated that lowering emissions to 0.35 lb/MMBtu was possible. In the March 26, 2008 Addendum for Unit 3, RMP proposed a permitted rate of 0.37 lb/MMBtu to account for unforeseen operational issues and site specific challenges.

RMP worked with Mobotec to conduct an analysis of retrofitting the existing boilers at the Naughton Power Plant with Mobotec's ROFA. Mobotec analyzed the operation of existing burners and OFA ports. Typically the existing burner system does not require modification and the existing OFA ports are not used by a new ROFA system. Instead, computational fluid modeling is performed to determine the location of the new ROFA ports. Mobotec concluded that Unit 3 may achieve 0.26 lb/MMBtu. RMP added an additional operating margin to the anticipated emission rate of 0.02 lb/MMBtu to account for site specific issues, including the type of coal burned in the boilers, for total proposed emission rates of 0.28 lb/MMBtu for Unit 3.

SL evaluated emission reductions associated with installing SNCR in addition to retrofitting the boilers with LNB with advanced OFA. SL concluded that installing SNCR on Unit 3 can reduce the anticipated rate of 0.37 lb/MMBtu by 20% resulting in a NOx emission rate of 0.30 lb/MMBtu. RMP noted in the analysis that the economics of SNCR are greatly impacted by reagent utilization. When SNCR is used to achieve high levels of NOx reduction, lower reagent utilization can result in significantly higher operating cost.

SL prepared the design conditions and cost estimates for installing SCR in each of the Naughton units. A high-dust SCR configuration, where the catalyst is located downstream from the boiler economizer before the air heater and any particulate control equipment, was used in the analysis. The flue gas ducts would be routed to a separate large reactor containing the catalyst to increase the removal rate. Additional catalyst would be added to accommodate the coal feedstock.

Based on the SL design, which included installing both LNB with advanced OFA and SCR; RMP concluded the Naughton units could achieve a NOx emission rate of 0.07 lb/MMBtu. RMP's proposed emission rates for each technology as applied to Naughton Unit 3 are shown in the following table:

NOx Emission Rates Per Boiler	
Control Technology	Unit 3 Resulting NOx Emission Rate (lb/MMBtu)
Existing Burners	0.45
Tune Existing LNB	0.37
New LNB with advanced OFA	--
Existing Burners with ROFA	0.28
New LNB with advanced OFA and SNCR	0.30
New LNB with advanced OFA and SCR	0.07

- Step 3: Evaluate control effectiveness of remaining control technologies (PM/PM_{10}))

As discussed in the BART application analysis for Naughton Unit 3, completed by the Wyoming Department of Environmental Quality on May 28, 2009, the Air Quality Division considered 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 for minimizing emissions. 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 devices, such as hot-side electrostatic precipitators, generally have 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.

Naughton Unit 3 is currently equipped with an ESP and FGC system. RMP analyzed the impact of upgrading the existing FGC and resulting impact of installing a new full-scale fabric filter. RMP's proposed emission rates for each technology as applied to Naughton Units 3 are shown in the following table.

PM_{10} Emission Rates Per Boiler	
Control Technology	Resulting PM10 Emission Rate (lb/MMBtu)
Existing ESP	0.094 [(a)]
Existing ESP with FGC	0.040
Full-scale Fabric Filter [(b)]	0.015
(a) Current achievable PM_{10} emissions from Unit 1, 2, and 3, respectively. (b) Applied to Naughton Unit 3.	

- Step 4: Evaluate Impacts and Document Results (NOx).

RMP evaluated the energy impacts associated with installing each of the proposed control technologies. Tuning the existing LNB on Unit 3 will not significantly impact the boiler efficiency or forced draft fan power usage, two common potential areas for adverse energy impact often affected by changes in boiler combustion. Installing the Mobotec ROFA system has a significant energy impact on Naughton. One (1) 6,000 hp ROFA fan would be required to provide a sufficient volume of air to cause rotation of the combustion air within Unit 3. The estimated annual energy impact from operating the proposed ROFA fan is 35,300 MW-hr.

RMP determined the SNCR system would require between 200 kilo Watt (kW) and 300 kW of additional power to operate pretreatment and injection equipment, pumps, compressors, and control systems.

For the SCR system, in addition to energy costs associated with the reagent handling and injection, the utilization of the SCR catalyst will require additional power for the existing flue gas fan systems to overcome the pressure drop across the catalyst. Based on the SL study, RMP estimated the additional power requirements for SCR installation on each unit at the Naughton Power Plant ranged from approximately 1.0 MW to 2.0 MW.

RMP identified and evaluated the potential environmental impacts from the proposed NOx control technologies.

- Installing LNB with advanced OFA may increase carbon monoxide (CO) emissions and unburned carbon in the ash, commonly referred to as loss on ignition (LOI). Mobotec predicted CO emissions and LOI would be the same or lower than prior levels for the ROFA system.
- The installation of SNCR and SCR could impact the sale ability and disposal of fly ash due to higher ammonia levels, and could potentially create a visible stack plume sometimes referred to as a blue plume, if the ammonia injection rate is not well controlled. Other environmental impacts involve the storage of ammonia (especially if anhydrous ammonia is used) and transportation of the ammonia to the power plant site.

As was stated in the Air Quality Division's BART analysis, RMP anticipates operating Naughton Unit 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. The annual cost to control was determined using a capital recovery factor based on a 7.1% interest rate. RMP labor and service costs were used to calculate the annual operating and maintenance costs. Annual power costs, including a cost escalation factor, associated with the operation of pollution controls were included as part of the analysis.

As discussed in the comprehensive visibility analysis presented later in this analysis as Step 5: Evaluate Visibility Impacts, the Air Quality Division evaluated the amount of anticipated visibility improvement gained by the application of additional emission control technology. The Air Quality Division considered capital cost, annual cost, cost effectiveness, and incremental cost effectiveness in the evaluation of each proposed NOx emission control. Economic and environmental costs for additional NOx controls on Naughton Unit 3 are summarized in the following tables (developed from information provided in the Air Quality Division's BART analysis).

Naughton Unit 3 Economic Costs					
Cost	Existing LNB	Tuning Existing LNB	Existing LNB and SNCR	Existing LNB with ROFA	Existing LNB and SCR
Control Equipment Capital Cost	$0	$1,000,000	$15,788,530	$14,747,608	$136,800,000
Capital Recovery Factor	N/A	0.09513	0.09513	0.09513	0.09513
Annual Capital Recovery Costs	$0	$95,130	$1,501,963	$1,402,940	$13,013,784
Annual O&M Costs	$0	$0	$414,076	$1,882,074	$2,668,918
Annual Cost of Control	$0	$95,130	$1,916,039	$3,285,014	$15,682,702

Naughton Unit 3 Environmental Costs					
	Existing LNB	Tuning Existing LNB	Existing LNB and SNCR	Existing LNB with ROFA	Existing LNB and SCR
NOx Emission Rate (lb/MMBtu)	0.45	0.37	0.30	0.28	0.07
Annual NOx Emission (tpy) (a)	6,563	5,397	4,376	4,084	1,021
Annual NOx Reduction (tpy))	N/A	1,167	2,188	2,480	5,542
Annual Cost of Control	$0	$95,130	$1,916,039	$3,285,014	$15,682,702
Cost per ton of Reduction	N/A	$82	$876	$1,325	$2,830
Incremental Cost per ton of Reduction	N/A	$1,783	$4,688	$4,049	$4,049

- Step 4: Evaluate Impacts and Document Results (PM/PM_{10}).

RMP evaluated the energy impact of upgrading the existing ESP on Unit 3. This upgrade is not anticipated to require additional power. Upgrading the existing FGC and installing a new full-scale fabric filter on Unit 3 are not anticipated to have significant negative environmental impacts. RMP anticipates operating Naughton Unit 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. The annual cost to control was determined using a capital recovery factor based on a 7.1% interest rate. RMP's labor and service costs were used to calculate the annual operating and maintenance costs. Annual power costs, including a cost escalation factor, associated with the operation of pollution controls were included.

As for the evaluation completed for NOx, the Air Quality Division considered capital cost, annual cost, cost effectiveness, and incremental cost effectiveness in the evaluation of each proposed PM emission control. Economic and environmental costs for additional PM controls on Naughton Unit 3 are summarized in the following tables (developed from information provided in the Air Quality Division's BART analysis).

Naughton Unit 3 Economic Costs			
Cost	Existing ESP	Existing ESP With Flue Gas Conditioning	New Full-scale Fabric Filter
Control Equipment Capital Cost	$0	$13,299,508	$121,000,000
Capital Recovery Factor	N/A	0.09513	0.09513
Annual Capital Recovery Costs	$0	$1,265,182	$11,510,730
Annual O&M Costs	$0	$0	$1,120,813
Annual Cost of Control	$0	$1,265,182	$12,631,543

Naughton Unit 3 Environmental Costs			
	Existing ESP	Existing ESP With Flue Gas Conditioning	New Full-scale Fabric Filter
PM_{10} Emission Rate (lb/MMBtu)	0.094	0.040	0.015
Annual PM10 Emission (tpy) [(a)]	1,371	583	219
Annual PM_{10} Reduction (tpy)	N/A	788	1,152
Annual Cost of Control	$0	$1,265,182	$12,631,543
Cost per ton of Reduction	N/A	$1,606	$10,963
Incremental Cost per ton of Reduction	N/A	$1,606	$31,172
[(a)] Annual emissions based on unit heat input rate of 3,700 MMBtu/hr and 7,884 hours of operation per year.			

- Step 5: Evaluate visibility impacts

The fifth of five steps in a BART determination analysis, as required by 40 CFR part 51 Appendix Y, is the determination of the degree of Class I area visibility improvement that would result from installation of the various options for control technology. This factor was evaluated for the RMP Naughton facility by using an EPA-approved dispersion modeling system (CALPUFF) to predict the change in Class I area visibility. The Air Quality Division had previously determined that the facility was subject to BART based on the results of initial screening modeling that was conducted using current (baseline) emissions from the facility. Screening modeling, as well as more refined modeling, was conducted by RMP.

Only those Class I areas most likely to be impacted by the Naughton Power Plant 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 modeled areas. In Wyoming, modeling was completed for the Bridger Wilderness Area (WA) and Fitzpatrick WA which are the closest Class I areas to the RMP Naughton facility. Bridger WA is located approximately 140 kilometers (km) northeast of the facility and Fitzpatrick WA is located approximately 165 km northeast of the facility.

The modeling procedures utilized to determine the degree of Class I area visibility improvement that would result from installation of the various options for control technology and the results of such modeling are discussed in pages 28 to 42 of the Division of Air Quality's BART Application Analysis - AP-6042 dated May 28, 2009.

Q. WHAT DETERMINATIONS WERE MADE, WHAT CONCLUSIONS WERE REACHED AND WHAT WAS DECIDED AS A RESULT OF THE BART ANALYSIS CONCERNING NOx?

A. 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 resulting from each proposed control technology, the Air Quality Division determined BART for each visibility impairing pollutant emitted from the Naughton Unit 3. For emissions of NOx, the Division considered the limitations shown in the following table to be BART for Naughton Unit 3.

Unit	Pollutant	Control Type	lb/MMBtu	lb/hr	tpy
3	NOx	Tune LNB/OFA + SCR	0.07 (30-day rolling)	259 (30-day rolling)	1,134
LNB = low NOx burners OFA = overfire air					

The Air Quality Division considered the installation and operation of the NOx controls, including the tuning of existing low NOx burners with overfire air and installing SCR on Unit 3, as sufficient to meet corresponding emission limits on a continuous basis and thus to meet the statutory requirements of BART. This decision was based, in part, on the following conclusions:

- The cost effectiveness of tuning the existing LNB with OFA and installing SCR on Unit 3 was reasonable at $2,830 per ton of NOx removed. The incremental cost effectiveness when compared to existing LNB with ROFA was $1,783 per ton of NOx and reasonable as well. Both the cost effectiveness and average cost effectiveness were based on a twenty year operational life for the proposed controls.
- The cumulative 3-year averaged 98th percentile visibility improvement from the baseline summed across both Class I areas achieved by tuning the existing LNB with OFA, wet FGD and installing a new full-scale fabric filter was 0.826 Δdv from Unit 3.
- The cumulative 3-year averaged 98th percentile visibility improvement from the baseline summed across both Class I areas achieved by tuning the existing LNB with OFA, SCR, wet FGD, and installing a new full-scale fabric filter was 1.849 Δdv. Annual NOx emission reductions from baseline achieved by tuning existing LNB with OFA and installing SCR are 5,542 tons as compared to only 1,167 tons from tuning existing LNB with OFA.

Another part of the process involved in reaching this conclusion was provided in a response to comments from the US Forest Service as found in the Decision Document which was part of the "Best Available Retrofit Technology (BART) Permit for the Naughton Power Plant" (Permit AP-6042) issued on December 31, 2009. This comment and response, as provided on pages 6 and 7 of 28 of the permit, are as follows:

> **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 [following] 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 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

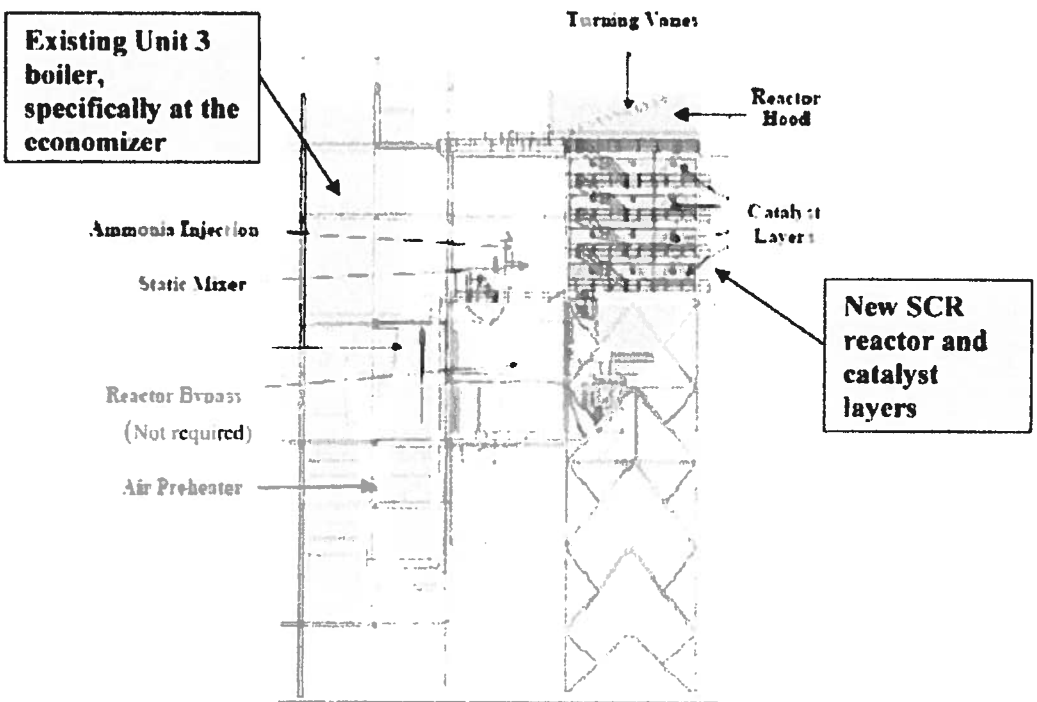
Note: "--" indicates that this value was not provided in the RBLC

As stated in the direct testimony presented by Mr. Chad Teply and in a response to comments from RMP as found in the Decision Document which was part of the "Best Available Retrofit Technology (BART) Permit for the Naughton Power Plant" (Permit AP-6042) issued on December 31, 2009 (see pages 12 to 16 of 28 of the permit). Mr. Teply stated on page 11 of his testimony:

"The Company disagreed with the determination that SCR was BART and asserted that Appendix Y of 40 CFR Part 51 did not contemplate the installation of post-combustion controls. The Company further disagreed that a long-term strategy requirement could be included in a BART permit. Additionally, the Company was concerned that other environmental laws and/or regulations could impact the Company's facilities affected by Wyoming's BART determinations in a way that impacted the economic analysis associated with the installation of the contemplated controls. . . . Due to the uncertainty associated with the potential impact of these rules on the Company's facilities, the Company appealed the BART permits to ensure that these and other issues were considered in the agency's decision and, to the extent these issues had an impact on long-term viability of the facilities, the economic analysis of adding emission reduction equipment was properly reflected."

Mr. Teply then indicated that this appeal was resolved in November 2010. He indicated that the settlement agreement provided flexibility in the event that other environmental requirements or uncertainties arose. If there are any changes in federal or state requirements or technology that would materially alter emissions controls or rates that would otherwise be required, modifications will be addressed.

Descriptions of the SCR system as proposed by RMP can be viewed on pages 20 to 22 of the Application for a Certificate of Public Convenience and Necessity. A diagram of the proposed system was provided on page 21 of the application and appears as follows:



The Air Quality Division was satisfied that RMP's Naughton Power Plant will comply with all applicable Wyoming Air Quality Standards and Regulations. On December 31, 2009, the Division issued a BART Air Quality Permit for modification to require RMP to tune the existing LNB and OFA on Naughton Unit 3 and install SCR to meet the statutory requirements of BART before December 31, 2014.

Q. WHAT DETERMINATIONS WERE MADE, WHAT CONCLUSIONS WERE REACHED AND WHAT WAS DECIDED AS A RESULT OF THE BART ANALYSIS CONCERNING PM?

A. 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 resulting from each proposed control technology, the Air Quality Division determined BART for each visibility impairing pollutant emitted from the Naughton Unit 3. For emissions of PM/PM_{10}, the Division considered the limitations shown in the following table to be BART for Naughton Unit 3.

Unit	Pollutant	Control Type	lb/MMBtu	lb/hr	tpy
3	PM/PM_{10}[(a)]	Fabric Filter	0.015	56	243

(a) Filterable portion only

Although feasible technical alternatives to meet an emissions compliance limit of 0.015 pounds per MMBtu include: (1) install a polishing baghouse and operate it in series with a rebuilt ESP; and (2) install a stand-alone PJFF, it was determined that a new full-scale fabric filter would be installed for Unit 3 based, in part, on the following conclusions:

- *Particulate Matter Technologies* – the *Multi-Pollutant Control Report,* (prepared by SL and previously discussed) indicated that Naughton Unit 3 would require extensive modification to the existing precipitator or a "polishing baghouse retrofit" to meet a 0.030 pounds per MMBtu level of PM emissions. The Naughton Unit 3 ESP is the smallest in the RMP coal fleet, is about 40 years old, and is in poor condition. This ESP does have a flue gas conditioning system to improve its performance. However, operating data established that the existing ESP's best PM emissions rate was approximately only 0.04 pounds per MMBtu.

- The initial costs for a stand-alone PJFF versus the polishing baghouse plus rebuilt ESP are similar. However, in May 2006 due to potential regional haze rules, it was concluded that there was a reasonable possibility that installation of a SCR system would be needed and the use of a COHPAC polishing baghouse would impact RMP's ability to add a SCR system in the future, so a PJFF was recommended BART for on-going consideration.

Initially, the Air Quality Division determined that the cost effectiveness and incremental cost effectiveness of applying a new full-scale fabric filter to Unit 3 were not reasonable. As such, it appears that the Division would have approved of the installation of a polishing baghouse operated in series with a rebuilt ESP to meet BART emission limits. However, a reconsideration of this determination was deemed appropriate after taking into account factors above and beyond the benefits associated with regional haze improvements including:

- the existing precipitator's current condition and performance and end-of-life issues,
- the ability of the current electrostatic precipitator to meet an ESP BART rate of 0.04 lb/MMBtu on a continuous basis,
- enhanced mercury removal co-benefits the baghouse provides, and
- reduced ash loading on the SO_2 scrubber which will enhance the scrubber performance.

As a result of this review, the Air Quality Division determined that the costs associated with the installation of a new full-scale fabric filter are reasonable. The Division had also determined that installation and operation of the fabric filter on Unit 3 will meet corresponding emission limits on a continuous basis and thus will satisfy the statutory requirements of BART.

Descriptions of the fabric filter system as proposed by RMP can be viewed on pages 22 to 24 of the Application for a Certificate of Public Convenience and Necessity.

The Division was satisfied that RMP's Naughton Power Plant will comply with all applicable Wyoming Air Quality Standards and Regulations. On December 31, 2009, the Division issued a BART Air Quality Permit for modification to require RMP to install a new full-scale fabric filter to meet the statutory requirements of BART before December 31, 2014.

Q. WERE COST PROJECTIONS INCLUDED IN THE APPLICATION AND BART ANALYSES TO EVALUATE THE ECONOMICS OF THE ENVIRONMENTAL CONTROLS AND DO THE COST PROJECTIONS APPEAR REASONABLE?

A. Two types of cost projections were used to evaluate the economics of this project. One type of cost projection procedure was used as part of the BART analysis in response to requirements of the Wyoming Department of Environmental Quality and another procedure was used for long term resource planning in response to requirements of the Wyoming Public Service Commission. After reviewing the cost projections that were prepared and the various requirements of proposed and projected EPA and Wyoming air quality regulations, air permit documents, and RMP's responses in the application and supporting documents, it can be concluded that the projected costs appear to be reasonable.

Economic Analysis in BART Determination Process

As part of the BART determination process, cost projections were prepared and an economic analysis was completed for each technology considered. To complete the economic analyses the Wyoming Air Quality Division followed USEPA Guidelines as provided in 40 CFR Part 51 Appendix Y and utilized a guidance document referred to as *OAQPS Control Cost Manual* [now referred to as *EPA Air Pollution Control Cost Manual - Sixth Edition* (EPA 452/B-02-001)]. The cost manual can be viewed on the USEPA website at http://www.epa.gov/ttn/catc/products.html.

As indicated in 40 CFR Part 51 Appendix Y [Section IV. D. 4. STEP 4.a.5.]:

> "In order to maintain and improve consistency, cost estimates should be based on the *OAQPS Control Cost Manual,* where possible.
>
> The *Control Cost Manual* addresses most control technologies in sufficient detail for a BART analysis. You should include documentation for any additional information you used for the cost calculations, including any information supplied by vendors that affects your assumptions regarding purchased equipment costs,

> equipment life, replacement of major components, and any other element of the calculation that differs from the *Control Cost Manual.*
>
> Whenever you calculate or report annual costs, you should indicate the year for which the costs are estimated. For example, if you use the year 2000 as the basis for cost comparisons, you would report that an annualized cost of $20 million would be: $20 million (year 2000 dollars)."

Two documents were prepared using this guidance for RMP by CH2MHill as part of the BART Analysis. These documents, "BART Analysis for Naughton Unit 3" prepared in December 2007 and "Addendum to Naughton Unit 3 BART Report" submitted on March 26, 2008, were part of the company's BART permit application material. They provided publicly available cost estimates for options being considered. Both documents can be viewed on the Wyoming Department of Environmental Quality website at: http://deq.state.wy.us/aqd/308%20SIP/BART%20Applications%20and%20AQD%20Analyses/BART%20Applications/Revised%20Reports_Dec07/BART_Naughton3_Dec2007_Final.pdf and http://deq.state.wy.us/aqd/308%20SIP/BART%20Applications%20and%20AQD%20Analyses/BART%20Applications/TechMemos_Mar08/BART_TMs_NaughtonUnit3_final.pdf.

Economic and environmental costs for additional NOx and PM controls on Naughton Unit 3 were summarized in the tables previously provided. These tables were derived from information included in the Air Quality Division's "BART Application Analysis AP-6042" dated May 28, 2009. This document is available on the Wyoming Department of Environmental Quality website at http://deq.state.wy.us/aqd/308%20SIP/BART%20Applications%20and%20AQD%20Analyses/AQD%20Analyses/6042ana_BART.pdf

Economic Analysis in RMP's Long-Term Resource Planning Process

The economic analysis performed by the Company was described in the application on pages 12 to 19, in the form of an overview in direct testimony by Mr. Chad Teply, and in much more detail in direct testimony by Mr. Rick T. Link. Inquiries concerning the information provided in these documents were submitted by interveners and detailed responses were provided. Much of the data and procedures utilized and results obtained from the various System Optimization modeling exercises are considered confidential and have been redacted from the publicly available documents.

As described in the direct testimony by Mr. Rick Link, long-term resource planning is done as part of the Company's Integrated Resource Plan ("IRP"). He stated on page 3:

> ". . . the purpose of the IRP is to provide a framework for discussion of the future actions being considered by the Company to ensure that it continues to provide reliable and least cost electric service to its customers, while striking a balance between cost and risk over the planning horizon including consideration of environmental issues and energy policies. ... During the IRP process, all material planning assumptions are updated and any resource deficiency is identified. The IRP process then models a number of potential new resource portfolios with the ultimate conclusion being the selection of a preferred portfolio that is expected to result in the least cost on a risk adjusted basis."

In Mr. Teply's direct testimony, he stated that he believed that they had appropriately assessed the cost effectiveness of the selected pollution control technologies. He stated on page 6:

> "Before determining to proceed with the proposed pollution control investments, the Company considered the cost effectiveness of alternate technologies. Measures of capital cost on a dollars per ton of pollutant removed have been reviewed, which is applied specifically as part of the BART determination process. In the case of particulate matter emission reductions, comparison on a cost per ton removal standard is not typically utilized, since the incremental emissions improvement will be much smaller due to the relatively high removal efficiency level of existing particulate matter removal equipment. In those instances ongoing compliance, emissions control co-benefits, and/or equipment end-of-life issues are typically the driving factors for technology selection."

Mr. Teply also stated, on page 7, that least cost principles were used to select pollution control equipment.

> "The various analyses discussed in my testimony, in the Application, and in the testimony of Mr. Link all demonstrate application of least cost principles by the Company in support of its request for CPCN approval of the Naughton Unit 3 pollution control investments described."

Although the economic analyses projections were completed for different reasons (a BART permit and a CPCN) and utilized differing metrics, the conclusions are consistent and reasonable. The assumptions used for each model were reasonable. Reasonable input parameters were utilized for each model. The economic projections were obtained using prescribed estimating techniques.

Q. WERE TIMELINES AND A SCHEDULE FOR CONSTRUCTION AND INSTALLATION OF CONTROL DEVICES INCLUDED IN THE APPLICATION AND DO THE SCHEDULES APPEAR REASONABLE?

A. RMP provided a time line and included schedules for construction and installation of the control devices. The deadlines, schedules, and timelines that were included in the application and supporting documents are reasonable and are consistent with those provided by others in similar circumstances at hearings, conferences, presentations, and meetings.

As expressed in the conclusion of the application (page 60),

> "The project duration is constrained by two dates: (1) a Commission order granting the CPCN Application to allow construction to begin and (2) an adequate period after the May 24, 2014 planned tie-in outage completion to allow performance testing to be completed and reported by December 31, 2014. It is hoped that a decision for approval of the application for CPCN could be completed by May 1, 2012, after which time, the following activities could be completed:
>
> 1. begin fabrication of structural steel for just-in-time erection;
> 2. establish manufacturing queue positions for major equipment;

3. begin relocation of the Naughton Substation existing capacitor banks so civil site work can begin and continue construction toward partial energization in time to supply 13.8 kV power for ID fan commissioning; and
4. take advantage of an essential summer construction season in 2012 for deep foundation construction."

A detailed project schedule is provided in Exhibit 26 of the application.

In direct testimony by Mr. Chad Teply on page 21, he discussed the project deadlines and implications of failing to meet the project start deadlines. His comments are as follows:

> "The project critical path schedule has been established to align with the planned major maintenance outage schedule for Naughton Unit 3 in the spring of 2014. Delayed CPCN approval could result in that schedule being unachievable, either resulting in a need to defer the planned major maintenance outage for Naughton Unit 3 or potentially the inability of the contractor to meet a 2014 completion schedule. Risks associated with delayed CPCN approval include loss or deferral of manufacturing queue for key materials and/or components, labor unavailability, inclement weather delays, costs associated with deferral of other planned major maintenance outage work, potential seasonal replacement power cost impacts, etc."

Also, in direct testimony by Mr. Chad Teply, several responses to scheduling and timeline questions were provided (note pages 32 to 41). In particular, on page 33, Mr. Teply replied to a question regarding deferral of installation of equipment. His response is as follows:

> "The Company has been engaged in Regional Haze Rule compliance planning with the respective state departments of environmental control since the initial development of the western states' regional program. During the initial 2003 to 2008 planning period, the Company was required by the Wyoming Department of Environmental Quality's Air Quality Division ("WDAQ") to conduct detailed BART reviews. It was the initial expectation of the western states' Regional Haze program that individual states would establish BART emission limits for BART eligible units and would require installation of appropriate controls by 2013.

RMP originally submitted these evaluations of its BART eligible facilities in Wyoming in January 2007, with revisions submitted in October 2007. Addendums to individual facility BART reviews were developed in March 2008. WDAQ completed its final reviews of the BART evaluations and the Company's associated permit applications and issued Air Quality Permits (construction permits) for the projects presented in this case in May 2009. WDAQ followed up by issuing BART permits for the pollution control projects presented in this case in December 2009. The pollution control projects presented in this case meet the Company's obligations in this regard."

He continues on page 34 of his direct testimony:

"The pollution control projects presented in this case are extremely complex and require a significant amount of evaluation and planning to bring to fruition. The permitting processes described above are required to define the technical requirements the Company needs to move forward with establishing competitive pricing for the work and ultimately executing the projects. The timeline for securing contracts for this type of work through project completion often has a multi-year duration."

On page 35, he expresses a concern for company-wide scheduling.

"Emission reduction projects of the number and size included in the Company's [RMP's] emissions control plan take many years to engineer, plan, and construct. When considering a fleet the size of the Company's, there is a practical limitation on available construction resources and labor. There is also a limit on the number of units that may be taken out of service at any given time, as well as the level of construction activities that can be supported by the local infrastructures at and around these facilities. Additional cost and construction timing limitations include the loss of large generating resources during some parts of construction and the associated impact on the reliability of the Company's electrical system during these extended outages. In other words, it is not practical, and it is unduly expensive, to expect to build these emission reduction projects all at once or even in a compressed time period."

Q. WHAT FUTURE ENVIRONMENTAL REQUIREMENTS CAN BE ANTICIPATED AND DOES RMP ADEQUATELY ACCOUNT FOR THEM IN THE APPLICATION?

A. In the application and supporting documents, extensive discussions were provided concerning the impact and ramifications of anticipated requirements. The interveners provided many questions on rumored or expected future requirements. Responses to these inquiries were provided. As the future is unknown, many of the responses consisted of "best guesses." After reviewing the requirements of the Clean Air Act, proposed and projected EPA and Wyoming air quality regulations and requirements, and RMP's responses in the application and supporting documents, it can be concluded that the company **is anticipating future emission control requirements** and **is incorporating control measures for mercury emissions and other air toxics into the design of its project**.

Detailed discussions of the anticipated environmental requirements and their implications are provided on pages 38 to 51 of the application and on pages 13 to 45 of the Direct Testimony of Chad A. Teply. The following is a summary of some of the anticipated new or revised regulatory requirements:

- *Mercury and Hazardous Air Pollutants* - In March 2005, the EPA issued the Clean Air Mercury Rule ("CAMR") to permanently limit and reduce mercury emissions from coal-fueled steam electric plants under a market-based cap-and-trade program. However, the CAMR was vacated in February 2008, with the court finding the mercury rules inconsistent with the stipulations of Section 112 of the CAA. A replacement rule [the Mercury and Air Toxics Standards (MATS)] signed by the Administrator on December 16, 2011, is scheduled to become effective early in 2012. This rule is expected to result in a significant reduction in emissions of mercury, acid gases, and other hazardous air pollutants produced by electric utilities. The new standards will require coal and oil fired steam electric plants to meet a specified emission limits for mercury and other hazardous air pollutants. [*In addition to mercury, the Mercury and Air Toxics Standards [MATS] regulates (1) acid gases, using hydrogen chloride (HCl) as a surrogate for all the acid gases; (2) non-mercury* *metals (such as arsenic, lead, and selenium) using particulate matter as a surrogate; (3) dioxins and furans; and (4) semi and volatile organics.*] Once the rule becomes effective, facilities will have 3 years to comply (2015), with a possible 1-year extension that the EPA can grant on a case-by-case basis. The EPA's actions on mercury and other HAPs will require installation of additional pollution controls. Mercury emissions control equipment is included in RMP's environmental and capital plans. Installation of controls for SO_2 and particulate matter will assist in achieving the MATS requirements.

- *New Source Review and Prevention of Significant Deterioration* - On May 13, 2010, the EPA issued a final rule that addressed GHG emissions from stationary sources under CAA permitting programs. This rule is referred to as the greenhouse gas "tailoring" rule. This rule established thresholds for GHG emissions that define when permits under the NSR, PSD and Title V Operating Permit programs are required for new and existing steam electric plants. This final rule "tailors" the requirements of CAA permitting programs to limit which facilities will be required to obtain PSD and Title V permits.

- *New Source Performance Standards ("NSPS")* - On December 23, 2010, in a settlement reached with several states and environmental groups in New York v. EPA, the EPA agreed to promulgate emissions standards covering GHGs from new and existing fossil-fueled electric generating units under Section III of the CAA by July 26, 2011 (which has since been extended to early 2012) and issue final regulations by May 26, 2012. The Clean Air Act required EPA to create a list of the important categories of stationary sources of air pollution, and to establish Federal standards of performance for new sources within these categories. These standards are known as New Source Performance Standards (NSPS), and apply to newly constructed sources or those that undergo major upgrades or modifications. The standards include both equipment specifications as well as operation and measurement requirements. NSPS must be reviewed every eight years and revised if appropriate.

- *Coal Combustion Residuals* - Coal combustion residuals ("CCR"), including bottom ash, fly ash, and FGD waste, are residual products from the combustion of coal in steam electric plants. As mentioned before, CCRs are currently considered exempt wastes under an amendment to the Resource Conservation and Recovery Act; however, EPA proposed in 2010 two primary potential options to regulate CCRs. Under one option, EPA would list these residual materials as special wastes subject to regulation under Subtitle C of RCRA with requirements from the point of generation to disposition including closure of disposal units. Under the other proposal, EPA would regulate CCR as non-hazardous waste under Subtitle D of RCRA and establish minimum nationwide standards for the disposal of CCR. A final rule is expected in 2012. Implication of the regulation of CCR on RMP's environmental plan was described in Application Section V (2).

- *Regional Haze SIP* - The States of Arizona, Colorado, Michigan, New Mexico, and Wyoming submitted SIPs to satisfy some, but not all of the basic program requirements of the 1999 regional haze rule. EPA has not taken action concerning these submittals. On November 9, 2011 - EPA issued a schedule to act on more than 40 state pollution reduction plans that will improve visibility in national parks and wilderness areas and protect public health from the damaging effects of the pollutants that cause regional haze. As EPA did not promulgate regional haze FIPs or approve regional haze SIPs correcting the non-submittal deficiencies that EPA found on January 15, 2009, a final decision is anticipated for SIPs submitted for Arizona, Colorado, Michigan, New Mexico and Wyoming. Final decisions by EPA could result in approval or partial approval/disapproval and promulgation of a Federal Implementation Plan. Such actions could result in more stringent requirements, emission limitations, and deadlines.

    - The State of Wyoming submitted its first Regional Haze SIP to the Environmental Protection Agency in 2003. Judicial challenges to the federal rule made it necessary for the State to submit SIP revisions in 2008. In response to public involvement and EPA comment, the State made further revisions to the Regional Haze SIP and completed additional documentation under 40 CFR 51.309(g). Final revisions were submitted on January 12, 2011. The State is now awaiting EPA review and approval.

Q. IN SHORT, WHAT CONCLUSIONS HAVE YOU REACHED WITH REGARD TO THE PROPOSED INSTALLATION OF POLLUTION CONTROL DEVICES AT NAUGHTON UNIT 3.

A. As a result of my review and analysis of the material submitted as part of the application for a CPCN, the following conclusions were reached:

- The installation of the listed control devices is the result of Wyoming DEQ and USEPA requirements.
- Alternative control options were considered.
- Cost estimates were utilized to evaluate the types of devices selected.
- Alternative lower cost control measures were suggested; however, the alternatives would not provide sufficient emission reductions to meet State and EPA requirements.
- The projected costs appear to be reasonable.
- The time line and schedule for construction and installation of the control devices appears reasonable.
- RMP has anticipated future emission control requirements and incorporated control measures for mercury and other toxic pollutants into the design of its project.

Q. IS IT PRUDENT TO UPGRADE THE NAUGHTON 3 GENERATION UNIT TO COMPLY WITH THE CURRNET AND REASONABLY ANTICIPATED FEDERAL AND STATE EMISSION CONTROL REQUIREMENTS?

A. Yes.

Q. HAS RMP PROPOSED THE LEAST CONST, LEAST RISK TECHNOLOGY SOLUTIONS FOR COMPLIANCE?

A. Yes

Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

A. Yes

BEFORE THE PUBLIC SERVICE COMMISSION OF WYOMING

IN THE MATTER OF THE APPLICATION OF ROCKY MOUNTAIN POWER FOR APPROVAL OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY TO CONSTRUCT THE SELECTIVE CATALYTIC REDUCTION SYSTEM, PULSE JET FABRIC FILTER SYSTEM AND RELATED ENVIRONMENTAL UPGRADES AT NAUGHTON UNIT 3 LOCATED NEAR KEMMERER, WYOMING	)))))))))))	DOCKET NO. 20000-400-EA-11 (Record No. 12953)

AFFIDAVIT, OATH AND VERIFICATION

Leo H. Stander (Affiant) being of lawful age and being first duly sworn, hereby deposes and says that:

Affiant is a consultant to the Wyoming Office of Consumer Advocate which is a party intervener in this matter pursuant to its Notice of Intervention filed on October 17, 2011.

Affiant prepared and caused to be filed the foregoing testimony. Affiant has, by all necessary action, been duly authorized to file this testimony and make this Oath and Verification.

Affiant hereby verifies that, based on Affiant's knowledge, all statements and information contained within the testimony are true and complete and constitute the recommendations of the Affiant in his official capacity as a consultant to the Wyoming Office of Consumer Advocate.

Further Affiant Sayeth Not.

Dated this 27 day of January, 2012.

Leo H. Stander, PE, BCEE
1117 Fernlea Court
Cary, NC 27511
(919) 467-8644

STATE OF NORTH CAROLINA)
) SS:
COUNTY OF WAKE)

The foregoing was acknowledged before me by Leo H. Stander on this 27 day of January, 2012. Witness my hand and official seal.

Notary Public

My Commission Expires: 12/27/2013

KATHLEEN JEEVES
NOTARY PUBLIC
WAKE COUNTY NC
My Commission Expires 12-27-2013