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BEFORE THE PUBLIC SERVICE COMMISSION OF UTAH

In the Matter of the Application of Rocky Mountain Power for Authority to Increase its Retail Electric Utility Service Rates in Utah and for Approval of its Proposed Electric Service Schedules and Electric Service Regulations	**Docket No. 10-035-124**

PREFILED DIRECT TESTIMONY OF HOWARD GEBHART

[REVENUE REQUIREMENT]

The UAE Intervention Group (UAE) hereby submits the Prefiled Direct Testimony of Howard Gebhart on revenue requirement issues.

DATED this 26th day of May, 2011.

/s/_____
Gary A. Dodge,
Attorney for UAE

CERTIFICATE OF SERVICE

I hereby certify that a true and correct copy of the foregoing was served by email this 26th day of May, 2011, on the following:

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BEFORE

THE PUBLIC SERVICE COMMISSION OF UTAH

Direct Testimony of Howard Gebhart

on behalf of

UAE

Docket No. 10-035-124

[Revenue Requirement]

May 26, 2011

DIRECT TESTIMONY OF HOWARD GEBHART

INTRODUCTION

Q. Please state your name and business address.

R. My name is Howard Gebhart. I am employed at Air Resource Specialists, Inc. (ARS), located at 1901 Sharp Point Drive, Suite E, Fort Collins, CO 80526. ARS is an environmental engineering and consulting firm. At ARS, I am the Manager for the Environmental Compliance Section. My staff and I assist regulated industries as well as government and commercial clients with environmental permitting and compliance issues, primarily with respect to the Clean Air Act and Clean Water Act.

Q. What is the purpose of your testimony?

R. My testimony today will examine certain air pollution control projects undertaken by PacifiCorp at some of its electric generating units (EGUs). I will evaluate whether or not these various pollution control projects are necessary or appropriate to meet the regulatory requirements of the Clean Air Act.

Q. Please describe your education and technical expertise.

R. I have over 30 years experience with air quality technical and regulatory matters, with my last 15 years at ARS. Prior to joining ARS, I held positions with Trinity Consultants and ENSR Consulting and Engineering (now known as AECOM). I started my professional career with a predecessor agency to what is now the Utah Department of Environmental Quality. I have testified as an Expert Witness in

other legal and administrative proceedings concerning issues surrounding the Clean Air Act. With respect to my academic background, I have a Bachelor of Science degree in Professional Meteorology issued by Saint Louis University and a Master's degree in Meteorology issued by the University of Utah. A copy of my resume is attached as UAE Exhibit RR 2.1.

TECHNICAL BACKGROUND

Q. Please provide an overview of the pollution control projects that have been or are being undertaken by PacifiCorp at its electric generating facilities.

R. My understanding is that PacifiCorp is installing various upgrades to pollution control equipment at many of the coal-fired EGUs it operates. The specific projects undertaken by the Company of relevance to my testimony are described more fully in PacifiCorp's Emissions Reduction Plan, which is explained in the prefiled direct testimony of Chad A. Teply. My testimony will be focusing primarily on the sulfur dioxide (SO_2) emission control systems, commonly called flue gas desulfurization (FGD) or "scrubbers". The testimony of Mr. Teply identifies the following EGUs for which PacifiCorp is seeking cost recovery in this docket relating to installation of or upgrades to scrubbers: Hunter Units 1 & 2, Huntington Unit 1, Dave Johnston Units 3 & 4, Jim Bridger Unit 3, Naughton Units 1 & 2, and Wyodak Unit 1. I have confined my analysis to these scrubber projects.

Q. Why is PacifiCorp installing and/or upgrading the pollution control equipment as its facilities?

R. It is my understanding that PacifiCorp claims that the pollution control equipment and upgrades described in its Emissions Reduction Plan were necessary to comply with provisions of the Clean Air Act, specifically, requirements for installation of Best Available Retrofit Technology (BART) under the US Environmental Protection Agency (EPA) regional haze rule and similar regulations adopted by state agencies in Utah and Wyoming.

Q. What is Best Available Retrofit Technology (BART)?

R. The concept of Best Available Retrofit Technology (BART) was introduced by the Clean Air Act Section 169 as part of a national strategy to remedy existing impairment of visibility at various important (Class I) sites, such as national parks. The federal regional haze rule promulgated by EPA at 40 CFR 51.308(e)(1)(ii)(B) directs states to identify the "*best system of continuous emissions control technology" taking into account "the technology available, the costs of compliance, the energy and non-air quality environmental impacts of compliance, any air pollution control equipment in use at the source, and the remaining useful life of the source*". The Clean Air Act requires BART reviews for "BART-Eligible" sources, consisting of certain categories of air pollution emission sources, including coal-fired EGUs that were constructed between 1962 and 1977 and that emit at least 250 tons per year (tpy) of visibility impairing

pollutants. Visibility impairing pollutants include sulfur dioxide (SO_2), nitrogen oxides (NOx), and particulate matter (PM).

Q. How is BART determined? Is there any official regulatory guidance from EPA on how to select BART?

R. EPA regulations prescribe formal procedures for selecting appropriate BART technologies at a given source, which are set out in EPA's regulations (40 CFR 51 Appendix Y). In a formal BART review, the analysis proceeds using five steps as described in Appendix Y. The "five factor" BART review is summarized below:

STEP 1: Identify all available retrofit control technologies. In order to be considered "available", the technology of interest must have a practical potential for application to the emissions unit and regulated pollutant being considered. Technologies which have not been applied to the source category or similar category on a commercial-scale are not considered to be "available". Emission control technologies to consider at this step may include inherently lower emitting processes, add-on emissions control technologies, or a combination of the two.

STEP 2: Eliminate technically infeasible options. Technologies identified at Step 1 are considered feasible if they have already been installed and operated on the type of source under review under similar conditions or if the technology could reasonably be applied to the source under review. Any claim of technical infeasibility needs to be documented based on physical, chemical, or engineering principles, with an explanation of why technical difficulties preclude the application of the particular technology on the emission source under review.

STEP 3: Evaluate control effectiveness of the remaining feasible technologies. The two key elements in describing the control effectiveness of a particular technology are to express the control level using a metric that allows for comparison between different alternatives and to consider how controls may perform over a wide range of operating conditions. Generally, the most common metrics used to describe pollution control performance are to consider emissions (lb/MMBtu) or a control efficiency (% of pollutant removed).

STEP 4: Perform the impact analysis. Relevant impacts to consider during the BART review are the costs of compliance, energy impacts, non-air quality environmental impacts, and remaining useful life of the source. Costs are generally evaluated in terms of the "cost-effectiveness" of the pollutant controlled, normally expressed as dollars ($) per ton of pollutant removed. With respect to any other impacts (energy and/or non-air quality environmental impacts), any significant impacts on these items tend to also have financial implications, so any such impacts that are significant would also be expected to be reflected in the economic analysis.

STEP 5: Evaluate the visibility impacts. In this step, the projected improvement in visibility from implementing each of the BART alternatives is evaluated. This is accomplished through dispersion modeling of the source emissions.

Q. Is cost an important factor in selecting BART ?

R. As stated above in the regulatory definition for BART, the "cost of compliance" is one of several factors that must be considered in selecting an appropriate BART air pollution control technology. Based on the formal five-factor BART decision-making process, cost is one of the important factors that can be used to exclude a particular control technology from selection as BART, if the associated costs are shown to be excessive in comparison to the results achieved or the costs for control at other similar sources.

Q. How are capital costs for pollution control equipment treated under BART when determining the annualized cost?

R. The capital costs in a standard BART analysis are annualized by computing the "cost recovery factor" (CRF), which accounts for the total cost of the equipment based on the life of the equipment and the interest rate. The CRF is computed as follows, based on EPA's *Office of Air Quality Planning & Standards (OAQPS) Cost Control Manual:*

$CRF = i\,(1 + i)^n / (1 + i)^n - 1$, where i = interest rate and n = equipment life

In all of the BART analyses conducted by PacifiCorp for its Wyoming units, the CRF used was 0.095, which is based on a 20-year life of equipment at interest rate of 7.1%.

Q. Are operating costs as well as capital costs factored into the BART analysis?

R. Operating costs for the pollution control equipment are also considered. In the case of an SO_2 scrubber, operating costs might include the costs associated with

the scrubber reagent consumption, power consumption to operate the scrubber, waste disposal costs, and labor to operate and maintain the control equipment.

In some instances, PacifiCorp is upgrading existing scrubber systems. For these circumstances, the operating costs are generally expressed in terms of the "incremental cost" above those incurred at the present pollution control system. For example, as the SO_2 removal increases for an upgraded scrubber unit, it is expected that scrubber reagent use would increase along with waste disposal costs. The incremental costs above the current scrubber operating costs are the appropriate operating costs to consider when reviewing a scrubber upgrade under BART.

The total annualized cost for the pollution control system is then the sum of the operating cost and the annualized capital cost based on the CRF.

Q. What is cost-effectiveness? How is this value calculated in a BART analysis?

R. The primary criterion in judging the reasonableness of costs from a BART perspective is the concept of "cost-effectiveness", generally expressed in terms of dollars spent per ton of pollutant removed. The cost-effectiveness for a particular pollution control device can be calculated as the annualized costs for the control equipment (capital cost plus operating cost) divided by the quantity of pollutant removed by that device.

Q. What criteria are used by regulatory agencies in deciding whether or not proposed controls meet BART from a cost perspective?

R. Data concerning BART decisions at EGUs across the country were for a time maintained by the Western Regional Air Partnership (WRAP) and listed on the WRAP website at www.wrapair.org. For the WRAP BART Clearinghouse, this information is current as of December 10, 2009. WRAP indicated that it would not be providing future updates to the BART Clearinghouse data after December 2009.

Within the WRAP BART Clearinghouse, cost data for the different BART technologies were maintained by Don Shepherd of the National Park Service (NPS). These data for SO_2 projects are summarized in the table below. In this table, the BART information considered was for plants where the SO_2 emissions control system was being upgraded, as this is the approach being employed by PacifiCorp for several of the units at issue in this Docket. No other BART decisions from the WRAP Clearinghouse were included in the chart. The other units for which BART information is available from the WRAP Clearinghouse either involved a completely new FGD system or were for EGUs using oil as the primary fuel. Costs are listed in dollars per ton of pollutant (SO_2) removed:

BART Cost Information – SO_2 Scrubber Upgrades

(from December 10, 2009 WRAP BART Clearinghouse, www.wrapair.org)

EGU & Location	***Estimated SO_2 BART Costs ($ per ton)***
Jim Bridger (WY)	$620 to $729 per ton
Coal Creek (ND)	$555 per ton
King (MN)	$49 per ton
Laramie River (WY)	$1,564 to $1,571 per ton
MR Young (ND)	$247 to $565 per ton
Naughton Unit #3 (WY)	$290 per ton
Sherburne County (MN)	$236 to $238 per ton
Wyodak (WY)	$1,428

Other data on the expected cost effectiveness for SO_2 BART emissions controls can be found in EPA's preamble for the BART rulemaking (See *Federal Register, Vol. 70, No 128, July 6, 2005, Page 39133*). For uncontrolled coal-fired EGUs, EPA projects the cost-effectiveness of SO_2 BART at an average of $919 per ton, with a range of $400 to $2,000 per ton SO_2 removed for a majority of the *uncontrolled* BART-eligible EGUs. EPA's cost data are generally consistent with the WRAP BART Clearinghouse. EPA provided cost information in the preamble to the BART rulemaking only for uncontrolled EGUs and not for scrubber upgrades.

Based on the above and on my experience, it is my opinion that the cost-effectiveness for BART control on coal-fired EGU SO_2 emissions control projects should generally be no higher than $2,000 per ton. Any costs that exceed $2,000 per ton SO_2 removed should not be designated as BART unless other regulatory factors in the analysis warrant a higher cost level.

Q. How were the EPA's Regional Haze regulations implemented within the States of Utah and Wyoming?

R. Each State was required to prepare and submit for EPA approval a State Implementation Plan (SIP). Some States, including Utah and Wyoming, opted to participate in a regional program for their Regional Haze SIPs under Section 309 of the EPA's regulations.

Q. Are Wyoming and Utah writing their regional haze plans under Section 309 of the EPA Regional Haze Regulations? What is the significance of being covered under Section 309?

R. Utah and Wyoming both elected to complete their regional haze SIPs under 40 CFR Part 51 Section 309, where the SIP constitutes a regional planning approach. This "regional" approach to regional haze regulation is an alternative regulatory framework which four states elected to implement: Arizona, New Mexico, Utah, and Wyoming. Other western states such as Colorado opted for a state-by-state program under Section 308. Oregon originally participated in the regional Section 309 SIP planning effort, but has since dropped out and is now operating

its regional haze program under Section 308. Arizona is also currently preparing a SIP under Section 308 in lieu of the regional approach.

Under Section 309, states may elect to implement a backstop regional emissions trading program or other alternative measures in lieu of requiring eligible sources to install Best Available Retrofit Technology (BART), so long as they achieve greater reasonable progress toward the national visibility goal than would otherwise be required through installation and operation of BART on individual emission sources. (See 40 CFR 51.309(d)(4) and 40 CFR 51.308(e)).

Q. Did PacifiCorp perform a five-factor analysis for its BART-eligible electric generating facilities located in Wyoming?

R. Yes. Although Wyoming is participating in the Section 309 regional program, the Wyoming Department of Environmental Quality (WDEQ) nevertheless required PacifiCorp to perform a "five factor" BART analysis following the guidelines set forth in 40 CFR 51 Appendix Y for all of its Wyoming coal-fired EGUs that are being considered in this Docket. The WDEQ reviewed PacifiCorp's BART application documents in reaching its regulatory decisions regarding BART.

Q. Have you relied upon WDEQ data and other information related to BART for PacifiCorp's Wyoming facilities in preparing your testimony today?

R. Yes. For PacifiCorp's Wyoming BART-eligible EGUs, I have relied on the BART application documents filed with WDEQ by PacifiCorp as well as WDEQ's technical analysis and other documents supporting the agency's BART decisions.

Q. Did PacifiCorp also perform a five-factor analysis for each of its BART-eligible EGUs located in Utah?

R. No. Unlike the WDEQ, the Utah Department of Environmental Quality (UDEQ) did not require PacifiCorp to perform a formal five-factor BART analysis following 40 CFR 51 Appendix Y for PacifiCorp's four BART-eligible coal-fired EGUs in Utah (Hunter Units 1 & 2 and Huntington Units 1 & 2).

Q. Is there a need for or relevance of the five-factor BART analysis for PacifiCorp's Utah BART-Eligible EGUs?

R. Yes. Utah's regional haze State Implementation Plan (SIP) was submitted under Section 309 of the Clean Air Act, where states may elect to implement a regional emissions trading program or other alternative measures in lieu of requiring eligible sources to install BART. However, the alternative program is required to achieve greater reasonable progress toward the national visibility goal than would otherwise be required through installation and operation of BART on individual emission sources (See 40 CFR 51.309(d)(4) and 40 CFR 51.308(e)). So, as a practical matter, some knowledge of the level of emissions control defined by BART is needed even in Section 309 states in order to make the required "better-than-BART' determination. In Wyoming this was achieved through individual BART analyses of each BART-Eligible EGU. In Utah, this was not done because PacifiCorp voluntarily offered to install environmental upgrades that were believed to be far better than any controls that would have been required by BART.

In lieu of conducting the standard five-factor BART analysis required by Appendix Y, PacifiCorp voluntarily proposed that the Company's Emissions Reduction Plan described in Mr. Teply's testimony would more than fulfill BART regulatory requirements. PacifiCorp told its regulators (EPA, WDEQ and UDEQ) that its voluntary plan was more aggressive than anticipated by the Western Regional Air Partnership (WRAP), and would achieve greater reductions than were required by BART (*See* pages 11 and 13 of Confidential UAE Exhibit RR 2.2). Moreover, I was told by representatives of the UDEQ that the Agency accepted PacifiCorp's Emissions Reduction Plan because they concluded that the Company's voluntary plans were more stringent than any controls that might have been required if a formal five-factor BART analysis had been performed.

Q. Since a detailed BART analysis was not performed by PacifiCorp for its Utah generating facilities, have you prepared your own independent calculations to determine whether the pollution control projects at the Utah plants would be required by BART?

R. Yes. Lacking any information from a BART application on the cost-effectiveness of PacifiCorp's scrubber upgrade controls at its BART-eligible Utah facilities, I have performed my own calculations relying upon data contained elsewhere in the record of this Docket and publicly available information.

DISCUSSION OF SPECIFIC POLLUTION CONTROL PROJECTS

Naughton Unit #1 and Unit #2

Q. Please summarize the pollution control projects at PacifiCorp's Naughton #1 and Naughton #2 Units.

R. At Naughton Unit #1 and Unit #2, the SO_2 controls being installed by PacifiCorp in 2011 and 2012 utilize a new wet scrubber unit in combination with the existing electrostatic precipitator systems. Previously, Naughton Units #1 and #2 had no post-combustion emission controls for SO_2 emissions.

Q. What are the capital costs associated with the Naughton Unit #1 and Unit #2 projects? What is the source of your data for the capital cost estimate?

R. At Naughton Unit #1, the installed capital cost for the wet SO_2 scrubber was approximately $89.4 million. At Naughton Unit #2, the installed capital cost for the wet SO_2 scrubber was $117.4 million. The information on capital costs for both units were taken from the *BART Application Analysis, AP-6042* prepared by the Wyoming Department of Environmental Quality (WDEQ) and dated May 28, 2009, attached as UAE Exhibit RR 2.3 (page 26). This exhibit also addresses a planned scrubber upgrade for Naughton Unit #3. Because that upgrade is not scheduled until 2014 and none of its costs are included in this docket, I have not addressed it in my testimony.

Q. What are the other operating costs associated with the Naughton Unit #1 and Unit #2 projects? What is the source of your operating cost data?

R. My data on operating costs are taken from the same WDEQ document described above. For Naughton Unit #1, the first-year operating and maintenance cost is approximately $4.56 million and for Naughton Unit #2, the first-year operating and maintenance cost is approximately $5.72 million.

Q. What are the pollution control benefits from the proposed projects? What is the source of your data?

R. My data on the pollution control benefits are also taken from the WDEQ document (pages 26-27). The projected SO_2 emissions reduction from installation of the emissions control equipment is 7,657 tons per year at Naughton Unit #1 and 9,934 tpy at Naughton Unit #2.

Q. What is the calculated cost effectiveness for the Naughton Unit #1 and Unit #2 pollution control projects?

R. Following the calculation procedures outlined previously in my testimony, the calculated cost effectiveness for the SO_2 control equipment is $1,707 per ton SO_2 removed at Naughton Unit #1 and $1,700 per ton SO_2 removed at Naughton Unit #2.

Q. Does the calculated cost effectiveness meet the standard criteria for selecting an appropriate BART control option?

R. These costs appear to be reasonable for SO_2 controls under BART. The WDEQ reached the same conclusion.

Q. After finding that the proposed scrubber upgrades at the Naughton units were cost-effective, did the WDEQ require PacifiCorp to install the proposed scrubber upgrades?

R. No. The WDEQ noted Wyoming's decision to participate in the Section 309 regional program under which a source-by-source installation of BART controls is not required (pages 51-53). Also, WDEQ referred to annual reports demonstrating that actual SO_2 emissions are well below the required regional milestones from the Wyoming Regional Haze SIP and that significant visibility improvements are occurring at all of the targeted Class I areas. WDEQ concluded that "PacifiCorp will not be required to install the company-proposed BART technology and meet the corresponding achievable emission limit. Instead, PacifiCorp is required to participate in the Regional SO_2 Milestone and Backstop Trading Program…." (page 53).

Q. How is PacifiCorp proceeding with respect to its proposed scrubber upgrades at its Naughton units?

R. PacifiCorp is proceeding to install its proposed scrubber upgrades at the Naughton Units.

Q. What is your reaction to this decision?

R. One could question the wisdom of or need to proceed with even these cost-effective scrubber upgrades, given the WDEQ's conclusion that they were not required in light of the progress already achieved towards meeting the regional emissions milestones in Wyoming's Regional Haze SIP. However, PacifiCorp is

the largest operator of BART-Eligible EGUs in Wyoming and Utah, and it is possible that future regional haze milestones would not be reached if PacifiCorp elected not to install cost-effective emission controls at any of its Wyoming plants.

Moreover, as reflected in UAE Exhibit RR 2.4, when the Western Regional Air Partnership (WRAP) prepared regional estimates near the turn of the century of projected 2018 SO_2 emissions under then-current controls, as well as potential emission reductions from achievable controls, WRAP assumed that SO_2 controls would be added to Naughton Units 1 and 2, which at that time were uncontrolled units, based on consideration of the Regional Haze BART Methodology (Wyoming tab/page).

Finally, a May 2004 analysis, attached as Confidential UAE Exhibit RR 2.5, which was prepared by PacifiCorp in the context of seeking internal approval for the scrubber upgrade at Huntington Unit #2, projected the relative costs for incremental SO_2 removal to be somewhat lower at Naughton 1 and 2 than at certain other plants, such as Hunter 1, Hunter 2 and Huntington 2 (pages 5-6). In targeting money to achieve a desired overall level of regional SO_2 reductions in the most cost-effective manner, PacifiCorp could reasonably have concluded that these upgrades were appropriate.

I have not determined whether it was reasonable or prudent for PacifiCorp to have elected to proceed with <u>all</u> of the "cost-effective" Wyoming SO_2 emission control projects. In my opinion, however, it was reasonable for PacifiCorp to

have proceeded with at least some of them. In this case, I am not challenging the Naughton 1 or 2 scrubber upgrade costs.

Wyodak

Q. Please summarize the pollution control projects at PacifiCorp's Wyodak Unit.

R. At Wyodak, the previous SO_2 control utilizes a three column dry scrubber. This scrubber reduces the uncontrolled emissions by about 69% to achieve an emissions rate of 0.5 lb/MMBtu. The pollution control project under construction at Wyodak in 2011 has two components. One component is to upgrade the existing SO_2 scrubber system. The equipment changes include the following: 1) eliminating the bypass flue gas flow, 2) placing new static mixers to redistribute the flue gas flow upstream of the ESPs, 3) increasing the reagent feed ratio, and 4) increasing the recycle ratio. These improvements on their own would increase the SO_2 emissions removal to about 80% and produce an outlet emission rate of 0.32 lb/MMBtu.

In addition, PacifiCorp is also replacing the existing ESPs with a full-scale fabric filter baghouse, which further increases the SO_2 removal of the system to 90% and reduces SO_2 emissions to 0.16 lb/MMBtu.

Q. What are the capital costs associated with the Wyodak emissions control project? What is the source of your data for the capital cost estimate?

R. At Wyodak, the installed capital cost for the SO_2 scrubber upgrades with full-scale baghouse was approximately $66.8 million. This information on capital costs was taken from the *BART Application Analysis, AP-6043* prepared by the Wyoming Department of Environmental Quality (WDEQ) and dated May 28, 2009, a copy of which is attached at UAE Exhibit RR 2.6 (page 18).

Q. What are the other operating costs associated with the Wyodak emissions control project? What is the source of your operating cost data?

R. My data on operating costs are taken from the same WDEQ document described above. For Wyodak, the first-year operating and maintenance cost is approximately $1.5 million.

Q. What are the pollution control benefits from the proposed project? What is the source of your data?

R. My data on the pollution control benefits are also taken from the WDEQ document. The projected SO_2 emissions reduction from the baseline attributable to installation of the Wyodak emissions control equipment is 6,300 tons per year (page 19). The incremental SO_2 control benefit of just the added control from the full-scale baghouse compared to the scrubber upgrades alone is 2,965 tpy.

Q. What is the calculated cost effectiveness for the Wyodak pollution control project?

R. Following the calculation procedures outlined previously in my testimony, the calculated cost effectiveness for the SO_2 control equipment at Wyodak is $1,242 per ton SO_2 removed. The incremental cost effectiveness for the full-scale fabric

filter baghouse in addition to the scrubber upgrades is $1,326 per ton SO_2 removed.

Q. Does the calculated cost effectiveness meet the standard criteria for selecting an appropriate BART control option?

R. These costs appear to be reasonable for SO_2 controls under BART, including the incremental cost-effectiveness for the fabric filter baghouse. I note that the WDEQ reached this same conclusion. Moreover, the WRAP projections reflected in UAE Exhibit RR 2.4 also assumed that Wyodak would receive additional SO_2 controls. Finally, PacifiCorp's internal 2004 analysis reflected in Confidential UAE Exhibit RR 2.5 projected relative Wyodak scrubber upgrade costs to be lower than most of its other units.

Q. Did the WDEQ require PacifiCorp to install these cost-effective scrubber controls, how did PacifiCorp proceed, and what are your conclusions as to the Wyodak scrubber control project?

R. As with its Naughton analysis, the WDEQ did not specifically require PacifiCorp to install the proposed Wyodak SO_2 emission controls given the Section 309 regulations and the ongoing regional progress towards meeting the emission milestones in the Wyoming Regional Haze SIP (pages 36-38). PacifiCorp nevertheless decided to proceed. As with the Naughton Units # 1 and #2, I am not challenging this decision.

Dave Johnston Unit #3 and Unit #4

Q. Please summarize the pollution control projects at PacifiCorp's Dave Johnston Unit #3 and Dave Johnston Unit #4.

R. At Dave Johnston Unit #3 and Unit #4, the SO_2 emission controls being installed by the Company are a dry scrubber followed by a fabric filter baghouse. With a dry scrubber, the baghouse is typically considered part of the scrubbing system as a dry scrubber injects particulate in the form of a reagent such as lime or limestone into the system and a downstream particle collection device is needed to remove the injected reagent. A fabric filter baghouse is normally included in the dry scrubber design where high SO_2 control efficiencies are required.

Q. What are the capital costs associated with the Dave Johnston Unit #3 and Unit #4 projects? What is the source of your data for the capital cost estimate?

R. The Dave Johnston Unit #3 pollution control project was completed by PacifiCorp in 2010 and my understanding is that the Unit #3 control equipment is currently operational. The installed capital cost for the Unit #3 SO_2 emission control system was approximately $169.5 million. At Dave Johnston Unit #4, the project is currently under construction with an expected completion date of 2012. The installed capital cost for the Unit #4 SO_2 emission control system is projected at approximately $243.1 million. The information on capital costs for both units were taken from the *BART Application Analysis, AP-6041* prepared by the Wyoming Department of Environmental Quality (WDEQ) and dated May 28,

2009, a copy of which is attached hereto as UAE Exhibit RR 2.7 (page 22). PacifiCorp listed the same capital costs for the Dave Johnston Units #3 and #4 emission control projects in its *Addendum to Dave Johnston Unit 3 BART Report* (UAE Exhibit RR 2.8) and *Addendum to Dave Johnston Unit 4 BART Report* (UAE Exhibit RR 2.9).

Q. What are the other operating costs associated with the Dave Johnston Unit #3 and Unit #4 emission control projects? What is the source of your operating cost data?

R. My data on operating costs are taken from the same WDEQ document described above. For both Dave Johnston Unit #3 and Unit #4, the first-year operating and maintenance cost is approximately $5.3 million each.

Q. What are the pollution control benefits from the proposed project? What is the source of your data?

R. My data on the pollution control benefits are also taken from the WDEQ document. At both Dave Johnston Unit #3 and Unit #4, the outlet SO_2 emission rate following installation of the pollution control equipment was set at 0.15 lb/MMBtu. The projected SO_2 emissions reduction was 11,660 tons per year at Dave Johnston Unit #3 and 5,657 tpy at Dave Johnston Unit #4 (pages 22-23).

Q. What is the calculated cost effectiveness for the Dave Johnston Unit #3 and Unit #4 SO_2 emissions control projects?

R. Following the calculation procedures outlined previously in my testimony, the calculated cost effectiveness for the SO_2 control equipment is $1,837 per ton SO_2

removed at Dave Johnston Unit #3 and $5,028 per ton SO_2 removed at Dave Johnston Unit #4.

Q. Were any other SO_2 emission control options evaluated at either Dave Johnston Unit #3 or Unit #4?

R. Yes, two other SO_2 emission control options were analyzed by PacifiCorp for Dave Johnston Unit #3 and one other option was considered for Unit #4. One of the options for Unit #3 would have employed a new dry SO_2 scrubber and utilize the existing ESP for downstream removal of the injected particulate matter. This option would have resulted in SO_2 emissions of 0.22 lb/MMBtu. The other option at Unit #3 would have employed a wet SO_2 scrubber system in combination with the existing ESP. This option would have achieved the lowest overall SO_2 emissions at 0.06 lb/MMBtu. At Unit #4, the alternative option studied was the use of a new wet scrubber (instead of a dry scrubber) with a new fabric filter baghouse. This option would have achieved SO_2 emissions of 0.10 lb/MMBtu at Unit #4.

Q. What did the BART review of the alternative SO_2 emission control options at Dave Johnston Units #3 and #4 reveal?

R. At Dave Johnston #3, both of the options where the existing ESP would be utilized downstream of the scrubber were less expensive than the dry scrubber and baghouse option chosen by the Company. Based on the Wyoming DEQ BART analysis, the dry scrubber/ESP option had a calculated capital cost of about $91.5 million with a cost effectiveness of $1,209 per ton SO_2 removed and the wet

scrubber/ESP option had a capital cost of about $144.3 million and a calculated cost effectiveness of $1,563 per ton SO_2 removed (page 22). This compares to a capital cost of about $169.5 million with a calculated cost effectiveness of $1,837 per ton SO_2 removed for the dry scrubber/baghouse combination chosen by PacifiCorp at Unit #3.

At Unit #4, the alternative option was to employ a wet scrubber/baghouse combination. This option was more expensive at about $289.1 million compared to the dry scrubber/baghouse combination selected by PacifiCorp, which had a capital cost of about $243.1 million. An ESP option was not evaluated for Unit #4, in part because only Unit #3 had an existing ESP. The existing particulate matter emissions control at Unit #4 was a venturi scrubber. The venturi scrubber technology is outdated and would be difficult to justify under BART at Unit #4.

Q. What did the WDEQ conclude about Dave Johnston Units 3 and 4?

R. The WDEQ concluded that the cost effectiveness and incremental cost effectiveness for all of the evaluated scrubber upgrade options were reasonable for both Units, other than the incremental cost effectiveness of the dry scrubber/baghouse option for Unit #3, which WDEQ found was not reasonable (page 23). As with the other analyses discussed above, the WDEQ said that PacifiCorp was not required to install any of the scrubber upgrades, given regional progress towards meeting the SO_2 milestones (pages 49-50).

Q. What did PacifiCorp elect to do at the Dave Johnston Plant?

R. At Unit 4, PacifiCorp is proceeding with its proposed upgrades, which were found to be cost-effective. At Unit 3, however, PacifiCorp chose to install the baghouse and dry scrubber, notwithstanding the WDEQ's conclusion that the incremental cost effectiveness of this option was not reasonable.

Q. Did PacifiCorp make the appropriate choice regarding BART emission controls at Dave Johnston Unit #3?

R. No. In my opinion, the control technology choices made by PacifiCorp for Dave Johnston Unit #3 are not justified under BART.

For Dave Johnston Unit #3, all of the control options selected have approximately the same level of emissions control. The total SO_2 emissions control ranges between 10,888 and 12,654 tons per year between the various options studied in PacifiCorp's BART application for Unit #3. Where the control level is roughly equal, an additional metric to consider is the incremental cost-effectiveness. Looking at the incremental cost effectiveness helps the decision maker differentiate between control options where the control levels are roughly equal, but the cost incurred may differ. If the incremental cost-effectiveness is high, the data tell the decision maker that the technology being considered provides roughly the same level of emissions control, but at a significantly higher cost. Control options that have a higher incremental cost effectiveness compared to other control options may be discarded as BART.

EPA's BART Guidelines at 40 CFR 51 Appendix Y suggest that decision makers consider incremental cost-effectiveness as one of the measures in

evaluating costs when selecting the appropriate BART technology. In particular, Appendix Y advises decision makers to apply greater weight to the incremental costs when considering a larger number of control options.

The incremental cost-effectiveness of the emissions control strategy proposed by PacifiCorp (dry scrubber/new baghouse) was calculated by Wyoming DEQ compared to the lowest cost control option (dry scrubber/existing ESP) and was determined to be $10,700 per ton SO_2 removed (page 22). This is almost 6 times the average cost-effectiveness value for Unit #3 and in my view is excessively high. Based on the cost data provided by PacifiCorp in its own BART analysis for Dave Johnston Unit #3, my opinion is that the controls selected cannot be justified under BART. The lower cost option where the existing ESP is used as the downstream particulate control device meets the cost-effectiveness test for BART. The capital cost savings from using the existing ESP instead of constructing a new baghouse would be about $78.0 million based on data in the Wyoming DEQ BART analysis and PacifiCorp's own BART data submittals to the Wyoming DEQ.

With respect to the wet scrubber/ESP combination at Unit #3, the BART analysis shows that PacifiCorp could have achieved even lower overall SO_2 emissions (0.06 lb/MMBtu vs. 0.15 lb/MMBtu) at a lower capital cost ($144.3 million vs. $169.5 million) compared to the control option selected by the Company. So, from a BART perspective, there was yet another control option for Unit #3 that was both better performing in terms of SO_2 emissions at a lower

overall cost. Yet PacifiCorp also failed to select this better performing and lower cost option at Unit #3.

My view, however, is that the better performing and lower cost option (wet scrubber/existing ESP) would also not meet the BART test based on incremental cost-effectiveness compared to the dry scrubber/existing ESP option discussed earlier. I made my own calculations for incremental-cost effectiveness for the wet scrubber/ESP option and derived a value of $3,744 per ton SO_2 removed compared to the dry scrubber/existing ESP option. This value exceeds more than two times the overall cost effectiveness value for this particular option. On the basis of incremental cost-effectiveness, my opinion is that the dry scrubber/ESP option still represents the most appropriate choice for BART at Dave Johnston Unit #3.

My opinion regarding the selection of the appropriate BART technology at Unit #3 are shared by Wyoming DEQ. In its Dave Johnston BART Application Analysis (page 23), WDEQ states: "*The cost effectiveness and incremental cost effectiveness of the proposed wet FGD and dry FGD controls for Units 3 and 4 are reasonable, except for the incremental cost effectiveness of installing a new fabric filter with dry FGD on Unit 3*".

So, the bottom line on Dave Johnston Unit #3 revolves around the cost incurred by PacifiCorp for installing the new fabric filter baghouse to replace the existing ESP unit. Although the costs for the added benefit of the baghouse from the perspective of SO_2 emissions are not justified under BART as explained

above, the baghouse also improves particulate matter (PM) emissions control. Fortunately, the control costs and potential benefits on PM emissions control from adding a fabric filter baghouse were also evaluated under BART. The calculated cost effectiveness for PM emissions at Dave Johnston #3 was $21,950 per ton PM removed based on the Wyoming DEQ BART Application Analysis (page 16). WDEQ also concluded that these costs were not reasonable under BART for PM emissions control (page 17).

Q. What about Dave Johnston Unit #4? What conclusions have you drawn regarding the cost-effectiveness of pollution controls installed on this Unit?

R. At Dave Johnston Unit #4, the cost-effectiveness of the emission controls planned by the Company were calculated at $5,028 per ton SO_2 removed. This is significantly higher than the BART cost thresholds discussed previously is my testimony. However, because of unique circumstances relating to Dave Johnston Unit 4, I am not challenging PacifiCorp's decision to proceed with the scrubber upgrade at that unit.

The higher cost-effectiveness of this upgrade is caused partly by the fact that Unit #4 already has minimal levels of SO_2 pollution controls through adding lime to the scrubber liquor in the venturi scrubber used for particulate emissions control. This system provides about 50% SO_2 removal at Dave Johnston Unit #4. Because Unit #4 is already partially controlled for SO_2, the cost-effectiveness values for appropriate emission controls are by nature higher. Moreover, the

current SO_2 control technology is outdated and significant improvements to this technology are not feasible. Because there are no technically feasible options for upgrading the existing SO_2 control system on Unit #4, the only reasonable choice is to add a wet or dry scrubber similar to what was analyzed for Unit #3 at a somewhat comparable cost. For these reasons, I believe the Unit #4 SO_2 control costs are reasonable under BART. As stated above, the Wyoming DEQ BART analysis also agrees that the Unit #4 SO_2 control costs are reasonable. In addition, the WRAP estimates reflected in UAE Exhibit 2.4 assume an upgrade to this unit and PacifiCorp's 2004 internal cost estimates reflected in Confidential UAE Exhibit RR 2.5 showed an upgrade at Unit 4 to be more cost-effective than at several other plants.

Jim Bridger Unit #3

Q. Please summarize the pollution control projects at PacifiCorp's Jim Bridger #3 Unit?

R. At Jim Bridger Unit #3, PacifiCorp is planning in 2011 to replace some of the equipment internal to the SO_2 scrubber that allows more of the flue gas to be treated by the control equipment, thereby increasing the SO_2 control efficiency of the system.

Q. What are the capital costs associated with the Jim Bridger #3 emissions control project? What is the source of your data for the capital cost estimate?

R. The capital costs for Jim Bridger Unit #3 scrubber upgrade project, as documented by PacifiCorp's *Response to UAE Data Request 3.4*, a copy of which is attached as UAE Exhibit RR 2.10, is $24,640,780. This is slightly different that the costs reported by PacifiCorp in the *Addendum to Jim Bridger Unit #3 BART Report*, dated March 26, 2008 and prepared on behalf of PacifiCorp by CH2MHill, a copy of which is attached as UAE Exhibit RR 2.11. The CH2MHill report listed the capital cost for this project at $25.3 million (page 4).

Q. What are the other operating costs associated with the Jim Bridger Unit #3 emissions control project? What is the source of your operating cost data?

R. For the annual operating and maintenance costs, the CH2MHill report described above lists these costs at $980,000.

Q. What are the pollution control benefits from the proposed project? What is the source of your data?

R. The CH2MHill report described above list the SO_2 removal from the Jim Bridger #3 scrubber improvements at 2,838 tons per year. The is based on an outlet SO_2 emission rate for Jim Bridger Unit #3 of 0.15 lb/MMBtu.

Q. What is the calculated cost effectiveness for the Jim Bridger Unit #3 pollution control project?

R. Using the capital costs reported by PacifiCorp in the *Response to UAE Data Request 3.4* (about $24.6 million) and the annual operating costs of $980,000, I have calculated the cost effectiveness of the Jim Bridger Unit #3

scrubber improvement project at $1,170 per ton SO_2 removed. The capital costs were annualized using the cost recovery factor of 0.095 as described earlier in my testimony.

Q. Does the calculated cost effectiveness meet the standard criteria for selecting an appropriate BART control option?

R. These costs appear to be reasonable for SO_2 controls under BART. Although not analyzed in this report, the Wyoming DEQ's analysis of proposed upgrades at the four Jim Bridger plants, attached as UAE Exhibit RR 2.12, found that proposed SO_2 upgrades were all cost effective (page 26).

The WRAP estimates reflected in UAE Exhibit RR 2.4 assume an upgrade to Jim Bridger Units 1, 2 and 3, but not 4. I have not analyzed the cost-effectiveness of the Unit 4 upgrade, which was apparently completed in 2008. Also, PacifiCorp's 2004 internal cost estimates reflected in Confidential UAE Exhibit RR 2.5 projected upgrades at the Jim Bridger units to be more cost-effective than at any of its other plants.

<u>Hunter Unit #2</u>

Q. Are you familiar with the pollution control upgrade projects at PacifiCorp's Hunter Unit #2?

R. Yes. I was hired by Deseret Generation & Transmission Co-Operative to testify in hearings conducted by the American Arbitration Association (AAA Case No. 77 198 00223 10) in January and February of this year regarding 2011 pollution

control projects at Hunter 2, including a scrubber upgrade. In that context, I became well aware of the Hunter 2 scrubber upgrade. I prepared a report for the arbitration, a copy of which is attached as UAE Exhibit RR 2.13, and attended and testified at the hearing. [1]

Q. What was the decision of that case as it relates to the Hunter Unit #2 scrubber upgrade project?

R. The Arbitrator entered an award, a copy of which is attached hereto as Confidential UAE Exhibit RR 2.14, basically agreeing with my analysis on the scrubber upgrade. My understanding of the arbitrator's decision is that the scrubber upgrade project at Hunter #2 did not represent "Reasonable Utility Practice," as defined in the parties' agreement. The decision was based in part on testimony that I presented during the hearing that PacifiCorp voluntarily undertook the scrubber upgrade project at Hunter Unit #2 and that the project could not be justified as being required under any currently existing or reasonably anticipated regulatory standard. In addition, the arbitrator noted that the costs for the Hunter Unit #2 scrubber upgrade project were excessive, given the minimal environmental benefits gained, and that PacifiCorp did not undertake any meaningful analysis of alternatives (including the "do nothing" alternative).

[1] The Deseret arbitration also involved a challenge by Deseret to PacifiCorp's decision to replace its electrostatic precipitator (ESP) at Hunter Unit #2 with a fabric filter baghouse for particulate matter (PM) control. I also addressed that issue in my arbitration report, concluding that BART did not require the ESP-to-baghouse conversion for PM control. The arbitrator did not challenge my BART conclusion, but he determined for other reasons that PacifiCorp's decision to convert its ESP to a fabric filter baghouse was reasonable. I was not asked to address any ESP-to-baghouse conversions in this testimony, except with regards to how such conversions impacted control of SO_2 emissions.

Q. Please summarize the pollution control projects at PacifiCorp's Hunter Unit #2.

R. PacifiCorp claims that the scrubber improvement project at Hunter Unit #2 will increase the existing wet scrubber SO_2 control efficiency from 80% to near 95%. The major elements of this project are to add forced oxidation equipment, vacuum drum filters, close the scrubber bypass and treat 100% of the flue gas from the coal-fired boiler, which in turn requires converting the stack to a wet operation and relocating the opacity monitoring equipment.

Q. What are the capital costs associated with the Hunter Unit #2 project? What is the source of your data for the capital cost estimate?

R. The Hunter Unit #2 capital costs as reported by PacifiCorp in its *Response to UAE Data Request 3.4* is about $70.2 million. This is lower than the figure utilized by the Arbitrator in the Deseret Arbitration. For purposes of this docket, I have used the lower figure.

Q. What are the other operating costs associated with Hunter Unit #2 scrubber upgrade project? What is the source of your operating cost data?

R. Based on data in the record from the Hunter Unit #2 arbitration case hearing, I have estimated the annual operating and maintenance costs at $760,329.

Q. What are the pollution control benefits associated with the Hunter Unit #2 scrubber upgrade project? What is the source of your data?

R. The reduction in SO_2 emissions attributable to the Hunter Unit #2 scrubber improvement project is 240 ton per year. This information comes from the Utah

Regional Haze State Implementation Plan (SIP), adopted in September 2008, reflected in the attached UAE Exhibit RR 2.15 (page 25).

Q. What is the calculated cost effectiveness for the Hunter Unit #2 scrubber upgrade project?

R. Using the data described above for capital cost, operating cost, and environmental benefit, the cost effectiveness of the Hunter Unit #2 scrubber improvement project is $30,943 per ton SO_2 removed. For these calculations a cost recovery factor of 0.095 was used to annualize the capital cost. The basis for a 0.095 cost recovery factor was provided previously in my testimony.

Q. Does the calculated cost effectiveness meet the standard criteria for selecting an appropriate BART control option?

R. No. The Hunter Unit #2 scrubber improvement project does not meet the test for BART. As described earlier in my testimony, the maximum expected cost for SO_2 control under BART is $2,000 per ton SO_2 removed. The cost-benefit at Hunter Unit #2 is about 15 times higher than other SO_2 emission control projects determined to be BART.

The cost-effectiveness of additional SO_2 controls at Hunter Unit #2 does not meet the BART test in part because the incremental environmental benefit of adding these controls in terms of SO_2 emission reductions is very small. Hunter Unit #2 was already well controlled with SO_2 emissions at or near the "presumptive BART" limit from 40 CFR 51 Appendix Y (0.15 lb/MMBtu). Only

a very minor incremental improvement in SO_2 emissions was achieved, but at a very high price.

My opinion is buttressed by the fact that WRAP's regional estimates of 2018 SO_2 emissions reductions from achievable controls, as reflected on UAE Exhibit 2.4 (Utah tab/page), did not assume any additional reductions from Hunter Unit #2 (or from Hunter Unit #1 or Huntington Unit #1), given that those units were already controlling 80 – 83.5% of SO_2 emissions. Moreover, PacifiCorp's own internal 2004 analysis reflected in Confidential UAE Exhibit RR 2.5 projected the incremental costs of removing additional SO_2 at Huntington Unit #1 and Hunter Units #1 and #2 to be the very highest among all of its EGUs, except for the two small, unscrubbed Carbon plants. PacifiCorp's internal analysis confirmed that these three Utah units would be the most expensive and least productive places to target dollars designed to reduce regional SO_2 emissions.

In summary, the scrubber improvement project at Hunter Unit #2 went substantially beyond the applicable regulatory requirements. Had PacifiCorp followed the normal industry practice and developed its emissions control strategy following the Appendix Y regulatory guidelines for BART, it would have been clear that the project was not cost-effective and would not have been required under BART. Instead, PacifiCorp embarked on a voluntary emissions control program at this and some of its other units that far exceeded regulatory requirements, potentially at a very significant cost to Utah ratepayers. My

recommendation is that cost recovery associated with the Hunter Unit #2 scrubber improvement project should be disallowed.

Q. Did your analysis in the Hunter Unit #2 arbitration also address similar scrubber upgrades at Hunter Unit #1 and Huntington Unit #1?

R. No, the scrubber upgrade projects at Hunter Unit #1 and Huntington Unit #1 were not part of the arbitration case. However, the actions undertaken by PacifiCorp with respect to scrubber upgrades at those units mirrored in almost all respects its actions relating to Hunter Unit #2, and the relative costs and results are very similar. As with Hunter Unit #2, PacifiCorp voluntarily proposed pollution controls for Hunter Unit #1 and Huntington Unit #1 that were far in excess of applicable regulatory requirements and that cannot be justified as being cost-effective or representing the lowest reasonable cost alternative. My opinion as to Hunter Unit #2, and the conclusions of the arbitrator with respect to that unit, can be directly applied to Hunter Unit #1 and Huntington Unit #1. In the following pages, I have analyzed the cost-effectiveness of PacifiCorp's emission controls at those two units.

Hunter Unit #1

Q. Please summarize the pollution control projects at PacifiCorp's Hunter Unit #1.

R. The planned 2014 Hunter Unit #1 scrubber project is nearly identical to the Hunter Unit #2 project. PacifiCorp claims that the scrubber improvement project at Hunter Unit #1 will increase the existing wet scrubber SO_2 control efficiency

from 80% to near 95%. The major elements of this project are to add forced oxidation equipment, vacuum drum filters, close the scrubber bypass and treat 100% of the flue gas from the coal-fired boiler, which in turn requires converting the stack to a wet operation and relocating the opacity monitoring equipment.

Q. What are the capital costs associated with the Hunter Unit #1 project? What is the source of your data for the capital cost estimate?

R. The Hunter Unit #1 capital costs as reported by PacifiCorp in its *Response to UAE Data Request 3.4* is about $78.0 million.

Q. What are the other operating costs associated with Hunter Unit #1 scrubber upgrade project? What is the source of your operating cost data?

R. Based on data in the record from the Hunter Unit #2 arbitration case hearing, I have estimated the annual operating and maintenance costs for Hunter Unit #1 at $760,329. The Hunter Unit #1 scrubber improvement project is similar in size and scope to the Hunter Unit #2 scrubber improvement project, so the annual operating and maintenance costs should also be similar. Since a formal five-factor BART analysis was never prepared for Hunter Unit #1, this is the best available data for estimating these scrubber operating and maintenance costs.

Q. What are the pollution control benefits associated with the Hunter Unit #1 scrubber upgrade project? What is the source of your data?

R. The reduction in SO_2 emissions attributable to the Hunter Unit #1 scrubber improvement project is 502 ton per year. This information comes from UAE

Exhibit RR 2.15, the Utah Regional Haze State Implementation Plan (SIP), adopted in September 2008 (page 25).

Q. What is the calculated cost effectiveness for the Hunter Unit #1 scrubber upgrade project?

R. Using the data described above for capital cost, operating cost, and environmental benefit, the cost effectiveness of the Hunter Unit #1 scrubber improvement project is $16,287 per ton SO_2 removed. For these calculations a cost recovery factor of 0.095 was used to annualize the capital cost. The basis for a 0.095 cost recovery factor was provided previously in my testimony.

Q. Does the calculated cost effectiveness meet the standard criteria for selecting an appropriate BART control option?

R. No. The Hunter Unit #1 scrubber improvement project does not meet the test for BART. As described earlier in my testimony, the expected costs for SO_2 control under BART are $2,000 per ton SO_2 removed or less. The cost-benefit at Hunter Unit #1 is about 10 times higher than other SO_2 emission control projects determined to be BART.

As with Hunter Unit #2, cost-effectiveness for additional SO_2 controls at Hunter Unit #1 does not meet the test for BART because the environmental benefits of adding these controls in terms of SO_2 emission reductions is very small. Hunter Unit #1 is already well controlled with SO_2 emissions at or near the presumptive BART limit from 40 CFR 51 Appendix Y (0.15 lb/MMBtu). Also, as with Hunter Unit #2, the WRAP projections did not assume any

additional controls at this unit. Finally, as with Hunter Unit #2, PacifiCorp's own internal projections showed this upgrade to be among the most costly for incremental emission reductions.

In summary, the scrubber improvement project at Hunter Unit #1 went substantially beyond the regulatory requirements in effect at the time the scrubber project was proposed and constructed. Had PacifiCorp followed the normal industry practice and developed its emissions control strategy following the Appendix Y regulatory guidelines for BART, it would have been clear that the project was not cost-effective and would not have been required under BART. Instead, PacifiCorp embarked on a voluntary emissions control program that far exceeds regulatory requirements at a potentially significant cost to Utah ratepayers. My recommendation is that the cost recovery associated with the Hunter Unit #1 scrubber improvement project should be disallowed.

Huntington Unit #1

Q. Please summarize the pollution control projects at PacifiCorp's Huntington Unit #1.

R. The Huntington Unit #1 scrubber upgrade completed in 2010 is also almost identical to the Hunter Units #1 and #2 upgrades. PacifiCorp claims that the scrubber improvement project at Huntington Unit #1 will increase the existing wet scrubber SO_2 control efficiency from 80% to near 95%. The major elements of this project are to add forced oxidation equipment, vacuum drum filters, close

the scrubber bypass and treat 100% of the flue gas from the coal-fired boiler, which in turn requires converting the stack to a wet operations and relocating the opacity monitoring equipment.

Q. What are the capital costs associated with the Huntington Unit #1 project? What is the source of your data for the capital cost estimate?

R. The Huntington Unit #1 capital costs as reported by PacifiCorp in its *Response to UAE Data Request 3.4* is about $53.0 million.

Q. What are the other operating costs associated with Huntington Unit #1 scrubber upgrade project? What is the source of your operating cost data?

R. Based on data in the record from the Hunter Unit #2 arbitration case hearing, I have estimated the annual operating and maintenance costs for Huntington Unit #1 at $760,329. The Huntington Unit #1 scrubber improvement project is similar in size and scope to the Hunter Unit #2 scrubber improvement project, so the annual operating and maintenance costs should also be similar. Since a formal five-factor BART analysis was never prepared for Huntington Unit #1, this is the best available data for estimating these scrubber operating and maintenance costs.

Q. What are the pollution control benefits associated with the Huntington Unit #1 scrubber upgrade project? What is the source of your data?

R. The reduction in SO_2 emissions attributable to the Huntington Unit #1 scrubber improvement project is 486 ton per year. This information comes from UAE Exhibit RR 2.15, the Utah Regional Haze State Implementation Plan (SIP), adopted in September 2008 (page 25).

Q. What is the calculated cost effectiveness for the Huntington Unit #1 scrubber upgrade project?

R. Using the data described above for capital cost, operating cost, and environmental benefit, the cost effectiveness of the Huntington Unit #1 scrubber improvement project is $11,929 per ton SO_2 removed. For these calculations a cost recovery factor of 0.095 was used to annualize the capital cost. The basis for a 0.095 cost recovery factor was provided previously in my testimony.

Q. Does the calculated cost effectiveness meet the standard criteria for selecting an appropriate BART control option?

R. No. The Huntington Unit #1 scrubber improvement project does not meet the test for BART. As described earlier in my testimony, the expected costs for SO_2 control under BART are $2,000 per ton SO_2 removed or less. The cost-benefit at Huntington Unit #1 is about six times higher than other SO_2 emission control projects determined to be BART.

As with the Hunter units, the cost-effectiveness of additional SO_2 controls at Huntington Unit #1 does not meet the test for BART because the incremental environmental benefits of adding these controls in terms of SO_2 emission reductions is very small. Huntington Unit #1 was already well controlled with SO_2 emissions at or near the presumptive BART limit from 40 CFR 51 Appendix Y (0.15 lb/MMBtu).

Moreover, as with the Hunter Units, the WRAP projections did not assume any additional controls at this unit. In contrast, WRAP assumed that the

previously-unscrubbed Huntington Unit #2 would be scrubbed, reducing SO_2 emissions by over 10,000 tons per year (UAE Exhibit RR 2.4). I have not challenged the reasonableness or cost-effectiveness of the 2006 Huntington Unit #2 scrubber project. Finally, PacifiCorp's internal projections reflected that the Huntington Unit #1 scrubber project would have among the highest incremental costs of any of its units (Confidential UAE Exhibit RR 2.5, page 6).

In summary, the scrubber improvement project at Huntington Unit #1 went substantially beyond the applicable regulatory requirements. Had PacifiCorp followed the normal industry practice and developed its emissions control strategy following the Appendix Y BART guidelines, it would have been clear that the project was not cost-effective and would not have been required under BART. Instead, PacifiCorp embarked on a voluntary emissions control program that far exceeds regulatory requirements and comes potentially at a significant cost to Utah ratepayers. My recommendation is that the cost recovery associated with the Huntington Unit #1 scrubber improvement project should be disallowed as imprudent.

Q. Are you aware of any BART analysis prepared by air regulators in the region that supports your conclusions that the scrubber upgrades at Hunter Units #1 and #2 and Huntington Unit #1 were not reasonable or required by BART or regional haze regulations?

R. Yes. A Wyoming DEQ Analysis dated May 28, 2009, with respect to Units 1, 2 and 3 at Basin Electric Power Cooperative's Laramie River Station is instructive

with respect to, and supportive of, my conclusions as to the Hunter Units #1 and #2 and Huntington Unit #1 scrubber projects. A copy of that Analysis is attached as UAE Exhibit RR 2.16.

For Units #1 and #2 at Laramie River, WDEQ analyzed three alternative SO_2 upgrade technologies – elimination of the stack reheat system (comparable to the scrubber upgrades done by PacifiCorp at Hunter Units #1 and #2 and Huntington Unit #1), improvements to an existing wet FGD system, and sorbent injection. The WDEQ concluded that elimination of the stack reheat system was by far the most expensive option (pages 15-17) and that elimination of the stack reheat system was not cost-effective at Units #1 and #2 (page 17). In finding the option to eliminate the reheat system not to be cost effective, WDEQ determined that the cost-per-ton of reduction was about $9,400, based on estimated annual SO_2 reductions of about 700 tons (pages 15-16). The WDEQ also concluded that the upgrades would produce insignificant visibility improvements at Class I sites, noting the modeled improvement was only .02 deciviews or less at nearby Class 1 sites (page 17).

The above results for Laramie River are very comparable to the Hunter and Huntington results, which produce costs per ton of reduction from about $12,000 - $30,000, annual tons of reduction ranging from 240 – 502 tons, and estimated visibility improvements of .019 deciviews or less. The Laramie River WDEQ Analysis confirms that a similar BART analysis of the three contested Utah units would have resulted in similar findings, that none of the scrubber

upgrades at Hunter Units #1 or #2 or Huntington Units #1 is cost effective or required by BART.

SUMMARY & CONCLUSIONS

Q. Would you please summarize the results of your cost-effectiveness calculations?

R. Yes. In the chart below, I have summarized the cost-effectiveness of the scrubber upgrades that I have evaluated, along with my conclusions:

PacifiCorp Plant	Cost-Effectiveness ($/ton)	Reasonable Under BART?
Naughton Unit #1	**$1,707**	**Yes**
Naughton Unit #2	**$1,700**	**Yes**
Wyodak	**$1,242**	**Yes**
Dave Johnston Unit #3	**$10,700[1]**	**NO**
Dave Johnston Unit #4	**$5,028**	**Yes**
Jim Bridger Unit #3	**$1,170**	**Yes**
Hunter Unit #2	**$30,943**	**NO**
Hunter Unit #1	**$16,287**	**NO**
Huntington Unit #1	**$11,929**	**NO**

[1] Represents incremental cost-effectiveness compared to other SO_2 control alternatives analyzed by PacifiCorp.

Q. What are the major conclusions of your testimony?

R. My expert conclusion in this case is that the pollution control project costs for scrubber upgrades at Huntington Unit #1, Hunter Unit #1, Hunter Unit #2, and

Dave Johnston Unit #3 are not justified and that cost recovery from ratepayers should not be allowed.

In the case of the three Utah EGUs (Huntington #1 and Hunter #1 & #2), the scrubber upgrade projects provide emissions control that is well beyond the regulatory requirements imposed on these units by current and reasonably anticipated environmental regulations. PacifiCorp claims that a major driver for its decision to proceed with the scrubber upgrade projects is the requirement to install Best Available Retrofit Technology (BART) under federal and state regulations governing regional haze. However, PacifiCorp made its decisions without even conducting the analysis anticipated by the very regulation cited as the driver for the decision. In the absence of these important analyses, PacifiCorp significantly overshot the regulatory target and voluntarily committed to a costly and unnecessary environmental control program, with very limited and unimpressive results. At its three Utah facilities, PacifiCorp is spending in excess of $200 million for scrubber upgrades that achieve very little in terms of real environmental improvements. Had PacifiCorp performed the types of analyses required to fulfill its regulatory obligation under BART and confirmed the level of emissions control needed, these results would have made it abundantly clear that the cost-benefit of the proposed emission controls would not meet BART standards. What in fact happened is the Company volunteered a pollution control program without regard for the real environmental need and/or benefit. Cost

recovery for the scrubber upgrades at these projects should be disallowed by the Commission.

A similar conclusion applies with respect to Dave Johnston #3. Since Dave Johnston #3 is located in Wyoming, a formal five-factor BART analysis was required by the Wyoming DEQ and PacifiCorp's contractor performed this analysis. Yet, PacifiCorp appears to have ignored these data when deciding on the scope and equipment for the Dave Johnston Unit #3 pollution control project. The option chosen by the Company was in fact the highest cost alternative for SO_2 control. Other technically feasible options not selected at Dave Johnston #3 (i.e., wet scrubber with existing ESP) provide for even lower SO_2 emissions at a lower cost. The Wyoming DEQ decided in its BART review and analysis that the option selected by PacifiCorp did not meet the regulatory standard under BART, based on the incremental cost-effectiveness of replacing the existing ESP with a full-scale fabric filter baghouse. Based on the data reviewed, I have concluded that the cost for the full-scale fabric filter baghouse at Dave Johnston Unit #3 cannot be justified under BART and that cost recovery for this equipment should not be allowed by the Commission.

Q. Does this conclude your direct testimony?

R. Yes.