United States Department of the Interior

NATIONAL PARK SERVICE
Air Resources Division
P.O. Box 25287
Denver, CO 80225

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IN REPLY REFER TO:

June 4, 2012

N3615 (2350)

Thomas Webb
EPA Region 9, Planning Office, Air Division
75 Hawthorne Street
San Francisco, California 94105

Docket ID No. EPA–R09–OAR–2011–0130

Dear Mr. Webb:

The National Park Service has reviewed the Environmental Protection Agency (EPA)'s proposed BART Determination for Reid Gardner Generating Station. We commend EPA Region 9 (R9) on the thoroughness of its modeling analysis. However, we have several concerns with EPA's proposal.

We believe that consistency is important to the success of a national program designed to address regional issues. Consistent with EPA findings for other similar facilities, therefore, we believe that Selective Catalytic Reduction (SCR) technology is cost-effective and should be implemented as BART for Reid Gardner Generating Station (RGGS) Units 1, 2 and 3.

Our enclosed comments demonstrate that EPA R9 has incorrectly estimated the cost-effectiveness of SCR by assuming that it can achieve annual average emission no lower than 0.083 – 0.98 lb/mmBtu, despite substantial evidence that SCR can achieve 0.05 lb/mmBtu (or lower) on an annual basis. EPA R9 also compared the costs and benefits of SCR to the ROFA+Rotamix® option which is no longer valid due to advice from NDEP that this technology was not performing as well as expected at RGGS Unit 4 and that SNCR should now instead be considered BART. We have demonstrated that addition of SCR on each RGGS unit costs less than $3,000/ton and that incremental costs are lower than estimated by EPA R9.

EPA R9 underestimated visibility impacts and improvements because it modeled annual average emissions instead of 24-hour maxima. Additionally, EPA R9 based its determination on visibility benefits of SCR for the single Class I area with the maximum visibility impact. NPS adjusted EPA's modeling results to project visibility benefits at five Class I areas impacted by RGGS. Our analyses demonstrate that the visibility benefits of installing SCR for each RGGS BART unit significantly exceed EPA's estimates. The cumulative visibility benefit at five Class I areas is almost two dv for SCR on all three RGGS BART units. Therefore, we believe SCR is justified for Craig Units 1, 2, and 3.

We appreciate the opportunity to work closely with EPA Region 9 to improve visibility in our Class I areas. For further information regarding our comments, please contact Don Shepherd at (303) 969-2075.

Sincerely,

Susan Johnson
Chief, Policy, Planning and Permit Review Branch

Enclosures

cc:
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NPS Comments on Best Available Retrofit Technology for Nitrogen Oxides from Nevada Energy's Reid Gardner Generating Station Units 1, 2 and 3
June 4, 2012

Background

Reid Gardner Generating Station (RGGS) consists of four operating units owned and operated by Nevada Energy (NVE) and producing a total of 557 MW. Three of the units, built in 1965, 1968, and 1976 with a nominal generating capacity of 110 megawatts (MW) each are subject to Best Available Retrofit Technology (BART) requirements. These units are wall-fired boilers, which burn primarily bituminous coal. Current controls for nitrogen oxides (NO_x) are Low-NO_x Burners (LNB) and Over-Fire Air (OFA). Sulfur dioxide (SO_2) is controlled by soda ash scrubbers and particulate matter (PM) is controlled by fabric filters. RGGS causes or contributes to visibility impairment in Grand Canyon National Park (NP) and Joshua Tree NP. According to EPA's BART Guidelines, the presumptive limit for a dry-bottom, wall-fired EGU burning bituminous coal is 0.28 lb/mmBtu.

Of 3,621 EGUs in EPA's 2011 Clean Air Markets (CAM) database, Unit 1 ranks #702 (677 tons), Unit 2 ranks #710 (710 tons), and Unit 3 ranks #578 (766 tons) for NO_X. Modeling conducted by EPA (Table 1 below) using the Western Regional Air Partnership (WRAP) base case emissions estimated a maximum visibility impact of 0.80 deciview (dv) in Grand Canyon NP, and the cumulative impact is 2.28 dv across the five Class I areas modeled

Table 1. Reid Gardner CALPUFF Visibility Modeling, EPA, 2012-03-09

Visibility Method 8, best 20% background

Class I Area	98th %ile Impact, dv
Bryce Canyon	0.27
Grand Canyon	0.80
Joshua Tree	0.60
Sycamore Canyon	0.16
Zion	0.46
Cumulative	2.28

EPA Region 9 (R9) conducted an extensive analysis of Nevada Department of Environmental Protection's (NDEP) BART proposal and concluded:

> Therefore, we are proposing to approve NDEP's conclusion that SCR is not required as BART for NOX. NDEP weighed the incremental cost of requiring SCR against the relatively small visibility improvement that would be achieved from installing and operating SCR.

The "relatively small visibility improvement" cited by EPA R9 is a result of underestimates of the base case emissions and the amounts of NO_x that could be removed by Selective Catalytic Reduction (SCR). We shall also show that EPA R9 overestimated incremental costs for SCR.

Selective Catalytic Reduction Effectiveness

In its proposal for RGGS, EPA R9 has underestimated the ability of modern SCR to reduce NO_X emissions by assuming that it can do no better than 0.083 – 0.098 lb/mmBtu on an annual basis. Because such an underestimate adversely changes the cost-benefit analysis, we conducted our analysis as discussed below.

It is generally assumed that SCR can achieve at least 90% NO_X reduction and 0.05 lb/mmBtu (or lower) on typical coal-fired boilers. For example, EPA Region 5 advised Minnesota that:

> We believe that the available evidence indicates that Xcel Energy's Sherburne County facility (Sherco) should add selective catalytic reduction (SCR) to the recommended nitrogen oxides (NO_X) combustion controls. We are basing this on calculations we have performed evaluating SCR at emission levels of 0.05 pounds per million British Thermal Units (lb/MMbtu) and 0.08 lb/MMBtu. Both of which are considered cost-effective. We chose to evaluate these two emission levels because you assumed a 0.08 lb/MMBTU level in your analyses and because we believe that the lower limit of 0.05 lb/MMBTU is generally achievable by this control technology. [1]

EPA Region 6's (R6) evaluation of NO_X BART for the San Juan Generating Station (SJGS) (included in Appendix A) provides a good example of a thorough technical analysis. [2] It is especially valuable to note that the boilers at SJGS are dry-bottom, wall-fired units like RGGS and were previously required to meet a NO_X limit of 0.30 lb/mmBtu (30-day rolling average), which is higher than current NO_X emissions from RGGS. In making its final determination, EPA R6 stated:

> For the reasons discussed in our proposal (76 FR 491), and in other responses to comments, we have concluded that BART for the SJGS is an emission limit of 0.05 lbs/MMBtu, based on a 30 BOD[3] average, more stringent than the levels achievable by the SNCR technology recommended by the State.

We agree with EPA R6's determination that SJGS can meet 0.05 lb/mmBtu on a 30-day rolling average and we have conducted our analyses on the (less-stringent) basis that RGGS can meet 0.05 lb/mmBtu on an annual average,[4] as opposed to the assumption by EPA R9 that SCR can

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[1] June 6, 2011 letter from Doug Aburano, Chief, Control Strategies Section, EPA Region 5 to John Seltz, Chief, Air Assessment Section, Minnesota Pollution Control Agency

[2] **San Juan Generating Station Source Description:** The San Juan Generating Station (SJGS) consists of four coal-fired electric generating units (EGUs) and associated support facilities. Units 1 and 2 are Foster Wheeler subcritical, dry-bottom, wall-fired boilers that operate in a forced draft mode and have a unit capacity of 360 and 350 MW, respectively. Units 3 and 4 are B&W subcritical, dry-bottom, opposed wall-fired boilers that operate in a forced draft mode, and each has a unit capacity of 544 MW. Consent Decree: On March 5, 2005, Public Service of New Mexico (PNM) entered into a consent decree (CD) with the Grand Canyon Trust, the Sierra Club, and the New Mexico Environment Department to settle alleged violations of the Clean Air Act. The CD required PNM to meet a 0.30 lb/mmBtu emission rate for NO_X (daily rolling, thirty day average), for each of Units 1, 2, 3, and 4. As a result, PNM has installed new LNB with OFA ports and a neural network system to reduce NO_X emissions.

[3] Boiler Operating Days

[4] In its comments on SJGS, EPA R6 noted that: The NPS and the USFS separately stated they believe PNM has underestimated the ability of SCR to reduce emissions. For example, the NPS states that B&V assumed that SCR could achieve 0.05 lbs/MMBtu (annual average) when evaluating retrofitting of SCR at the Craig power plant in Colorado. Both the NPS and the USFS stated that EPA's Clean Air Markets data, and vendor guarantees show that SCR can typically meet 0.05 lb/MMBtu (or lower) on an annual average basis. The USFS stated NOX emissions can be reduced by 90% with SCR installed at 0.05 lbs/MMBtu emission limit. The NPS included data it claims indicates that SCR can achieve year-round emissions of 0.05 lbs/MMBtu or lower at 26 coal-fired EGUs, eleven of which are dry-bottom, wall-fired units like SJGS. The USFS also referenced this data. The NPS believes PNM has not provided any documentation or justification to support the higher values used in its analyses. They also present information from industry sources that supports their understanding that SCR can achieve 90% reduction and reduce

only achieve 0.083 – 0.098 lb/mmBtu on an annual average. To further support our conclusion, we are providing updated CAM data (in Appendix A) that again shows that, in 2011, SCR achieved year-round emissions of 0.05 lbs/mmBtu or lower at 21 coal-fired EGUs, eleven of which are dry-bottom, wall-fired units like RGGS.

SCR Costs

Figure 3 of a survey (included in Appendix B) of industry SCR cost data and EPA Integrated Planning Model (IPM) estimates shows that typical SCR costs for units the size of RGGS would be less than $300 - $350/kW.[5] In conducting our cost analysis of SCR at RGGS, we used an approach similar to that used by EPA R8 in its evaluation of SCR on the Colstrip power plant—following is an excerpt from EPA R8's proposed Montana FIP:

> We relied on a number of resources to assess the cost of compliance for the control technologies under consideration. In accordance with the BART Guidelines (70 FR 39166), and in order to maintain and improve consistency, in all cases we sought to align our cost methodologies with the EPA CCM.[6] However, to ensure that our methods also reflect the most recent cost levels seen in the marketplace, we also relied on a set of cost calculations developed for the Integrated Planning Model (IPM) version 4.10.[7] These IPM cost calculations are based on databases of actual control project costs and account for project specifics such as coal type, boiler type, and reduction efficiency. The IPM cost calculations reflect the recent increase in costs in the five years proceeding 2009 that is largely attributed to international competition. Finally, our costs were also informed by cost analyses submitted by the sources, including in some cases vendor data.
>
> Annualization of capital investments was achieved using the CRF [Capital Recovery Factor] as described in the CCM.[8] Unless noted otherwise, the CRF was computed using an economic lifetime of 20 years and an annual interest rate of 7%.[9] All costs presented in this proposal have been adjusted to 2010 dollars using the Chemical Engineering Plant Cost Index (CEPCI).[10]

For RGGS Unit 1, we used EPA's IPM model to estimate Direct Capital Cost (DCC) at $23.7 million,[11] which is higher than the $20 million DCC estimated by EPA R9. We used the IPM estimate for DCC and then applied the EPA Control Cost Manual (CCM) factors (totaling 141%) for Indirect Capital Cost to estimate a Total Capital Investment (TCI) of $33.4 million ($303/kW) versus $26.8 million ($244/kW) estimated by EPA R9. Next, we applied the CCM methods for estimating Direct and Indirect Annual Costs to the TCI and arrived at a Total Annual Cost of $4.5 million for SCR with combustion control improvements versus $3.9 million by EPA R9. We concluded that combustion controls plus SCR for Unit 1 would remove over 1,800 tpy and cost about $2,500/ton (compared to $2,100/ton estimated by EPA R9). We

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emissions to 0.05 lb/MMBtu or lower on coal-fired boilers. **We agree with the NPS that PNM has underestimated the ability of SCR to reduce emissions. As discussed elsewhere in our response to comments, we are requiring that the units of the SJGS meet an emission limit of 0.05 lbs/ MMBtu on the basis of a 30 day rolling BOD average. (emphasis added)**

[5] "OVERVIEW OF INFORMATION ON PROJECTED CONTROL TECHNOLOGY COSTS AND PERFORMANCE AS DEVELOPED FOR EPA'S INTEGRATED PLANNING MODEL (IPM)" October 15, 2010, Prepared by J. Edward Cichanowicz for the Utility Air Regulatory Group

[6] EPA Control Cost Manual Sixth Edition, January 2002, EPA 452/B–02–001

[7] Documentation for EPA Base Case v.4.10 Using the Integrated Planning Model, August 2010, EPA #430R10010

[8] Section 1, Chapter 2, page 2-21.

[9] Office of Management and Budget, Circular A-4, Regulatory Analysis, http://www.whitehouse.gov/omb/circulars_a004_a-4/.

[10] Chemical Engineering Magazine, p. 56, August 2011. (*http://www.che.com*).

[11] after adjusting to 2010$ using the CEPCI

applied the same approach to RGGS 2 and 3 and arrived at the similar values in Table 2 below. (Excel workbooks in Appendix B contain details of our calculations.)

Table 2. NPS SCR Cost Analysis (using IPM & CCM methods)

Unit	Unit #1	Unit #2	Unit #3
Rating (mmBtu/hr)	1,426	1,657	1,440
Uncontrolled Emissions (tpy)	2,062	2,279	2,067
Uncontrolled Emissions (lb/mmBtu)	0.45	0.46	0.419
Combustion Controls Cost-benefit Analysis			
Control Efficiency	19%	22%	0%
Controlled emissions (lb/mmBtu)	0.363	0.355	0.421
Controlled Emissions (tpy)	1,665	1,777	2,076
Emissions Reduction (tpy)	397	502	-8
Capital Cost	$ 3,840,000	$ 3,840,000	$ 3,840,000
Capital Cost ($/kW)	$ 35	$ 35	$ 35
Annualized Cost	$ 442,469	$ 442,469	$ 442,469
Cost-Effectiveness ($/ton)	$ 1,114	$ 881	$ (52,855)
SCR Cost-benefit Analysis			
Control Efficiency	86%	86%	88%
Controlled emissions (lb/mmBtu)	0.05	0.05	0.05
Emissions Reduction (tpy)	1,436	1,527	1,829
Capital Cost	$ 33,379,469	$ 37,614,268	$ 33,885,270
Capital Cost ($/kW)	$ 303	$ 342	$ 308
O&M Cost	$ 952,755	$ 1,055,986	$ 1,039,366
Annualized Cost	$ 4,103,541	$ 4,606,507	$ 4,237,895
Cost-Effectiveness ($/ton)	$ 2,858	$ 3,017	$ 2,317
Combustion Controls + SCR Cost-benefit Analysis			
Control Efficiency	89%	89%	88%
Controlled Emissions (tpy)	229	250	247
Emissions Reduction (tpy)	1,833	2,029	1,821
Capital Cost	$ 37,219,469	$ 41,454,268	$ 37,725,270
Capital Cost ($/kW)	$ 338	$ 377	$ 343
O&M Cost	$ 952,755	$ 1,055,986	$ 1,039,366
Annualized Cost	$ 4,546,010	$ 5,048,976	$ 4,680,364
Cost-Effectiveness ($/ton)	$ 2,480	$ 2,489	$ 2,571

We used EPA's data for combustion control costs and resulting emissions. As a result, a major anomaly can be seen highlighted above for combustion controls (LNB+OFA) applied to RGGS 3. EPA assumed that combustion controls on RGGS 3 could do no better than 0.421 lb/mmBtu, which is higher than the 0.419 lb/mmBtu average emission rate during the 2001 – 2003 baseline period, and much higher than 2009 - 2011 emission rates (0.21 – 0.26 lb/mmBtu).

Table 3 compares critical values estimated by EPA and NPS. Our approach yielded average costs that were 16% - 28% higher than EPA's estimates, which is a reasonable range for this "study" level of cost estimate.[12] The differences in "Baseline" emissions can likely be attributed to the methods used to derive them. According to NDEP, "To arrive at the level of performance for all three units, first we took the highest two consecutive years from the acid rain data for 2001 through 2007 and averaged them for each unit."[13] As a result, NDEP used maximum two-year averages from the 2001 – 2003 baseline period. On the other hand, we simply averaged 2001 – 2003 emissions from CAM data. Our higher annual costs for SCR are largely driven by the CAM data maximum daily heat input rates that exceeded the EPA values by 30% - 40%; this resulted in higher SCR capital costs to accommodate the higher gas flows.

Table 3. Reid Gardner NOx Control Effectiveness Summary - EPA Revised Costs vs. NPS Costs

			Baseline		LNB+OFA	SCR+LNB+OFA	
Unit No.	**Parameter**	**Units**	**EPA**	**NPS**	**EPA**	**EPA**	**NPS**
Unit 1	Emission Rate	(tpy)	2,267	2,062	1,784	417	229
	Annual Heat Input	(MMBtu/yr)	9,818,313	9,174,894	9,818,313	9,818,313	9,174,894
	Removed	(tpy)	--	--	483	1,850	1,833
	Removal Rate	(%)	--	--	21.3%	81.6%	88.9%
	Emission Factor	(lb/MMBtu)	0.462	0.450	0.363	0.085	0.050
	Annual Cost	($)			$491,140	$3,903,494	$4,546,010
	Average Cost Effectiveness	($/ton)			$1,017	$2,110	$2,480
Unit 2	Emission Rate	(tpy)	2,445	2,279	1,866	436	250
	Annual Heat Input	(MMBtu/yr)	10,501,749	10,011,619	10,501,749	10,501,749	10,011,619
	Removed	(tpy)	--	--	579	2,009	2,029
	Removal Rate	(%)	--	--	23.7%	82.2%	89.0%
	Emission Factor	(lb/MMBtu)	0.466	0.455	0.355	0.083	0.050
	Annual Cost	($)			$491,140	$3,952,244	$5,048,976
	Average Cost Effectiveness	($/ton)			$848	$1,967	$2,489
Unit 3	Emission Rate	(tpy)	2,268	2,067	2,118	493	247
	Annual Heat Input	(MMBtu/yr)	10,063,851	9,860,464	10,063,851	10,063,851	9,860,464
	Removed	(tpy)	--	--	150	1,775	1,821
	Removal Rate	(%)	--	--	6.6%	78.3%	88.1%
	Emission Factor	(lb/MMBtu)	0.451	0.419	0.421	0.098	0.050
	Annual Cost	($)			$491,140	$3,874,586	$4,680,364
	Average Cost Effectiveness	($/ton)			$3,284	$2,183	$2,571

[12] The EPA Control Cost manual says, "…the costs and estimating methodology in this Manual are directed toward the "study" estimate with a nominal accuracy of ± 30% percent. According to Perry's Chemical Engineer's Handbook, a study estimate is '… used to estimate the economic feasibility of a project before expending significant funds for piloting, marketing, land surveys, and acquisition … [However] it can be prepared at relatively low cost with minimum data'"

[13] 3/14/12 e-mail from Mike Elges (NDEP) to Colleen McKaughan (EPA R9)

Although OAQPS guidance recommends evaluating both average and incremental costs and benefits, EPA R9 has based its BART determination entirely upon the incremental costs and benefits:

> SCR would result in a very small incremental improvement of visibility over other technologies, which **did not justify the incremental cost** of installing and operating SCR. (emphasis added)

A major hazard with placing too much emphasis on incremental costs is exemplified in this situation. EPA calculated the incremental costs of LNB+OFA+SCR versus ROFA+Rotamix® and estimated incremental costs of $2,756 - $4,534/ ton. However, in its March 12, 2012 letter to EPA, NDEP explained that ROFA+Rotamix® was no longer a viable option at RGGS. We have therefore recalculated EPA's incremental costs by excluding ROFA+Rotamix® from Table 4.

Table 4. Revised EPA NOx Control Effectiveness Summary

Unit No.	Parameter	Units	Baseline[2]	LNB+OFA	LNB+OFA+SNCR	SCR+LNB+OFA
Unit 1	Emission Rate	(tpy)	2,267	1,784	1,340	417
	Removed	(tpy)	--	483	927	1,850
	Removal Rate	(%)	--	21.3%	40.9%	81.6%
	Emission Factor	(lb/MMBtu)	0.462	0.363	0.273	0.085
	Annual Cost	($)		$491,140	$1,019,864	$3,903,494
	Average Cost Effectiveness	($/ton)		$1,017	$1,100	$2,110
	Incremental Cost Effectiveness	($/ton)		--	$1,191	$3,124
	Previous ctrl technology			--	LNB+OFA	LNB+OFA+SNCR
Unit 2	Emission Rate	(tpy)	2,445	1,866	1,401	436
	Removed	(tpy)	--	579	1,044	2,009
	Removal Rate	(%)	--	23.7%	42.7%	82.2%
	Emission Factor	(lb/MMBtu)	0.466	0.355	0.267	0.083
	Annual Cost	($)		$491,140	$1,042,273	$3,952,244
	Average Cost Effectiveness	($/ton)		$848	$998	$1,967
	Incremental Cost Effectiveness	($/ton)		--	$1,185	$3,015
	Previous ctrl technology			--	LNB+OFA	LNB+OFA+SNCR
Unit 3	Emission Rate	(tpy)	2,268	2,118	1,590	493
	Removed	(tpy)	--	150	678	1,775
	Removal Rate	(%)	--	7%	30%	78%
	Emission Factor	(lb/MMBtu)	0.451	0.421	0.316	0.098
	Annual Cost	($)		$491,140	$969,586	$3,874,586
	Average Cost Effectiveness	($/ton)		$3,284	$1,430	$2,183

	Incremental Cost Effectiveness	($/ton)	--	$906	$2,648
	Previous ctrl technology		--	LNB+OFA	LNB+OFA+SNCR

The resulting "EPA" incremental costs for LNB+OFA+SCR versus LNB+OFA+ Selective Non-Catalytic Reduction (SNCR) are now lower at $2,648 - $3,124/ton. However, because the EPA costs for LNB+OFA+SNCR are based upon it achieving a much higher emission rate than the proposed BART limits, LNB+OFA+SNCR costs are underestimated.

EPA is now basing its BART determination on the assumption that LNB+OFA+SNCR can achieve 0.20 lb/mmBtu on a 30-day rolling average. Given the sensitivity of SNCR to boiler operation, size, and configuration, we are concerned that SNCR may not be able to achieve that level of performance on a consistent basis. For example, our query of CAM data for 2011 (included in Appendix A) found only seven out of 3,621 coal-fired EGUs that met 0.20 lb/mmBtu on a monthly basis, and two of those units (at Taconite Harbor) are using ROFA+Rotamix®.[14]

We are also concerned that EPA underestimated the cost of SNCR, which biases its analysis of incremental costs against SCR. We first estimated the costs of this option by applying EPA's IPM model for SNCR to RGGS and used heat inputs and emission estimates from CAM data for 2001 - 2003.[15] Our results are presented in Table 5, and details can be found in Appendix B.

[14] Big Brown #1 & #2, Boswell #3, Monticello #1, Sandow #5A, Taconite Harbor #1 & #2.

[15] We did not use the EPA Control Cost Manual for estimating SNCR costs due to an error in its method for estimating reagent use.

Table 5. NPS SNCR Cost Analysis (using IPM)

Proposed Controls	**LNB+OFA+SNCR**	**LNB+OFA+SNCR**	**LNB+OFA+SNCR**
Unit	Unit #2	Unit #2	Unit #3
Rating (MW Gross) each	110	110	110
Rating (mmBtu/hr)	1,426	1,657	1,440
Uncontrolled Emissions (tpy)	2,062	2,279	2,067
Uncontrolled Emissions (lb/mmBtu)	0.450	0.455	0.419
Combustion Controls Cost-benefit Analysis			
Control Efficiency	19%	22%	0%
Controlled emissions (lb/mmBtu)	0.36	0.355	0.421
Controlled Emissions (tpy)	1,665	1,777	2,076
Emissions Reduction (tpy)	397	502	-8
Capital Cost	$ 1,600,000	$ 3,840,000	$ 3,840,000
Capital Cost ($/kW)	$ 15	$ 35	$ 35
Annualized Cost	$ 442,469	$ 442,469	$ 442,469
Cost-Effectiveness ($/ton)	$ 1,114	$ 881	$ (52,855)
SNCR Cost-benefit Analysis			
Control Efficiency	45%	44%	52%
Controlled emissions (lb/mmBtu)	0.20	0.20	0.20
Emissions Reduction (tpy)	748	776	1,090
Capital Cost	$ 5,172,000	$ 5,341,000	$ 5,303,000
Capital Cost ($/kW)	$ 47	$ 49	$ 48
O&M Cost	$ 1,139,161	$ 1,259,307	$ 1,559,760
Annualized Cost	$ 1,627,362	$ 1,763,459	$ 2,060,326
Cost-Effectiveness ($/ton)	$ 2,176	$ 2,273	$ 1,891
Combustion Controls + SNCR Cost-benefit Analysis			
Control Efficiency	56%	56%	52%
Controlled Emissions (tpy)	917	1,001	986
Emissions Reduction (tpy)	1,145	1,278	1,081
Capital Cost	$ 6,772,000	$ 9,181,000	$ 9,143,000
Capital Cost ($/kW)	$ 62	$ 83	$ 83
O&M Cost	$ 1,139,161	$ 1,259,307	$ 1,559,760
Annualized Cost	$ 2,069,830	$ 2,205,928	$ 2,502,795
Cost-Effectiveness ($/ton)	$ 1,808	$ 1,726	$ 2,315

Table 6 compares critical values estimated by EPA and NPS. Our approach yielded "NPS" SNCR costs that were consistently much higher than "EPA" SNCR estimates.

Table 6. Reid Gardner NOx Control Incremental Cost-effectiveness Summary - EPA Revised Costs vs. NPS Costs

			Baseline		LNB+OFA	SNCR+LNB+OFA		
Unit	**Parameter**	**Units**	**EPA**	**NPS**	**EPA**	**EPA**	**EPA (1)**	**NPS**
Unit 1	Emission Rate	(tpy)	2,267	2,062	1,784	1,340	1,340	917
	Annual Heat Input	(MMBtu/yr)	9,818,313	9,174,894	9,818,313	9,818,313	9,818,313	9,174,894
	Removed	(tpy)	--	--	483	927	927	1,145
	Removal Rate	(%)	--	--	21.3%	40.9%	40.9%	55.5%
	Emission Factor	(lb/MMBtu)	0.462	0.450	0.363	0.273	0.273	0.200
	Annual Cost	($)			$491,140	$1,019,864	$1,384,513	$2,069,830
	Average Cost Effectiveness	($/ton)			$1,017	$1,100	$1,493	$1,808
	Incremental Cost Effectiveness	($/ton)				$1,191	$2,010	$2,386
	Previous ctrl technology					LNB+OFA	LNB+OFA	LNB+OFA
Unit 2	Emission Rate	(tpy)	2,445	2,279	1,866	1,401	1,401	1,001
	Annual Heat Input	(MMBtu/yr)	10,501,749	10,011,619	10,501,749	10,501,749	10,501,749	10,011,619
	Removed	(tpy)	--	--	579	1,044	1,044	1,278
	Removal Rate	(%)	--	--	23.7%	42.7%	42.7%	56.1%
	Emission Factor	(lb/MMBtu)	0.466	0.455	0.355	0.267	0.267	0.200
	Annual Cost	($)			$491,140	$1,042,273	$1,372,565	$2,205,928
	Average Cost Effectiveness	($/ton)			$848	$998	$1,315	$1,726
	Incremental Cost Effectiveness	($/ton)				$1,185	$1,895	$2,453
	Previous ctrl technology					LNB+OFA	LNB+OFA	LNB+OFA
Unit 3	Emission Rate	(tpy)	2,268	2,067	2,118	1,590	1,589	986
	Annual Heat Input	(MMBtu/yr)	10,063,851	9,860,464	10,063,851	10,063,851	10,063,851	9,860,464
	Removed	(tpy)	--	--	150	678	679	1,081
	Removal Rate	(%)	--	--	6.6%	29.9%	29.9%	52.3%
	Emission Factor	(lb/MMBtu)	0.451	0.419	0.421	0.316	0.316	0.200
	Annual Cost	($)			$491,140	$969,586	$1,472,850	$2,502,795
	Average Cost Effectiveness	($/ton)			$3,284	$1,430	$2,169	$2,315
	Incremental Cost Effectiveness	($/ton)				$906	$1,855	$2,159
	Previous ctrl technology					LNB+OFA	LNB+OFA	LNB+OFA

(1) NPS application of IPM using EPA emission rates for SNCR

To explore the reasons for these differences, we input EPA's heat and emission rates into our IPM SNCR workbooks and produced the results shown in the "EPA (1)" column above. Because our estimates of annual costs were still 30% - 50% higher than EPA, we compared operation and maintenance (O&M) costs in the following Table 7.

Table 7. SNCR O&M Cost Comparisons				
Unit	Unit #1	Unit #2	Unit #3	Comments
Controlled emissions (lb/mmBtu)	0.273	0.267	0.316	EPA assumption
Emissions Reduction (tpy)	444	465	528	EPA
Total O&M costs	$ 396,248	$ 418,657	$ 345,970	EPA
O&M Cost/ton	$ 893	$ 900	$ 655	calculated
Controlled emissions (lb/mmBtu)	0.273	0.267	0.316	EPA assumption
Emissions Reduction (tpy)	442	462	528	calculated
O&M Cost	$ 499,436	$ 488,338	$ 582,676	calculated by IPM
O&M Cost/ton	$ 1,131	$ 1,058	$ 1,103	calculated
Controlled emissions (lb/mmBtu)	0.20	0.20	0.20	EPA proposed BART limit
Emissions Reduction (tpy)	748	776	1,090	calculated
O&M Cost	$ 1,139,161	$ 1,259,307	$ 1,559,760	calculated by IPM
O&M Cost/ton	$ 1,523	$ 1,623	$ 1,432	calculated

The EPA and IPM cost estimates compared favorably when similar controlled emission rates and reductions were input. However, when we input the 0.20 lb/mmBtu proposed BART limits into IPM, we found that O&M costs were now more than double the estimates for the higher emission limits used by EPA to generate its cost estimates. For example, Table 8 below shows that EPA has significantly underestimated reagent cost/use (which is the primary component of the variable O&M costs for SNCR).

Table 8. Control Cost Comparison - LNB+OFA+SNCR

Cost Element	Unit #1				Unit #2				Unit #3			
	EPA		NPS (1)		EPA		NPS (1)		EPA		NPS (1)	
Subtotal, fixed O&M costs	$	207,500	$	110,136	$	207,500	$	111,696	$	207,500	$	111,348
Subtotal, variable costs	$	188,748	$	1,139,161	$	211,157	$	1,259,307	$	138,470	$	1,559,760
Total O&M costs	$	396,248	$	1,249,297	$	418,657	$	1,371,003	$	345,970	$	1,671,108
Reagent	$	151,080	$	1,135,206	$	169,985	$	1,254,935	$	98,612	$	1,554,345

(1) IPM at EPA emission rates

The primary advantage of SCR over SNCR is its more-efficient use of reagent due to the presence of the catalyst, as shown in Table 9, below. For a given amount of NO_X reduction, less reagent is needed by SCR than by SNCR. However, the EPA estimates of reagent cost/use do not reflect this.

Table 9. Control Cost Comparison - SCR+LNB+OFA

Cost Element	Unit #1				Unit #2				Unit #3			
	EPA		NPS (1)		EPA		NPS (1)		EPA		NPS (1)	
Subtotal, fixed O&M costs	$	330,000	$	408,761	$	330,000	$	408,577	$	330,000	$	410,386
Subtotal, variable costs	$	699,801	$	449,976	$	748,551	$	470,380	$	670,893	$	498,466
Total O&M costs	$	1,029,801	$	858,737	$	1,078,551	$	878,957	$	1,000,893	$	908,853
Reagent	$	301,192	$	215,086	$	326,816	$	225,093	$	257,830	$	256,152

(1) IPM at EPA emission rates

Where NPS use of IPM shows that SCR would use less reagent than SNCR (as is expected), the EPA reagent estimates for SCR are roughly double their estimates for SNCR. We conclude that the EPA SNCR cost estimates are not valid for the proposed BART limits. We are therefore presenting our cost estimates for the remaining SNCR and SCR BART options in Table 10.

Table 10. Reid Gardner NOx Control Effectiveness Summary - EPA vs. NPS Costs

			LNB+OFA+SNCR		SCR+LNB+OFA	
Unit No.	**Parameter**	**Units**	**EPA**	**NPS**	**EPA**	**NPS**
Unit 1	Emission Rate	(tpy)	1,340	917	417	229
	Removed	(tpy)	927	1,145	1,850	1,833
	Removal Rate	(%)	40.9%	55.5%	81.6%	88.9%
	Emission Factor	(lb/MMBtu)	0.273	0.200	0.085	0.050
	Annual Cost	($)	$1,019,864	$2,069,830	$3,903,494	$4,546,010
	Average Cost Effectiveness	($/ton)	$1,100	$1,808	$2,110	$2,480
	Incremental Cost Effectiveness	($/ton)	$1,191	$2,386	$4,534	$3,598
	Previous ctrl technology		LNB+OFA	LNB+OFA	ROFA+Rotamix	+SNCR
Unit 2	Emission Rate	(tpy)	1,401	1,001	436	250
	Removed	(tpy)	1,044	1,278	2,009	2,029
	Removal Rate	(%)	42.7%	56.1%	82.2%	89.0%
	Emission Factor	(lb/MMBtu)	0.267	0.200	0.083	0.050
	Annual Cost	($)	$1,042,273	$2,205,928	$3,952,244	$5,048,976
	Average Cost Effectiveness	($/ton)	$998	$1,726	$1,967	$2,489
	Incremental Cost Effectiveness	($/ton)	$1,185	$2,453	$4,330	$3,786
	Previous ctrl technology		LNB+OFA	LNB+OFA	ROFA+Rotamix	+SNCR
Unit 3	Emission Rate	(tpy)	1,590	986	493	247
	Removed	(tpy)	678	1,081	1,775	1,821
	Removal Rate	(%)	30%	52.3%	78%	88.1%
	Emission Factor	(lb/MMBtu)	0.316	0.200	0.098	0.050
	Annual Cost	($)	$969,586	$2,502,795	$3,874,586	$4,680,364
	Average Cost Effectiveness	($/ton)	$1,430	$2,315	$2,183	$2,571
	Incremental Cost Effectiveness	($/ton)	$906	$2,159	$2,756	$2,945
	Previous ctrl technology		LNB+OFA	LNB+OFA	ROFA+Rotamix	+SNCR

Although our approach yielded average SCR costs that were 16% - 28% higher than EPA's estimates, our incremental costs are 21% lower for Unit #1, 13% lower for Unit #2, and 7% higher for Unit #3.

SCR Visibility Benefits

<u>BART Control Option Emission Rates</u>

EPA R9 incorrectly assumed that "Baseline" visibility impacts are represented by modeling the NDEP baseline emission rates." According to NDEP, "To arrive at the level of performance for all three units, first we took the highest two consecutive years from the acid rain data for 2001 through 2007 and averaged them for each unit."[16] As a result, NDEP used maximum two-year averages from the 2001 – 2003 baseline period. While this may have been a reasonable approximation of baseline annual average emissions for use in estimating cost-effectiveness, it

[16] 3/14/12 e-mail form Mike Elges (NDEP) to Colleen McKaughan (EPA R9)

significantly underestimates the 2001 – 2003 24-hour maximum emission rates that should have been modeled for visibility impacts, as shown in Table 11, below. (SO_2 and PM emissions were also underestimated.) EPA also modeled WRAP emission rates, but did not consider them in its analysis.

Table 11. Comparison of Base Case NO_X Emission Rates

Unit ID	CAM Avg. NOx Rate (lb/MMBtu)	CAM NOx (lb/hr)	NDEP NOx (lb/mmBtu)	NDEP NOx (lb/hr)	WRAP NOx (lb/mmBtu)	WRAP NOx (lb/hr)
1	0.744	893	0.462	561	0.591	718
2	0.691	1,055	0.466	566	0.635	772
3	0.631	880	0.451	558	0.592	732

EPA modeled five Class I areas within 300 km. The results in Table 12 represent maximum impacts based upon the WRAP baseline emissions, and, as discussed above, underestimate the actual baseline impacts.

Table 12. Reid Gardner CALPUFF Visibility Modeling, EPA, 2012-03-09
Visibility Method 8, best 20% background

Class I Area	98th %ile Impact, dv
Bryce Canyon	0.27
Grand Canyon	0.80
Joshua Tree	0.60
Sycamore Canyon	0.16
Zion	0.46
Cumulative	2.28

Not only did EPA R9 model incorrect baseline emission rates, none of its modeling scenarios correctly estimates the 24-hour emissions that would result from the control options it evaluated. EPA R9 should have applied its estimated control efficiencies to the baseline 24-hour maximum emissions to estimate maximum 24-hour controlled emissions.[17] Instead, EPA R9 appears to have modeled its estimates for annual average emission rates (used to estimate annual costs) as if they represented 24-hour maxima. In Table 13 below we present an example of how EPA R9 should have estimated 24-hour maximum NO_X emissions.

[17] This is the approach used by EPA R8 in its analysis of the Colstrip power plant.

Table 13. 24-hour Maximum NO_X Emission Rates

Unit ID	CAM Avg. NOx Rate (lb/MMBtu)	CAM NOx (lb/hr)	Enhanced. LNB+OFA Reduction	Enhanced. LNB+OFA (lb/hr)	SNCR+LNB+ OFA Reduction	SNCR+LNB +OFA (lb/hr)	SCR+LNB+OFA Reduction	SCR+LNB+OFA (lb/hr)
1	0.744	893	21.3%	703	55.5%	397	88.9%	99
2	0.691	1,055	23.7%	805	56.1%	463	89.0%	116
3	0.631	880	6.6%	822	52.3%	420	88.1%	105

Because of these emission rate issues, we conclude that the EPA R9 analysis does not provide acceptable estimates of visibility impacts of any of the scenarios modeled.

Cumulative Impacts

Even though there are five Class I areas within 300 km of RGGS, EPA R9 only considered visibility impacts and improvements at one Class I area (Grand Canyon NP). Instead, it is appropriate to consider both the degree of visibility improvement in a given Class I area as well as the cumulative effects of improving visibility across all of the Class I areas affected. If reducing emissions from a BART source impacts multiple Class I areas, then a BART determination should incorporate those benefits. It is not justified to evaluate impacts at one Class I area, while ignoring others that are similarly significantly impaired by the BART source. If emissions from the BART source are reduced, the benefits will be spread well beyond only the most-impacted Class I area, and these benefits are an integral part of the BART determination.[18] The BART Guidelines attempt to create a workable approach to estimating visibility impairment. The Guidelines do not attempt to address the geographic extent of the impairment, but in effect assume that all Class I areas are created equal, i.e., widespread impacts in a large Class I area and isolated impacts in a small Class I area are given equal weight for BART determination purposes. To address the problem of geographic extent, we look at the cumulative impacts of a source on all Class I areas affected, as well as the cumulative benefits from reducing emissions. While there may be more sophisticated approaches to this problem, we believe that this is the most practical, given current modeling techniques and information available. EPA R6 took a similar position regarding its BART determination for the San Juan Generating Station (SJGS):

> We agree with the NPS and the USDA Forest Service on the utility of a cumulative visibility metric in addition to the other visibility metrics we utilized and we do not agree that our approach is inconsistent with BART guidelines. Our visibility modeling shows that a number of Class I areas are individually and significantly impacted by emissions from the SJGS. The number of days per year significantly impacted by the facility's NO_X emissions is expected to decrease drastically at each Class I area (Table 6-8 of the TSD) as the result of installation of NO_X BART emission controls at the SJGS. Clearly, the visibility benefits from NO_X BART emission reductions will be spread among all affected Class I areas, not only the most affected area, and should be considered in evaluation of benefits from proposed reductions.
>
> In fully considering the visibility benefits anticipated from the use of an available control technology as one of the factors in selection of NO_X BART, it is appropriate to account for visibility benefits across all affected Class I areas and the BART guidelines provide the flexibility to do so. One approach as noted above is to qualitatively consider, for example, the frequency, magnitude, and duration of impairment at each and all affected Class I areas. Where a source such as the SJGS significantly impacts so many Class I

[18] For example, the cumulative benefits have been a factor in the BART determinations by NM, OR, and WY, as well as EPA in its proposals for the Navajo Generating Station, SJGS, and the Four Corners Power Plant. EPA also sums impacts and benefits in proposing that the Clean Air Transport Rule is "better-than-BART."

areas on so many days, the cumulative `total dv' metric is one way to take magnitude of the impacts of the source into account.

We concluded that a quantitative analysis of visibility impacts and benefits at only the Mesa Verde area would not be sufficient to fully assess the impacts of controlling NOX emissions from the SJGS.

Again, nothing in the RHR suggests that a state (or EPA in issuing a FIP) should ignore the full extent of the visibility impacts and improvements from BART controls at multiple Class I areas. Given that the national goal of the program is to improve visibility at all Class I areas, it would be short-sighted to limit the evaluation of the visibility benefits of a control to only the most impacted Class I area. As noted previously, NMED and PNM's BART analyses also presented visibility impact and improvement projections at all 16 Class I areas. We believe such information is useful in quantifying the overall benefit of BART controls.[19]

In its October 26, 2010 letter to the Colorado Department of Public Health and Environment, EPA R8 states:

The visibility results section in each analysis only addresses visibility improvements at the most-impacted Class I area. Since visibility improvements are also likely at other nearby Class I Areas, the State needs to provide visibility modeling information for other Class I areas. This information will help inform the selection of BART.

Additionally, EPA R1 considered cumulative benefits in evaluating New Hampshire's regional haze plan.[20] And, EPA R2 also required a cumulative visibility analysis for the New York State Regional Haze SIP. EPA R2's analysis states,

In making BART determinations, EPA also recommends the consideration of cumulative impacts and improvements that could occur at all of the Class I areas a particular facility might impact. EPA's analysis of the cumulative visibility improvements at all 7 Class I areas justifies a more stringent BART emission limit.

Adjusted Modeling Results

Despite the problems we discussed above concerning the emission rates modeled by EPA, we attempted to use EPA's modeling results to gain some insight as to the cumulative visibility improvement that might be realized by the application of SCR. For example, comparison of EPA R9's estimates for the effectiveness of SCR+LNB+OFA compared to EPA R9's estimates for baseline emissions (Table 14, below) results in a reduction of 1,359 lb NO_x/hr. EPA R9 estimated that this would result in a total of 1.04 dv of improvement.

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[19] ENVIRONMENTAL PROTECTION AGENCY 40 CFR Part 52, EPA-R06-OAR-2010-0846; FRL-9451-1, Approval and Promulgation of Implementation Plans; New Mexico; Federal Implementation Plan for Interstate Transport of Pollution Affecting Visibility and Best Available Retrofit Technology Determination, AGENCY: Environmental Protection Agency (EPA). ACTION: Final rule. Federal Register / Vol. 76, No. 162 / Monday, August 22, 2011

[20] ENVIRONMENTAL PROTECTION AGENCY40 CFR Part 52, [EPA–R01–OAR–2008–0599; A–1–FRL–9639–1], Approval and Promulgation of Air Quality Implementation Plans; New Hampshire; Regional Haze AGENCY: Environmental Protection Agency, ACTION: Proposed rule., Federal Register /Vol. 77, No. 39 /Tuesday, February 28, 2012

Table 14. EPA Emission Estimates

Unit ID	Baseline NOx Rate (lb/MMBtu)	Baseline NOx (lb/hr)	SCR+LNB+OFA Reduction	SCR+LNB+OFA Reduction (lb/hr)	SCR+LNB+OFA (lb/hr)
1	0.462	561	81.6%	458	103
2	0.466	566	82.2%	465	101
3	0.451	558	78.2%	436	122
Totals		1,685		1,359	326

Our estimates of baseline and SCR+LNB+OFA emissions are shown in Table 15, below.

Table 15. NPS Emission Estimates

Unit ID	2001 - 2003 CAM Avg. NOx Rate (lb/MMBtu)	2001 - 2003 CAM NOx (lb/hr)	SCR+LNB+OFA Reduction	SCR+LNB+OFA Reduction (lb/hr)	SCR+LNB+OFA (lb/hr)
1	0.744	893	88.9%	794	99
2	0.691	1,055	89.0%	939	116
3	0.631	880	88.1%	775	105
Totals		2,828		2,508	320

The 2,508 lb NO_X/hr reductions estimated by NPS for SCR are 184% of the reductions estimated by EPA R9. Applying that ratio to the EPA model results produces a cumulative benefit of 1.92 dv in Table 16.

Table 16. Adjusted Reid Gardner CALPUFF Visibility Modeling, EPA, 2012-03-09

Visibility Method 8, best 20% background						Adjusted EPA Improvements	
Area	**scen**	**Scenario**	**Unit 1 NOx, lb/MMbtu**	**98th %ile Impact, dv**	**Visibility Change, dv**	Adjustment Factor	**Visibility Change, dv**
Bryce Canyon	c04	**Baseline NOx LNB+OFA**	0.462	**0.19**			
	c16	**SCR+LNB+OFA 0.06 lb/MMBtu**	0.06	**0.08**	**-0.11**	184%	-0.20
Grand Canyon	c04	**Baseline NOx LNB+OFA**	0.462	**0.59**			
	c16	**SCR+LNB+OFA 0.06 lb/MMBtu**	0.06	**0.20**	**-0.38**	184%	-0.70
Joshua Tree	c04	**Baseline NOx LNB+OFA**	0.462	**0.45**			
	c16	**SCR+LNB+OFA 0.06 lb/MMBtu**	0.06	**0.20**	**-0.25**	184%	-0.45
Sycamore Canyon	c04	**Baseline NOx LNB+OFA**	0.462	**0.11**			
	c16	**SCR+LNB+OFA 0.06 lb/MMBtu**	0.06	**0.05**	**-0.07**	184%	-0.12
Zion	c04	**Baseline NOx LNB+OFA**	0.462	**0.35**			
	c16	**SCR+LNB+OFA 0.06 lb/MMBtu**	0.06	**0.11**	**-0.24**	184%	-0.44
						Cumulative	-1.92

BART Determination

EPA R9 has determined that BART for RGGS is 0.20 lb/mmBtu on a 30-day rolling average and comments:

> Based on our revised cost estimates, we do not consider these average and incremental cost effectiveness values for SCR with LNB and OFA as cost prohibitive. Our analysis of this factor indicates that costs of compliance ($2000 - $2200/ton average $2700 - $4700/ton incremental) are not sufficiently large to warrant eliminating SCR from consideration.
>
> The incremental cost effectiveness values for Units 1 and 2 are around $4,500/ton. Although EPA does not consider this incremental cost prohibitive, we note that the State has certain discretion in weighing this cost. Because RGGS is not a facility over 750 megawatts and therefore not subject to EPA's presumptive BART limits, the State may exercise its discretion more broadly in this particular determination. [21]

We have shown that the upper end of the incremental cost range for SCR is significantly lower than estimated by EPA.

<u>Cost-Effectiveness Metrics</u>

BART is not necessarily the most cost-effective solution. Instead, it represents a broad consideration of technical, economic, energy, and environmental (including visibility improvement) factors. For example, Oregon DEQ established a cost/ton threshold of $7,300 based upon the premise that improving visibility in multiple Class I areas warrants a higher cost/ton than where only one Class I area is affected. In their BART proposal for the San Juan Generating Station, New Mexico used a range from $5,946/ton to $7,398/ton, and Wisconsin is using $7,000 - $10,000/ton as its BART threshold.[22] In its proposal to disapprove part of the North Dakota plan, EPA R8 stated:

> In our BART analysis for NOx at Milton R. Young Station 1, we considered SNCR + ASOFA and SCR + ASOFA...We have concluded that SNCR + ASOFA and SCR + ASOFA are both cost effective control technologies and that both would provide substantial visibility benefits. SNCR + ASOFA has a cost effectiveness value of $687 per ton. While SCR + ASOFA is more expensive than SNCR + ASOFA, it has a cost effectiveness value of $2,569 per ton of NOx emissions reduced. This is well within the range of values we have considered reasonable for BART and that states other than North Dakota have considered reasonable for BART. Even with more frequent catalyst replacement, SCR would still be cost effective even at the high end of the range ($2,783 per ton) allowing for the most frequent catalyst replacement of one layer per year and allowing for the questionable costs of lost power generation revenue in TESCR Scenario 4. We also analyzed the SCR costs assuming the same baseline emissions of 9,032 tons per year used by North Dakota and determined that the high-end cost effectiveness value, assuming the most frequent catalyst replacement frequency, would be about $3,115 per ton of NOx reduced. All of these cost effectiveness values are well within the range of values that North Dakota considered reasonable in several of its NOx BART determinations, where predicted visibility improvement was considerably lower.
>
> We have weighed costs against the anticipated visibility impacts at Milton R. Young Station 1, as modeled by Minnkota and the State. Both sets of controls would have a positive impact on visibility. As compared to SNCR + ASOFA, SCR + ASOFA would provide an additional visibility benefit 0.553 deciviews and 18

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[21] ENVIRONMENTAL PROTECTION AGENCY 40 CFR Part 52 [EPA–R09–OAR–2011–0130, FRL–9658–5] Approval and Promulgation of Air Quality Implementation Plans; State of Nevada; Regional Haze State and Federal Implementation Plans; BART Determination for Reid Gardner Generating Station AGENCY: Environmental Protection Agency (EPA). ACTION: Proposed rule. Federal Register / Vol. 77, No. 71 / Thursday, April 12, 2012

[22] "The Department used cost-per-ton reduced as the primary metric for determining the BART level of control. The upper limit for this metric was $7,000 to $10,000 per ton, which reflects historical low-end costs for controls required under BACT." BEST AVAILABLE RETROFIT TECHNOLOGY AT NON-EGU FACILITIES April 19, 2010, WISCONSIN DEPARTMENT OF NATURAL RESOURCES

fewer days above 0.5 deciviews at Theodore Roosevelt. We consider these impacts to be substantial, especially in light of the fact that neither of these Class I areas is projected to meet the uniform rate of progress. We also note that the 0.553 deciview improvement at Theodore Roosevelt is greater than the improvement in visibility that North Dakota found reasonable to support other NOx BART determinations in the SIP despite higher cost effectiveness values for the sources involved in these other BART determinations. Given the incremental visibility improvement associated with SCR + ASOFA, the relatively low incremental cost effectiveness between the two control options ($4,855 per ton), and the reasonable average cost effectiveness values for SCR + ASOFA, we propose that the NOx BART emission limit for Milton R. Young Station 1 should be based on SCR + ASOFA.[23]

Although EPA R8 subsequently decided not to disapprove the ND plan, its reason for changing its proposal for NO_X controls was due to issues of technical feasibility and EPA R8 did not change its determination that the costs cited above are "reasonable." Also, in its proposed Federal Implementation Plan for Montana, R8 determined that it was reasonable to spend $4,659/ton to control SO_2 and $4,415/ton for NO_X at the J.E. Corette power plant.[24]

In evaluating addition of SCR at the Four Corners Power Plant, EPA R9 stated:

EPA considers its revised cost-effectiveness estimates of $2,515 - $3,163/ton of NOx removed to be more accurate and representative of the actual cost of compliance. However, even if EPA had decided to accept APS's worst-case cost estimates of $4,887 – $6,170/ton of NOx removed, EPA considers that estimate to be cost effective for the purpose of proposing an 80% reduction in NOx, achievable by installing and operating SCR as BART at FCPP.[25]

EPA R6 agreed with our conclusion that $2,600/ton was a reasonable cost for adding SCR at SJGS:

We agree with the general contention that many individual cost items for the installation of SCR on the units of the SJGS were overestimated by PNM... We note that the NPS estimate of an average cost of $2,600/ton for the four units of the SJGS closely agrees with our own revised estimate.[26]

EPA has determined that costs as high as $6,170/ton are reasonable, while some states use even higher thresholds.

One of the options suggested by the BART Guidelines to evaluate cost-effectiveness is cost/deciview. We believe that visibility improvement must be a critical factor in any program designed to improve visibility. Compared to the typical control cost analysis in which estimates

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[23] ENVIRONMENTAL PROTECTION AGENCY 40 CFR Part 52 [EPA–R08–OAR–2010–0406; FRL–9461–7] Approval and Promulgation of Implementation Plans; North Dakota; Regional Haze State Implementation Plan; Federal Implementation Plan for Interstate Transport of Pollution Affecting Visibility and Regional Haze AGENCY: Environmental Protection Agency (EPA). ACTION: Proposed rule. Federal Register / Vol. 76, No. 183 / Wednesday, September 21, 2011

[24] EPA R8 determined that the visibility benefits of those controls were not sufficient.

[25] ENVIRONMENTAL PROTECTION AGENCY 40 CFR Part 49 [EPA–R09–OAR–2010–0683; FRL–9213–7] Source Specific Federal Implementation Plan for Implementing Best Available Retrofit Technology for Four Corners Power Plant: Navajo Nation AGENCY: Environmental Protection Agency (EPA). ACTION: Proposed rule. Federal Register / Vol. 75, No. 201 / Tuesday, October 19, 2010

[26] ENVIRONMENTAL PROTECTION AGENCY 40 CFR Part 52 EPA–R06–OAR–2010–0846; FRL–9451–1 Approval and Promulgation of Implementation Plans; New Mexico; Federal Implementation Plan for Interstate Transport of Pollution Affecting Visibility and Best Available Retrofit Technology Determination AGENCY: Environmental Protection Agency (EPA). ACTION: Final rule. Federal Register / Vol. 76, No. 162 / Monday, August 22, 2011

fall into the range of $2,000 - $10,000 per ton of pollutant removed, spending millions of dollars per deciview (dv) to improve visibility may appear extraordinarily expensive. However, our compilation[27] of BART analyses across the U.S. reveals that the **average cost per dv proposed by either a state or a BART source is $14 - $18 million,**[28] with a maximum of $51 million per dv proposed by South Dakota at the Big Stone power plant. We note that, even though it has no Class I areas, Nebraska DEQ has chosen $40 million/dv as a cost criterion, which is also above the national average.

We have estimated the total annual cost of SCR+LNB+OFA for all three BART units at $14.3 million, and the cumulative benefit is 1.92 dv. Our resulting $7.4 million/dv cost-effectiveness value is half the national average and well below the thresholds established by Nebraska, South Dakota and PacifiCorps.

Conclusions & Recommendations

- EPA R9 did not properly evaluate the costs or benefits of its proposed BART control option.
- EPA R9 has incorrectly estimated the cost-effectiveness of SCR by assuming that it can achieve annual average emission no lower than 0.083 – 0.98 lb/mmBtu, despite substantial evidence that SCR can achieve 0.05 lb/mmBtu (or lower) on an annual basis. EPA R9 also compared the costs and benefits of SCR to the ROFA+Rotamix® option which is no longer valid. We have demonstrated that addition of SCR on each RGGS unit costs less than $3,000/ton and that incremental costs are lower than estimated by EPA R9.
- EPA R9 has not conducted a proper visibility analysis due to the baseline and controlled emission rates used.
- EPA R9 did not consider the benefits of reducing impacts on visibility in Class I areas other than the most-impacted.
- EPA R9 has not provided to the public its criteria for making BART determinations. Instead, the reasoning EPA R9 appears to be using is inconsistent with EPA's BART Guidelines and the intent of the Regional Haze Rule.
- We have shown that SCR+LNB+OFA is cost-effective and should be determined to be BART for RGGS Units 1, 2, and 3.

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[27] http://www.wrapair.org/forums/ssjf/bart.html

[28] For example, PacifiCorp has stated in its BART analysis for its Dave Johnston Unit #4 that "The incremental cost effectiveness for Scenario 1 compared with the baseline is reasonable at $800,000 per day and $31.7 million per deciview."