NPS Comments
Salt River Project (SRP)'s Coronado Generating Station BART Analysis and
Determination

November 29, 2010

Process Description

Salt River Project (SRP) Coronado Generating Station (CGS) is located near St. Johns in Apache County and is comprised of two dry-turbo-fired Units 1 and 2 with a net rated output of 395 MW and 390 MW, respectively. Presumptive BART applies to these two units with total capacity greater than 750 MW. Of 1,228 plants, EPA Clean Air Markets (CAM) data for 2008 rank the Coronado facility #146 for SO_2 and #59 for NO_X. Of 3,558 EGUs, 2008 CAM data rank Coronado Units 1 and 2 at #298 and #300, respectively for SO_2, and #76 and #85 respectively for NO_X.

Despite the improper modeling methods applied by SRP and the resulting underestimations of impacts, the cumulative impacts of Coronado Units 1 and 2 across the 17 Class I areas modeled rank among highest of any facility we have evaluated under the BART program.

Consent Decree

On December 22, 2008, SRP and EPA entered into a Consent Decree which requires the implementation of the following pollution control projects for SO_2 and NO_x at SRP's CGS facility.
- Addition of Low-NO_X Burners (LNB) to Units 1 and 2 to reduce NO_x emissions to 0.32 lb/mmBtu by June 2011. Coupled with the burner additions, the furnace combustion air system on each Unit (ACC) will be modified.
- Addition of a Selective Catalytic Reduction (SCR) to Unit 2 by June 2014. The SCR will further reduce NO_x emissions from Unit 2 to 0.08 lb/mmBtu.
- Replacement of the existing wet limestone Flue Gas Desulfurization (WFGD) systems on Unit 1 and Unit 2 with new WFGD systems by January 2012 to reduce SO_2 emissions by 95% or to 0.08 lb/mmBtu.

BART for NO_x

Step 1: Identify the Existing Control Technologies in Use at the Source
ADEQ: NO_x emissions from both Units 1 and 2 are currently controlled by good combustion practices and overfire air. The resulting emission rate ranges from 0.45 to 0.50 lbs/MMBtu.

NPS: 2000 – 2008 CAM data show Units 1 and 2 averaged 0.41 & 0.44 lb/mmBtu, respectively.

Step 2: Identify All Available Retrofit Control Options
ADEQ: The alternative NO_x control technologies for limiting NO_x emissions from Unit 1 and Unit 2 are listed as follows:
- Advanced Combustion Control-Low NO_x burners (LNB) and over fire air (OFA)
- Selective non-catalytic reduction (SNCR)
- Selective catalytic reduction (SCR)

NPS: We agree with the suite of options.

Step 3: Eliminate All Technically Infeasible Control Options
ADEQ has determined that all of the above control technologies are feasible options for BART at CGS.

Step 4: Evaluate Control Effectiveness of Remaining Technologies
NPS: ADEQ selected LNB+OFA as BART at 0.32 lb/mmBtu with an estimated reduction of 26% for Unit 1.

ADEQ has included this statement (copied from the company BART analysis):

> SCR can achieve NO_x control efficiencies as high as 90% with inlet concentrations in the range of 300 to 400 ppmvd. If inlet NO_x concentrations are less than 250 ppmvd, SCR can achieve NO_x control efficiencies ranging from 70% to 80%.

This assertion is contrary to our understanding of SCR performance factors. (Please see our General BART Comments.) We suspect that ADEQ may have misunderstood because SCRs on lower concentration gas streams may have been designed to achieve lower removal efficiencies.[1] Our understanding is that SCR performance is primarily a function of catalyst temperature, volume, type, and area. It is unlikely that the NO_X concentration proposed as BART by ADEQ would present such a low concentration as to significantly reduce SCR removal efficiency. We request that ADEQ provide support for its contention.

Because SCR will be applied to Unit 2 as a result of the Consent Decree, we will confine the remainder of our comments to Unit 1.

For its cost-effectiveness analysis, ADEQ has estimated that LNB+OFA+SCR can achieve 0.08 lb/mmBtu on an annual basis,[2] which represents a 75% reduction by SCR from the emission rate to be achieved by LNB+OFA alone. It is generally assumed that

---

[1] However, as noted below in an excerpt from the EPA Control Cost manual, at very low inlet concentrations, removal efficiency may be lower:

> In general, higher uncontrolled NOx inlet concentrations result in higher NOx removal efficiencies due to reaction kinetics. However, NOx levels higher than approximately 150 parts per million (ppm), generally do not result in increased performance. Low NOx inlet levels result in decreased NOx removal efficiencies because the reaction rates are slower, particularly in the last layer of catalyst.

[2] ADEQ appears to have assumed that SCR would achieve 0.07 lb/mmBtu regardless of averaging time. While we agree that 0.07 lb/mmBtu is a reasonable estimate for input into a visibility model that requires a 24-hour emission rate, it is always the case that average emission rates decrease as the averaging period increases. The data we present in our General BART Comments indicate that, if SCR can achieve 0.08 lb/mmBtu on a 24-hour basis, it is likely that that same SCR is achieving 0.06 lb/mmBtu (or lower) on a 30-day average basis and 0.05 lb/mmBtu (or lower) on an annual average.

SCR can achieve at least 90% NO$_X$ reduction, and we conclude that ADEQ has underestimated the ability of a modern SCR retrofit to reduce NO$_X$ emissions. Because such an underestimate adversely affects the cost-benefit analysis, we conducted our analysis as discussed in our General BART Comments and below.

Step 5: Evaluate the Energy and Non-Air Quality Environmental Impacts and Document Results

Non-Air Quality Environmental Impacts

ADEQ: SNCR and SCR installation could impact the salability and disposal of fly ash due to ammonia levels. Other environmental impacts involve the potential public and employee safety hazard associated with the storage of ammonia, especially anhydrous ammonia, and the transportation of the ammonia to the power plant site.

NPS: Please see our General BART Comments.

Economic Impacts

NPS: A critical cost element is the Total Capital Investment (TCI) upon which much of the EPA Cost Manual method is based. As discussed in our General BART Comments, SCR costs can be expected to fall between $50 and $300/kW, with the recent average at slightly below $200/kW. In this context, the SRP estimate of $167/kW appears reasonable.

Annual Cost estimates are generated by a direct application of the Cost Manual method to the new TCI and other interim values. We applied the Cost Manual method and found that SRP's Annual Cost estimates are also reasonable.

We concur with ADEQ's estimated $1,021/ton for combustion controls plus SCR.

Step 6: Evaluate Visibility Impacts

NPS: Because SRP used background ammonia levels that are unacceptably low (Appendix A Table A-2 of the company report), the visibility benefits are under-estimated and the Evaluation of Visibility Impacts step is unacceptable.

Step 7: Select BART

ADEQ: After reviewing the BART analysis provided by the company, and based upon the information above, ADEQ has determined that BART control at CGS for NO$_x$ is ACC (Low NO$_x$ burners with OFA) with an associated NO$_x$ emission rate of 0.32 lbs/MMBtu on 30-day rolling average basis.

NPS: Because of the improper visibility modeling analysis noted above, ADEQ has not conducted a valid five-factor BART analysis. However, based upon the relatively low

cost/ton for SCR and the magnitude and extent of the visibility impacts, it is likely that a proper evaluation of costs and visibility benefits across the 17 impacted Class I areas would conclude that SCR is BART.

ADEQ estimates that SCR would cost less than $1,100/ton, which is less than EPA assumed for presumptive BART costs. BART, like BACT, is not necessarily the most-cost-effective option. Instead, it is typically chosen based upon a comparison to options selected by other regulatory agencies in similar situations. For example, Oregon DEQ has 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, Colorado is using $5,000/ton as a non-binding "guidepost," and Wisconsin is using $7,000 - $10,000/ton as its BART threshold.[3] Because BART is the best option that meets the selection criteria, SCR should be selected as BART due to the reasonable cost/ton and lower-than-average cost/deciview.

PM_{10} BART

Step 1: Identify the Existing Control Technologies in Use at the Source

PM_{10} emissions from the facility are currently controlled through the use of a hot-side ESP.

Steps 2-6: Streamlined Review

ADEQ: SRP's BART analysis for PM_{10} was limited to a statement that the current emission levels associated with the existing controls at the Coronado Generating Station range from 0.01 to 0.03 lb/MMBtu. As noted in Section X, PM_{10} BART for similar emissions units with similar emissions controls was determined to be 0.03 lb/MMBtu. Since SRP's CGS is already meeting or exceeding the stringency of the emissions limitation, further analysis was determined to be unnecessary.

NPS: ADEQ's contention that its proposed 0.03 lb/mmBtu BART limit "is already meeting or exceeding the stringency of the emissions limitation" "for similar emissions units with similar emissions controls" is not consistent with its Cholla BART analysis which concluded that replacement of the existing hot-side ESPs with fabric filters at 0.015 lb/mmBtu is BART.

Step 7: Select BART

ADEQ: After reviewing the analysis provided by SRP, and the information presented

---

[3] "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

above, ADEQ has determined that BART for PM_{10} from Units 1 and 2 is no further control, and an emissions limitation of 0.03 lb/MMBtu.

NPS: ADEQ did not conduct the necessary five-step BART anaysis.

SO_2 BART

Step 1: Identify the Existing Control Technologies in Use at the Source

SO_2 emissions are currently controlled with the use of low-sulfur coal and partial wet flue gas desulfurization. The resulting emission rate ranges from 0.6 to 0.7 lbs/MMBtu.

Step 2: Identify All Available Retrofit Control Options

Following control options are available for control of SO_2.

- Wet Flue Gas Desulfurization
- Spray Dryer Absorber
- Dry Sorbent Injection

Step 3: Eliminate All Technically Infeasible Control Options

ADEQ has determined that all of the referenced control technologies are technically feasible.

Step 4: Evaluate Control Effectiveness of Remaining Technologies

ADEQ: SRP and EPA's consent decree stipulates the installation of WFGDs for both the units. WFGD is the most effective control technology available for controlling SO_2 emissions. Since SRP is committing to the WFGD technology, other control technologies are not evaluated from this point forward in the BART analysis.

Step 5: Evaluate the Energy and Non-Air Quality Environmental Impacts and Document Results

Costs of Compliance

ADEQ: Based on the vendor data on the capital cost and operation & maintenance cost for different control options, Table 9 provides the information on the annual costs associated with each of the control options.

Table 9: Total Capital and Annual Costs associated with SO_2 Controls

Control Option	Control Technology	Total Capital Cost	Fixed Capital Cost	Annual O&M	Total Annualized Cost
1	Baseline- Partial FGD	--	--	--	--

2	WFGD	$347,000,000	$32,753,330	$11,600,000	$44,353,330

* Fixed capital cost calculation is based on a Capital Recovery Factor (CRF) of 0.09439, assuming an interest rate of 7%, and amortization period of 20 years.

Table 10 provides annual estimated emission numbers for SO_2 and cost figures relating to the implementation of WFGDs.

Table 10: Total Annual Emissions of SO_2 and cost of reduction with WFGD

	Baseline, Option 1	**Option 2, WFGD**
Unit 1	14,556 tpy	1,909 tpy
Unit 2	14,828 tpy	1,722 tpy
Total (Both Units)	29,384 tpy	3,631 tpy
Reduction from Baseline	-	25,753 tpy
Annualized Cost	-	$ 44,353,330
Cost of reduction ($ per ton)	-	$1,722

Step 6: Evaluate Visibility Impacts

ADEQ: The new WFGD control scenario was modeled for each meteorological year (2001-2003) and for all 17 Class I areas within 300 km. The modeling result indicates that the installation of a WFGD will provide for significant visibility benefit. The highest visibility improvement will occur at the Petrified National Forest where an improvement of 1.38 Δdv is expected.

Table 11 provides information on annualized cost and the cost in dollars per deciview average improvement in visibility achieved by implementing the control option.

Table 11: Summary for SO_2 BART

	Option 1, Baseline	**Option 2, WFGD**
Reduction in Emission (tpy)	-	25,753
Annualized Cost	-	$44,353,330
Visibility index (dv)	2.66	1.28
Improvement in Visibility Index (dv)	-	1.38
Incremental Cost Effectiveness ($ per dv)	-	$32,140,094

NPS: Because SRP used background ammonia levels that are unacceptably low (Appendix A Table A-2 of the company report), the visibility benefits are under-estimated and the Evaluation of Visibility Impacts step is unacceptable.

Step 7: Select BART

ADEQ: Based on its review of the company's analysis and the information above, the Department accepts SRP's recommended BART control of WFGDs for both units with an associated SO_2 emission rate of 0.08 lbs/MMBtu on 30-day rolling average basis.

NPS: We concur and note that ADEQ has accepted the WFGD option at $1,722/ton and $32.1 million/dv.