Please describe the regulatory history of the BART Rule.

In 1999, the EPA published a final rule to address a type of visibility impairment known as regional haze.\(^1\) This rule requires States to submit state implementation plans (SIPs) to address regional haze visibility impairment in 156 Federally-protected parks and wilderness areas. The 1999 rule was issued to fulfill a long-standing EPA commitment to address regional haze under the authority and requirements of sections 169A and 169B of the Clean Air Act (CAA).\(^2\)

As required by the CAA, the EPA included in the final regional haze rule a requirement for Best Available Retrofit Technology (BART) for certain large stationary sources. The regulatory requirements for BART were codified at 40 CFR § 50.308(e) and in definitions that appear in 40 CFR § 50.301.

The BART-eligible sources are those sources which (1) have the potential to emit 250 tons per year or more of a visibility impairing air pollutant, (2) were put in place between August 7, 1962 and August 7, 1977, (3) and whose operations fall within one or more of 26 specifically listed source categories.\(^3\) Under the CAA, BART is required for any BART-eligible source which a State determines “emits any air pollutant which may reasonably be anticipated to cause or contribute to any impairment of visibility in any such area.”\(^4\) Accordingly, for stationary sources meeting these criteria, States must address the BART requirement when they develop their regional haze SIPs.

The EPA published a second Regional Haze rulemaking on June 6, 2005\(^5\) that made changes to the Final Rule published July 1, 1999. This second rulemaking was in response to a U.S. District

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\(^1\) 64 Fed. Reg. 35714, July 1, 1999.
\(^2\) 42 U.S.C. §§ 7491 & 7492.
\(^3\) 42 U.S.C. § 7491 (g)(7).
Court of Appeals ruling that vacated part of the regional haze rule. The June 6, 2005 Final Rule (1) required the BART analysis to include an analysis of the degree of visibility improvement resulting from the use of control technology at BART-subject sources; (2) revised the BART provisions; (3) included new BART Guidelines contained in a new Appendix Y to Part 51 (Guidelines); and (4) added the requirement that States use the Guidelines for determining BART at certain large electrical generating units (EGUs).

The guidelines are designed to help States and others (1) identify those sources that must comply with the BART requirement, and (2) determine the level of control technology that represents BART for each source.

The Guidelines also contained specific presumptive limits for SO2 and NOx for certain large EGUs based on fuel type, unit size, cost effectiveness, and presence or absence of pre-existing controls. For NOx emissions, the EPA directs states to generally require owners and operators to meet the presumptive limits at coal-fired EGUs greater than 200 MW with a total facility-wide generating capacity greater than 750 MW. The presumptive limits for NOx are based on coal type, boiler type and whether SCR or SNCR are already installed at the source.

Was PNM required to perform the BART analysis in accordance with Guidelines?

Yes, BART must be determined for fossil-fuel fired generating plants having a total generating capacity in excess of 750 megawatts pursuant to the Guidelines. Because the San Juan Generating Station is a fossil-fuel fired generating plant having a total generating capacity in excess of 750 megawatts, BART must be determined in accordance with the Guidelines.

How did NMED determine which sources are subject to the BART rule?

Section II of the Guidelines prescribes how to identify BART-eligible sources. States are required to identify those sources that satisfy the following criteria: (1) sources that fall within the 26 listed source categories as listed in the CAA, (2) sources that were “in existence” on August 7, 1977 but were not “in operation” before August 7, 1962, and (3) sources that have a current potential to emit that is greater than 250 tons per year of any single visibility impairing pollutant.

In May 2006, the New Mexico Environment Department, Air Quality Bureau (Department) conducted an internal review of sources potentially subject to the BART rule. New Mexico identified 11 sources as BART-eligible sources as part of this review.

The Guidelines then prescribe to the states how to identify those sources that are subject to BART. At this point, states are directed to either (1) make BART determinations for all BART-eligible sources, or (2) to consider exempting some of the sources from BART because they may

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6 American Corn Growers Association v. EPA, 291 F.3d 1 (DC Cir. 2002).
7 See 40 CFR § 51.308(e)(1)(ii)(A).
not reasonably be anticipated to cause or contribute to any visibility impairment in a Class I area. New Mexico opted to perform an initial screening model on each of these BART-eligible sources to determine whether each source did cause or contribute to any visibility impairment. The Guidelines direct States that if the analysis shows that an individual source or group of sources is not reasonably anticipated to cause or contribute to any visibility impairment in a Class I area, then the States do not need to make a BART determination for that source or group of sources.

The Western Regional Air Partnership (WRAP) performed the initial BART modeling for the state of New Mexico.

The basic assumptions in the WRAP BART CALMET/CALPUFF modeling used for New Mexico are as follows:

2. Visibility impacts due to emissions of SO2, NOx and primary PM emissions were calculated. PM emissions were modeled as PM2.5.
3. Visibility was calculated using the Original Interagency Monitoring of Protected Visual Environments (IMPROVE) equation and Annual Average Natural Conditions.

Initial modeling was performed for the 11 source complexes in New Mexico to estimate visibility impacts from the sources’ SO2, NOx, and PM emissions. Then for those sources whose 98th percentile visibility impacts at any Class I area due to their combined SO2, NOx, and PM emissions exceeded the 0.5 dv significance threshold, the separate contribution to visibility at Class I areas was assessed for SO2 alone (modeled as SO4), NOx alone (modeled as NO3), PM alone (modeled as PMF) and combined NOx plus PM emissions (modeled as NO3 + PMF).

Of the 11 source complexes analyzed, only one source complex’s visibility impacts at any Class I area due to combined SO2, NOx, and PM emissions exceeded the 0.5 dv threshold (PNM San Juan Generating Station Boilers #1-4). Of the 10 other source complexes, none exceed a 0.33 dv impact. Consequently, only the PNM San Juan Boilers #1-4 were subject to the additional analysis of determining the pollutant-specific contribution...

On November 9, 2006, the Department informed PNM that the modeling performed by the WRAP indicated the visibility impairment from the San Juan Generating Station (SJGS) was over the 0.5 dv threshold, and was therefore subject to a BART analysis. In response, Black & Veatch (B&V), on behalf of PNM, submitted the BART Modeling Protocol document which described the CALPUFF modeling methodology to be used as part of the BART engineering evaluation for Units 1-4 at the SJGS.

When did PNM submit the BART analysis for the SJGS?

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8 See 70 Fed. Reg. at 39161.
PNM submitted the BART analysis for the SJGS to the Department on June 6, 2007.

How was the BART analysis structured?

The BART analysis was performed in two stages. First, a BART analysis was performed for the consent decree technologies being implemented at the SJGS. On March 5, 2005, PNM entered into a consent decree with the Grand Canyon Trust, the Sierra Club, and the Department to settle alleged violations of the CAA. The consent decree required PNM to meet a PM average emission rate of 0.015 pounds per million British thermal units (lb/MMbtu) (measured using EPA Reference Method 5), and a 0.30 lb/MMbtu emission rate for NOx (daily rolling, thirty day average), for each of Units 1, 2, 3, and 4. As a result, PNM has installed new Low NOx burners (LNB) with overfire air (OFA) ports and a neural network (NN) system to reduce NOx emissions, and pulse jet fabric filters (PJFF) to reduce the PM emissions.

In the second stage of the BART analysis, additional control technology alternatives to the consent decree technologies were identified and evaluated. To determine the visibility improvements from both the consent decree technology upgrades and additional control technology, the Department determined it was appropriate to review both pre-consent decree to consent decree visibility improvement and improvement projected from consent decree plus additional control technologies.

Did PNM follow the 5 Step process in their preparation of the BART analysis?

Yes, PNM followed the 5 Step Process in the SJGS BART Analysis.

What are the five steps?

The five steps are:

Step 1 – Identify All Available Retrofit Control Technologies
Step 2 – Eliminate Technically Infeasible Options
Step 3 – Evaluate Control Effectiveness of Remaining Control Technologies
Step 4 – Evaluate Impacts and Document the Results
   a) Costs of Compliance
   b) Energy Impacts
   c) Air quality environmental impacts
   d) Non-air environmental impacts
   e) Remaining useful life
Step 5 – Evaluate Visibility Impacts

Did PNM submit updates to the original BART analysis?

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9 Grand Canyon Trust v. Pub. Serv. Co. of New Mexico, No. CV 02-552 BB/ACT (ACE), (D. N.M. 2005)
10 See 70 Fed. Reg. at 39164.
Yes, PNM submitted multiple updates to the original analysis.

Would you provide an overview of each of those additional submittals?

On November 6, 2007, PNM submitted additional modeling analyses to provide SJGS plant-wide regional haze visibility impacts at 16 Class I areas. The analysis was based on refinements which included using the nitrate repartitioning methodology and monthly variable background ammonia concentrations. The NOx control technologies analyzed were the SCR and SNCR/SCR Hybrid.

On March 29, 2008, PNM submitted an additional discussion of cost estimation methods used to determine costs of SCR installation and a discussion of Nalco Mobotec ROFA and Rotamix technology.

On March 31, 2008, PNM submitted two additional modeling analyses to provide SJGS plant-wide and unit specific regional haze visibility impacts at 16 Class I areas for the SCR NOx control technology only. One of the analyses, believed by PNM to be the more representative of ammonia chemistry of the area, was based on the November 6, 2007 refinements which included using nitrate repartitioning methodology and monthly variable background ammonia concentrations. The other analysis included nitrate repartitioning and a constant background ammonia concentration as requested by the Department.

On May 30, 2008, PNM submitted two additional modeling analyses to provide SJGS plant-wide and unit specific regional haze visibility impacts at 16 Class I areas for the SNCR NOx control technology only. Similar to the March 31, 2008 analyses, one of the analyses was based on the November 6, 2007 refinements which included using nitrate repartitioning methodology and monthly variable background ammonia concentrations. The other analysis used nitrate repartitioning methodology and constant background ammonia concentration. It should be noted that PNM modeled all variants of SNCR together (including Fuel Tech and Nalco Mobotec) as one technology called SNCR. This is the same approach that is used for modeling SCR control technology, where all variants are modeled generically as SCR.

At the request of the Department, PNM and B&V also provided a five-factor BART analysis for SNCR technology and a discussion of coal characteristics of the coal burned at the SJGS.

On August 29, 2008, PNM submitted three additional modeling analyses to provide SJGS plant-wide and unit specific regional haze visibility impacts at 16 Class I areas for the ROFA with Rotamix, Rotamix, ROFA, and WESP PM control technologies (the NCx and PM analyses were submitted separately). Similar to the May 30, 2008 analyses, these analyses were also based on the November 6, 2007 refinements which included using the nitrate repartitioning methodology and monthly variable background ammonia concentrations.
At the request of the Department, PNM and B&V also provided a five-factor BART analysis of Nalco Mobotec control technology, including ROFA, Rotamix and ROFA/Rotamix and a five-factor BART analysis of additional PM control technology.

On March 16, 2009, PNM submitted four additional modeling analyses to provide SJGS plant-wide and unit specific regional haze visibility impacts at 16 Class I areas. These include SCR technology, SCR/SNCR Hybrid technology; SCR technology with sorbent injection; and SCR/SNCR Hybrid technology with sorbent injection. As requested by the Department, for each of these cases, the modeling also took into consideration inherent SO3 removal of the SO3 formed from the catalyst oxidation of SO2 to SO3.

On February 15, 2011, PNM submitted a revised analysis of SNCR technology after PNM received a lower vendor-guaranteed emission rate from Fuel Tech, a vendor of SNCR technology. The analysis also included updated cost estimates for SCR, SNCR/SCR Hybrid, ROFA/Rotamix, Rotamix (SNCR), ROFA, and SNCR (Fuel Tech) technologies. The Department did not review the updated cost analyses for these control technologies and does not necessarily agree with the new cost-estimates supplied in the analysis.

The February 2011 submittal further included a ratepayer impact analysis which estimated the cost impact to residential ratepayers from installation of SNCR and SCR technologies.

One modeling analysis was performed to provide SJGS plant-wide and unit specific regional haze visibility impacts at 16 Class I areas assuming the revised SNCR control technology on all four units.

**Did PNM include all Available Retrofit Emissions Control Technologies in Step 1 of the BART analysis?**

Yes, the Department found that PNM included a complete list of all available control technologies.

**What are the strategies for reducing NOx and PM emissions from power plants?**

The main strategies for reducing NOx emissions take two forms: 1) modification to the combustion process to control fuel and air mixing and reduce flame temperatures, and 2) post-combustion treatment of the flue gas to remove NOx.

Particulate matter emissions can only be controlled by post-combustion control technologies.

**What specific control technologies did PNM include in Step 1?**

1) Low NOx Burners, Overfire Air, and Neural Network

Low NOx burners slow and control the rate of fuel and air mixing, thereby reducing the oxygen availability in the ignition and main combustion zones. Overfire Air uses low excess air levels in the primary combustion zone with the remaining (overfire) air added
higher in the furnace to complete combustion. Neural Network provides improvements in the heat rate and reduce combustion-related emissions by fine-tuning the combustion process.

2) Selective Non Catalytic Reduction (SNCR)
SNCR is based on the chemical reduction of the NO molecule into molecular nitrogen and water vapor. A nitrogen based reducing agent (reagent), such as ammonia or urea, is injected into the post combustion flue gas. The reduction with NO is favored over other chemical reaction processes at temperatures ranging between 1600F and 2100F (870C to 1150C), therefore, it is considered a selective chemical process.

3) Selective Catalytic Reduction (SCR)
The SCR process chemically reduces the NO molecule into molecular nitrogen and water vapor in the presence of a reducing catalyst. A nitrogen based reducing reagent such as ammonia or urea is injected into the ductwork, downstream of the combustion unit. The waste gas mixes with the reagent and enters a reactor module containing catalyst. The hot flue gas and reagent diffuse through the catalyst. The reagent reacts selectively with the NO within a specific temperature range and in the presence of the catalyst and excess oxygen.

SCR plus Sorbent Injection
Sorbent injection removes SO3 in the flue gas by reaction of the SO3 with an alkaline sorbent material to form a particulate that is subsequently removed in a particulate control device. The alkaline material injected can be a magnesium, sodium, or calcium-based sorbent. The injection points for the reagents may vary. For this analysis, hydrated lime was selected.

4) SNCR/SCR Hybrid
The SNCR/SCR hybrid systems use components and operating characteristics of both SNCR and SCR systems. Hybrid systems were developed to combine the low capital cost and high ammonia slip associated with SNCR systems with the high reduction potential and low ammonia slip inherent in the catalyst of SCR systems.

SNCR/SCR Hybrid plus Sorbent Injection
Sorbent injection removes SO3 in the flue gas by reaction of the SO3 with an alkaline sorbent material to form a particulate that is subsequently removed in a particulate control device. The alkaline material injected can be a magnesium, sodium, or calcium-based sorbent. The injection points for the reagents may vary. For this analysis, hydrated lime was selected.

5) Gas Reburn
The gas reburn process combusts auxiliary natural gas, along with coal, in the boiler.
Three separate combustion zones in the boiler are manipulated to reduce NOx emissions.
6) Nalco Mobotec ROFA and Rotamix
ROFA and Rotamix are proprietary control technologies developed by Nalco Mobotec.
ROFA, or Rotating Opposed Firing Air, is a modified overfire air technology that utilizes rotation of flue gases and turbulent mixing to reduce NOx emissions. Rotamix is a version of SNCR technology and operates under the same principles as other SNCR technology.

7) NOxStar
NOxStar is the trademarked name for a NOx control technology that involves the injection of ammonia and a hydrocarbon (typically natural gas) into the flue gas path of a coal-fired boiler at around 1600F to 1800F for the reduction of NOx.

8) ECOTUBE
The ECOTUBE system utilizes retractable lance tubes that penetrate the boiler above the primary combustion burner zone and inject high-velocity air as well as reagents. The lance tubes work to create turbulent airflow and to increase the residence time for the air/fuel mixture. In principle, the OFA and SNCR processes are combined in this technology.

9) PowerSpan ECO
The PowerSpan ECO system is a multi-pollutant technology with limited experience. The PowerSpan 5ECO system is located downstream of an existing particulate control device and treats the power plant’s flue gas in three process steps to achieve multi-pollutant removal of sulfur dioxide (SO2), nitrogen oxides (NOX), oxidized mercury, and fine particulate matter.

10) Phenix Clean Combustion
Phenix Clean Combustion System is an advanced hybrid coal gasification/combustion process that prevents the formation of NOx and SO2 emissions when burning coal.

11) e-SCRUB
The e-SCRUB process is similar to the PowerSpan technology in that it uses an energy source to oxidize pollutants in the flue gas. However, there are some variations in the oxidation energy source and the byproduct recovery systems.

PM Control Technologies

1) Flue Gas Conditioning with Hot-Side ESP
Flue gas conditioning improves the collection efficiency of particulate matter in the ESP. Flue gas leaving the air heater into the ESP can be conditioned by addition of ionic compounds, such as SO3 or ammonia. These compounds combine with the moisture in the flue gas and are deposited on the surface of the fly ash particles. This will increase the conductivity of the fly ash and make it more suitable for capture.
2) Pulse Jet Fabric Filter (PJFF)
In PJFFs, the flue gas typically enters the compartment hopper and passes from the outside of the bag to the inside of the bag, depositing particulate on the outside of the bag. To prevent collapse of the bag, a metal cage is installed on the inside of the bag. The flue gas passes up through the center of the bag into the output plenum. Cleaning is performed by initiating a downward pulse of air into the top of the bag. The pulse causes a ripple effect along the length of the bag. This releases the dust cake from the bag’s exterior surface, allowing the dust to fall into the hopper.

3) Compact Hybrid Particulate Collector
A variant of the PJFF is the compact hybrid particulate collector. This is a high air to cloth (A/C) ratio fabric filter installed downstream of existing particulate collection devices where the majority of PM has been removed.

4) Max-9 Electrostatic Fabric Filter
The Max-9 filter is essentially a high-efficiency PJFF utilizing a discharge electrode as in an ESP. However, there are no collector plates. When the dust particles are charged, they are attracted to the grounded metal cage inside the filter element, just as they would be attracted to the collecting plates in an ordinary precipitator.

During the Department review of available PM control technologies, the Department requested PNM to perform a complete five-factor BART analysis on Wet Electrostatic Precipitator (WESP). The Department believes this technology should have been identified as technically feasible in Step 1 of the PM BART analysis. PNM performed a complete five-factor BART analysis on WESP and PJFF and submitted report in a subsequent submittal dated August 28, 2008.

Did PNM Propose to Eliminate any Control Technologies as Technically Infeasible In Step 2 of the BART Analysis?

Yes, PNM excluded several of the identified NOx and PM controls due to technical infeasibility.

Which specific technologies did PNM Propose to Eliminate?

1) Selective Non Catalytic Reduction
PNM determined in its submittal of June 6, 2007 that SNCR technology was technically infeasible because the technology was unable to meet the presumptive limits for NOx; determined by EPA to be 0.23 lb NOx/MMbtu for dry bottom, wall-fired boilers burning sub-bituminous coal. A vendor estimated that the technology could only achieve 0.24 lb NOx/MMbtu. In order for the technology to achieve the presumptive limit, PNM stated that ammonia slip limit would need to be raised from 5 ppm to 10 ppm, and that this higher ammonia slip posed additional operational problems.
The Department did not agree with PNM’s assertion that because SNCR could not meet the presumptive limits the technology should be eliminated as technically infeasible. Therefore the Department requested PNM to perform the complete 5-factor BART analysis required by the Guidelines on SNCR. PNM submitted the five-factor analysis of SNCR in a subsequent submittal dated May 30, 2008 and an updated analysis of Fuel Tech’s SNCR on February 11, 2011.

2) Natural Gas Reburn
PNM determined that the current boiler space inhibits sufficient residence time for the natural gas reburn zone. The Department accepts PNM’s elimination of this technology due to space limitations.

3) NalcoMobotec ROFA and Rotamix
PNM determined the Rotamix technology was technically infeasible due to limited application at coal-fired boilers equivalent to the size of Units 1-4 at SJGS. PNM determined ROFA technology was technically infeasible because ROFA is a variant of OFA, which at the time was being installed at Units 1-4 at SJGS.

The Department did not agree with PNM’s position that Rotamix has limited application at coal-fired boilers equivalent the size of Units 1-4 at SJGS. The Department did not agree that because ROFA is a variant of OFA, the technology can be eliminated as technically infeasible. Therefore the Department requested PNM perform the complete 5-factor analysis for ROFA and Rotamix. PNM performed the analyses and submitted them in two subsequent submittals dated March 29, 2008 and August 29, 2008.

4) NOxStar
NOxStar currently has only one major installation in the US. In addition, PNM stated that in recent discussions the supplier has identified limited ability and willingness to market the commercial technology. The Department agrees that this technology has limited application to large coal-fired boilers and is not technically feasible.

5) ECOTUBE
The ECOTUBE technology has been demonstrated on industrial/small boilers firing sold waste, wood, and biomass. ECOTUBE has limited application to boilers similar to Units 1-4 at the SJGS. The Department agrees that this technology has limited application to large coal-fired boilers and is not technically feasible.

6) PowerSpan
PowerSpan has not been demonstrated on large boilers, such as Units 1-4 at SJGS. The Department agrees that this technology has limited application to large coal-fired boilers and is not technically feasible.

7) Phenix Clean Combustion
PNM determined that the Phenix Clean Combustion system is still in the demonstration and testing stage, and there are no commercial retrofits at facilities similar to SJGS. The Department agrees that this technology has no demonstrated application to the source type and is not technically feasible.

8) e-SCRUB
PNM determined that the e-SCRUB technology has only one known medium scale installation with limited data. The Department agrees that the technology should be considered technically infeasible due to limited demonstrated applications.

PNM excluded the following PM control technologies as technically infeasible:

1) Flue Gas Conditioning with Hot-Side ESP
Flue gas conditioning does improve collection efficiencies, but will not achieve an emission limit lower than the current PM limit in their air quality permit. The Department agrees that flue gas conditioning control technology should not be considered in the BART analysis. Because the vendor was unable to guarantee a lower emission rate, the technology does not need to undergo the three additional factors of the five factor analysis.

2) Compact Hybrid Particulate Collector
The compact hybrid particulate collector does not provide a performance guarantee lower than the current permitted limit for PM. The Department agrees that the compact hybrid PM control technology should not be considered in the BART analysis. Because the vendor was unable to guarantee a lower emission rate, the technology does not need to undergo the three additional factors of the five factor analysis.

3) Max-9 Electrostatic Fabric Filter
The Max-9 electrostatic fabric filter has been installed in a small-sized utility boiler, but there are no commercial installations of a similar size to Units 1-4 at SJGS. The Department agrees that the limited application of this technology to large utility boilers justifies removing the technology as technically infeasible.

Please explain Step 3 of the BART Analysis.

Step 3 of the BART analysis requires evaluating the control effectiveness of each remaining technically feasible control technology identified in Step 2.

PNM contracted with B&V to determine the control effectiveness of the remaining available NOx and PM control technology, with exception of the ROFA/Rotamix technology, for Units 1-4.

PNM requested the control effectiveness of the ROFA/Rotamix technologies from Nalco Mobotec, the vendor of the control equipment.
1. PNM then ranked the remaining control technologies by effectiveness of control.

2. **NOx Control Effectiveness for Unit 1**

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<th>Control Technology</th>
<th>Control Efficiency (%)</th>
<th>Baseline Emissions (tpy)</th>
<th>Emissions Reduction (tpy)</th>
<th>Controlled Emission Rate (lb/MMbtu)</th>
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<td>SCR + Sorbent</td>
<td>77</td>
<td>6431</td>
<td>4930</td>
<td>0.07</td>
<td>1501</td>
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</table>

**NOx Control Effectiveness for Unit 4**

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<th>Control Efficiency (%)</th>
<th>Baseline Emissions (tpy)</th>
<th>Emissions Reduction (tpy)</th>
<th>Controlled Emission Rate (lb/MMbtu)</th>
<th>Controlled Emission Rate (tpy)</th>
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<td>Pre-Consent Decree (Pre-CD)</td>
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<td>8833</td>
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<td>6309</td>
</tr>
<tr>
<td>ROFA</td>
<td>15</td>
<td>6309</td>
<td>841</td>
<td>0.26</td>
<td>5468</td>
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<td>6309</td>
<td>1472</td>
<td>0.23</td>
<td>4837</td>
</tr>
<tr>
<td>SNCR</td>
<td>23</td>
<td>6309</td>
<td>1472</td>
<td>0.23</td>
<td>4837</td>
</tr>
<tr>
<td>ROFA/Rotamix</td>
<td>33</td>
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<tr>
<td>SCR/SNCR Hybrid</td>
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<tr>
<td>SCR + Sorbent</td>
<td>77</td>
<td>6309</td>
<td>4837</td>
<td>0.07</td>
<td>1472</td>
</tr>
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</table>
1 **PM Control Effectiveness for Unit 1**

<table>
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<th>Control Efficiency (%)</th>
<th>Baseline Emissions (tpy)</th>
<th>Emissions Reduction (tpy)</th>
<th>Controlled Emission Rate (lb/MMbtu)</th>
<th>Controlled Emission Rate (tpy)</th>
</tr>
</thead>
<tbody>
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<td>Pre-Consent Decree (Pre-CD)</td>
<td>NA</td>
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<td>690</td>
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<td>PJFF (CD)</td>
<td>70</td>
<td>690</td>
<td>483</td>
<td>0.015</td>
<td>207</td>
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<tr>
<td>WESP</td>
<td>33</td>
<td>207</td>
<td>69</td>
<td>0.010</td>
<td>138</td>
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2 **PM Control Effectiveness for Unit 2**

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<th>Emissions Reduction (tpy)</th>
<th>Controlled Emission Rate (lb/MMbtu)</th>
<th>Controlled Emission Rate (tpy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Consent Decree (Pre-CD)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>0.050</td>
<td>687</td>
</tr>
<tr>
<td>PJFF (CD)</td>
<td>70</td>
<td>687</td>
<td>481</td>
<td>0.015</td>
<td>206</td>
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<td>WESP</td>
<td>33</td>
<td>206</td>
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<td>0.010</td>
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</tr>
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</table>

3 **PM Control Effectiveness for Unit 3**

<table>
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<th>Emissions Reduction (tpy)</th>
<th>Controlled Emission Rate (lb/MMbtu)</th>
<th>Controlled Emission Rate (tpy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Consent Decree (Pre-CD)</td>
<td>NA</td>
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<td>1072</td>
</tr>
<tr>
<td>PJFF (CD)</td>
<td>70</td>
<td>1072</td>
<td>750</td>
<td>0.015</td>
<td>322</td>
</tr>
<tr>
<td>WESP</td>
<td>33</td>
<td>322</td>
<td>108</td>
<td>0.010</td>
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4 **PM Control Effectiveness for Unit 4**

<table>
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<th>Control Efficiency (%)</th>
<th>Baseline Emissions (tpy)</th>
<th>Emissions Reduction (tpy)</th>
<th>Controlled Emission Rate (lb/MMbtu)</th>
<th>Controlled Emission Rate (tpy)</th>
</tr>
</thead>
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<td>1052</td>
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<td>0.015</td>
<td>315</td>
</tr>
<tr>
<td>WESP</td>
<td>33</td>
<td>315</td>
<td>105</td>
<td>0.010</td>
<td>210</td>
</tr>
</tbody>
</table>
Please explain Step 4 of BART Analysis.

Step 4 requires an impacts analysis of each technology identified in Step 3.

The Guidelines require states to consider four types of impact analysis in Step 4 of the BART analysis. These four types of impacts consider the costs of compliance, energy impacts, non-air quality environmental impacts, and remaining useful life of the facility. These impacts are each evaluated, monetized, and included in the total capital investment of each additional control technology and allow comparisons to be made between the remaining controls. B&V performed an impact analysis for the remaining NOx and PM control technologies.

B&V prepared the design parameters and developed estimates of capital and annual costs for applications of SCR, SCR/SNCR Hybrid, ROFA, Rotamix, ROFA/Rotamix, PJFF, and WESP technologies. B&V relied on a number of sources to prepare the design parameters, including information from the Nalco Mobotec equipment vendors, EPA cost manuals, engineering and performance data, and B&V’s own in-house engineering estimates.

PNM evaluated the energy impacts, non-air quality environmental impacts, and remaining useful life of all additional technically feasible control options for NOx and PM. Energy impacts from control equipment that consume auxiliary power during operation were considered for all control options. For SCR and SCR/SNCR Hybrid technology, the non-air quality environmental impacts included the consideration of water usage and waste generated from each control technology. For WESP technology, PNM considered the auxiliary power consumption to operate the WESP and fans, and the additional water consumption and waste water disposal requirements from operating the WESP. Lastly, PNM evaluated the remaining useful life of the source. The Guidelines define the remaining useful life as the difference between the date the controls will be put in place and the date the facility permanently stops operation. Per the Guidelines, if the remaining useful life will exceed the amortization period of the capital investment loan, no additional consideration of a short remaining useful life need to be analyzed. PNM determined the remaining useful life was greater than the assumed amortization period of the loan, defined as 20 years, therefore, no additional cost adjustments for a short remaining useful life were considered.

Following the initial submittal, the Department made additional requests for information on the impact analysis for SCR, SNCR, ROFA, Rotamix and WESP, and for further consideration of inherent and additional control of SO3 from both the SCR and SCR/SNCR Hybrid technology.

The Department reviewed the original cost analysis for SCR technology and subsequently requested PNM to provide additional information on the basis of their cost analysis of SCR technology. In response to the request, B&V provided additional clarification for the cost analysis for SCR technology and submitted it to the Department on March 29, 2008. The

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submitting discussed how the OAQPS cost control manual is an insufficient method for
determining actual costs of retrofitting the SJGS with SCR and provided a comparison between
cost estimation based on the OAQPS manual and the B&V provided estimate.

PNM’s initial analysis of SCR and SCR/SNCR technology took into consideration additional
oxidation of SO2 to SO3 across the SCR catalyst bed. The Department requested PNM to
consider inherent removal of SO3 emissions from existing air pollution control equipment, and
removal of SO3 emissions through installation of sorbent injection. PNM responded with an
amended submittal addressing both inherent and add-on removal of SO3. PNM’s submittal
provided cost estimates of the sorbent injection system and updated visibility modeling for both
SCR and SCR/SNCR Hybrid technologies.

The Department understands that there are SCR catalysts now on the market that are capable of a
much smaller SO2 to SO3 conversion (around 0.5%) as opposed to the assumed 1%. The
Department believes use of such a catalyst will minimize SO3 oxidation to less than what was
represented in PNM’s analysis.

PNM provided additional impact analyses of SNCR, WESP, ROFA, and Rotamix technologies
and submitted those updates to the Department.

The final impact analysis for the technologies evaluated, as contained in PNM’s submission of
February 2011, is summarized in the two Tables below:

### Impact Analysis and Cost Effectiveness of Additional NOx Control Technologies

<table>
<thead>
<tr>
<th>Control Technology</th>
<th>Emission Performance Level (lb/MMbtu)</th>
<th>Expected Emission Rate (tpy)</th>
<th>Expected Emission Reduction (tpy)</th>
<th>Total Capital Investment (TCI) (1,000$)</th>
<th>Total Annualized Cost (TAC) (1,000$)</th>
<th>Cost Effectiveness ($/ton)</th>
<th>Incremental Cost Effectiveness ($/ton)</th>
<th>Energy Impacts (1,000$)</th>
<th>Non-Air Impacts (1,000$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCR + sorbent</td>
<td>0.07</td>
<td>966</td>
<td>3,174</td>
<td>192,070</td>
<td>21,998</td>
<td>6,931</td>
<td>3,815</td>
<td>1,496</td>
<td>NA</td>
</tr>
<tr>
<td>SNCR/SCR Hybrid</td>
<td>0.18</td>
<td>2,484</td>
<td>1,656</td>
<td>110,683</td>
<td>16,816</td>
<td>10,154</td>
<td>35,917</td>
<td>706</td>
<td>1,762</td>
</tr>
<tr>
<td>ROFA/Rotamix</td>
<td>0.20</td>
<td>2,760</td>
<td>1,380</td>
<td>30,790</td>
<td>6,902</td>
<td>5,001</td>
<td>7,982</td>
<td>1,413</td>
<td>3</td>
</tr>
<tr>
<td>Rotamix (SNCR)</td>
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<td>11,822</td>
<td>3,597</td>
<td>3,723</td>
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<td>Consent Decree</td>
<td>Pre-CD</td>
<td>SCR + sorbent</td>
<td>SNCR/SC R Hybrid</td>
<td>ROFA/Rotamix</td>
<td>Rotamix (SNCR)</td>
<td>SNCR</td>
<td>ROFA</td>
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<tr>
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<td>1,501</td>
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<td>Control Technology</td>
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<td>Expected Emission Rate (tpy)</td>
<td>Expected Emission Reduction (tpy)</td>
<td>Total Capital Investment (TCI) (1,000$)</td>
<td>Total Annualized Cost (TAC) (1,000$)</td>
<td>Incremental Cost Effectiveness ($/ton)</td>
<td>Cost Effectiveness (1,000$)</td>
<td>Energy Impacts (1,000$)</td>
<td>Non-Air Impacts (1,000$)</td>
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</tr>
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<td>WESP</td>
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<td>20,696</td>
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<tr>
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<td>0.050</td>
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<td>NA</td>
<td>NA</td>
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<td>NA</td>
<td>NA</td>
<td>NA</td>
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<tr>
<td><strong>Unit 2</strong></td>
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</tr>
<tr>
<td>WESP</td>
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<td>137</td>
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<td>99,663</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>WESP</td>
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<td>214</td>
<td>108</td>
<td>129,565</td>
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<td>28,741</td>
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<td>750</td>
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<td>Pre-CD</td>
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<td>NA</td>
<td>NA</td>
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<tr>
<td>WESP</td>
<td>0.010</td>
<td>210</td>
<td>105</td>
<td>130,012</td>
<td>15,609</td>
<td>29,352</td>
<td>148,657</td>
<td>1,728</td>
<td>NA¹</td>
</tr>
<tr>
<td>PJFF (CD)</td>
<td>0.015</td>
<td>315</td>
<td>737</td>
<td>73,328</td>
<td>12,527</td>
<td>NA</td>
<td>16,997</td>
<td>6,895</td>
<td>NA¹</td>
</tr>
<tr>
<td>Pre-CD</td>
<td>0.050</td>
<td>1052</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

¹ PMM performed an impact analysis for these technologies and incorporated any monetized energy or non-air environmental impacts into the cost analysis.

3 Impact Analysis and Cost Effectiveness of Additional PM Control Technologies
Please explain Step 5 of the BART Analysis

The Guidelines require states to conduct a visibility improvement determination for the each source subject to BART. The visibility improvement was determined using the computer program CALPUFF.

CALPUFF is computer-based dispersion model listed in the US EPA Guidelines on modeling. This model is used for regulatory applications such as air quality permitting and analysis of the effects of varying levels of air pollution control for regulation development. It is the best EPA-approved model for analysis of long range transport of pollutants. The CALPUFF model is a complex model that incorporates chemical transformation calculations, the deposition of pollutants that occurs as pollution is emitted, and the effects of existing relative humidity on visibility. As input, the model requires ozone data, ammonia background concentrations, speciated emissions data, and complex meteorological data, including three-dimensional wind fields. The model outputs predicted impacts to visibility as well as the impact of air pollutants.

A CALPUFF model run was conducted for the following control technologies for each unit during the BART engineering analysis, including the pre-consent decree: Consent Decree, SNCR or Rotamix, ROFA/Rotamix, ROFA, SCR/SNCR Hybrid (SCR/SNCR Hybrid with Inherent SO₂ Removal), SCR with Sorbent (SCR with Inherent SO₂ Removal and Sorbent Injection), PJFF, and WESP.

For both the facility-wide and unit-by-unit modeling analysis conducted with the 2001-2003 years of meteorological data, the expected degree of visibility impact for each control technology was determined by the difference between the visibility impaired by the facility sources and annual average natural visibility conditions for each receptor at each of the 16 Class I area which is indicative of delta-deciview (delta-dv) The modeling results showed that for each additional control technology the source exhibited a decrease in the visibility impacts.

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12 See 70 Fed. Reg. at 39170.
How did the NMED select BART for SJGS?

In accordance with Section 169A(g)(7) of the Clean Air Act, the Department considered the following five statutory factors in the BART analysis for the SJGS: (1) the costs of compliance; (2) energy and non-air quality environmental impacts of compliance; (3) any existing pollution control technology in use at the source; (4) the remaining useful life of the source; and (5) the degree of improvement in visibility which may reasonably by anticipated to result from the use of such technology.

What did NMED determine as BART for PM at SJGS?

Based on the five factor analysis, the Department has determined that BART for Units 1-4 for PM is existing PJFF technology and the existing emission rate of 0.015 lb/MMbtu. The Department’s determination of BART was based on the following results of the full five factor analysis:

1) Each of Units 1-4 is equipped with PJFF and is subject to a federally-enforceable emission limit of 0.015 lb PM/MMbtu.
2) The Department reviewed both the cost-effectiveness and incremental cost-effectiveness of additional control technology (WESP) and found these costs to be excessive.

3) There are additional energy impacts associated with the WESP technology and the Department considers these costs to be reasonable.

4) The Department reviewed the visibility improvement that resulted from the installation of the consent decree technology (PJFF and LNB/OFA) and that would result from the addition of WESP technology. The Department determined that on a facility-wide basis the visibility improved by 1.06 deciviews (dv) from the installation of the consent decree technology at Mesa Verde National Park (Mesa Verde). The installation of WESP would result in a facility-wide improvement of 0.62 dv at Mesa Verde. Improvements on a unit-by-unit basis at all Class I areas showed very minor improvements, usually less than 0.1 dv.

What did NMED determine as BART for NOx at SJGS?

Based on the five factor analysis, the Department has determined that BART for Units 1-4 for NOx is SNCR technology and an emission rate of 0.23 lb/MMbtu on a 30-day rolling average. The Department’s determination of BART was based on the following results of the five factor analysis:

1) SNCR technology is considered cost-effective at an average cost of $3,494 dollars per ton of NOx removed. SNCR technology will reduce the facility annual NOx emissions by 4,900 tons.

2) The SNCR technology will result in additional energy impacts and non-air impacts. The SNCR technology will require a new reagent system and a reagent storage system. The Department considered these additional costs in the review of the overall cost-effectiveness of SNCR and found these costs to be reasonable.

3) The Department reviewed the visibility improvement that resulted from the installation of the SNCR technology. The Department determined that on a facility-wide basis the visibility improved by 0.25 dv at San Pedro, 0.22 dv at Mesa Verde, and 0.21 at Bandelier.

4) An emission limit of 0.23 lb NOx/MMbtu at each of Units 1-4 equals the EPA’s established presumptive limit for dry-bottom, wall-fired boilers burning sub-bituminous coal. This is the most stringent presumptive limit that may be applicable to SJGS.

5) The Department reviewed additional economic information provided by PNM that analyzed the economic impact to ratepayers in New Mexico. The PNM estimates indicate the cost of control technology beyond SNCR would be financially burdensome and cause economic hardship to low-income New Mexicans. According to the US Census Bureau,
as of 2009, 18% of New Mexicans were living below the poverty line, as defined by the federal poverty standards. PNM estimates a rate increase of $11.50 per year per residential ratepayer from the installation of SNCR versus an estimated rate increase of $82.00 per year from the installation of SCR.

6) The Department has determined that in light of the unreasonable costs of SCR, particularly as reflected in the impact on ratepayers, requiring controls to achieve reductions beyond the most stringent presumptive standard prescribed by EPA is not justified.

Do the BART Guidelines Provide for Consideration of the Economic Impacts of Control Costs?

Yes. The guidelines explain that “[t]here may be unusual circumstances that justify taking into consideration the conditions of the plant and the economic effects of requiring the use of a given control technology. These effects would include effects on product prices, the market share, and profitability of the source. Where there are such unusual circumstances that are judged to affect plant operations, you may take into consideration the conditions of the plant and the economic effects of requiring the use of a control technology.”13

The Department believes it is particularly appropriate to consider the effect of BART costs on product prices where the product is electric power, an essential service, and where most customers do not have access to a competing provider. The Department believes that economic effects on ratepayers is a more compelling policy consideration than economic effects such as the profitability of the source, which is a recognized factor for making a BART determination under the Guidelines.

13 70 Fed. Reg. at 39171.