TECHNICAL SUPPORT DOCUMENT

METHODOLOGY FOR DEVELOPING BART NO_x PRESUMPTIVE LIMITS

Environmental Protection Agency

Clean Air Markets Division

June 15, 2005

This Technical Support Document describes the methodology adopted by EPA to calculate the NO_x control costs and control rates shown in the "Technical Support Document for BART NOx Limits for Electric Generating Units Excel Spreadsheet" ("Excel Spreadsheet") prepared by EPA and included in the docket (docket OAR 2002-0076, June 15, 2005). This analysis used cost and control performance assumptions from EPA,[1] as well as supplemental cost and performance information developed for EPA.[2] These documents are included in the docket.

The methodology EPA used in applying current combustion control technology to BART-eligible EGUs is described in the following: If a BART-eligible EGU ("unit") currently had no NO_x controls installed, i.e., an "uncontrolled" unit, we applied a complete set of combustion controls. A complete set of combustion controls for most units includes a low NO_x burner and over-fire air. If a unit had "partial" combustion controls installed, i.e., either low NO_x burners or over-fire air but not both, we added whichever component was missing until the unit had a complete set of combustion controls. For example, if a unit had a low NO_x burner but no over-fire air, we added over-fire air. Conversely, if a unit had over-fire air but no low NO_x burner, we added a low NO_x burner. If a unit had a complete or partial set of combustion controls but installed them prior to 1997, our analysis assumed that such controls were not current combustion control technology and

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1 Documentation for the Integrated Planning Model version 2.1.9, and "Updating Performance and Cost of NOx Control Technologies in the Integrated Planning Model, Paper #137," by Sikander Khan and Ravi Srivastava.

2 "Supplemental cost and performance information for NO_x combustion controls" and "Supplemental cost and performance information for NOx controls excel spreadsheet" developed for EPA by Andover Technology Partners.

replaced them with a complete set of combustion controls. We chose 1997 as a cutoff because EPA estimates the current generation of NO_x combustion control technology became operational at approximately this time. If, after applying current combustion control technology, a unit's new controlled NO_x emission rate was higher than the average NO_x emission rate reported for the unit in the most recent year (2004), we assumed the unit already had current combustion control technology. EPA assumed units that received over-fire air in the analysis would have space available to install over-fire air.

The first worksheet in EPA's analysis is a description of the control cases included in EPA's analysis. The second worksheet, "Unit Fuel Specific Summary," contains cost and performance of the Nox controls included in EPA's analysis by boiler type and fuel type for each control case. The third worksheet, "Cyclones," lists all of the Cyclone units. The highlighted (yellow) units indicate those that have existing SCR post combustion controls. The fourth worksheet, "Percentile Analysis," calculates the 75th percentile NO_x rate by unit and fuel type for coal-fired Case 1a (installation of current combustion control technology) and then determines if installing coal-fired Case 1e (Rotating Opposed Fire Air- ROFA) controls will result in meeting the 75th percentile NO_x rate determined for Case 1a. The fifth worksheet, "Nox control costs and performance," contains the cost and performance assumptions (algorithms) used in the analysis.

I. Coal-fired Control Cases

The Coal-fired Case 1a, 1d, and 1e worksheets show the detailed calculations and assumptions used in these three cases. The list of units and unit characteristics (boiler type, fuel type, controls installed, and nameplate capacity) are consistent among the three cases and are limited to those coal-fired units that EPA had identified as BART-eligible (or possibly BART-eligible) and that have a Nameplate Capacity (MW) greater than or equal to 25 MW.

The list of BART-eligible coal-fired units was developed originally by EPA in 2003 and then was updated in the first half of 2004. The electronic version of the file uses the file name "BART Eligible Coal-Fired EGU List.xls" and is located in the docket. Attachments A and B to this Technical Support Document are memoranda developed by Perrin Quarles Associates ("PQA") for EPA that explain the development of this list of potentially BART-eligible coal-fired boilers. This list was used to populate the Excel Spreadsheet.

To develop some of the unit characteristics, EPA used a variety of sources. NO_x controls and emissions data were queried directly from EPA's Clean Air Markets Division database "CAMD database" and "Scorecard" data, respectively. The CAMD database is derived from EPA's Source Management System (SMS), which serves as the primary inventory database that includes all units covered under existing EPA emissions trading programs managed by CAMD. States and sources can access SMS to update certain information on sources affected by programs, such as the Acid Rain Program (ARP) and the NO_x Budget Program (NBP). The Scorecard emissions data are derived from the Electronic Data Reports (EDR)[3] as submitted by power plants and other generation sources subject to the ARP.

These data are saved in the Excel Spreadsheet. Coal type information came from EPA's Mercury ICR.[4] The pre-control rates (see column J in the Coal-fired control cases) were obtained from the "Summary of NO_x Database" document, dated September 30, 1996. This document, parts 1 through 3, are included in the docket. These pre-control rates were derived primarily from relative accuracy test audits conducted at the beginning of the Acid Rain Program and were used to establish pre-control NO_x emission rates for purposes of EPA's Phase II Acid Rain Program NO_x Rulemaking. This file includes summary information on boilers affected by Phase I and II of the ARP and also lists information specific to each boiler, such as state, ORIS code, unit ID, plant name, capacity, firing type, control type, and other source-specific information.

For cases where incremental controls were installed, the controlled NO_x rate was calculated using the 2004 NO_x Rate.

For nameplate capacity, EPA used the information in the list of BART-eligible units. This data represents information stored in EPA's Monitoring Data Checking (MDC) inventory database. This data was collected over time from EIA sources, contacts with utilities to populate the Data and Maps section of CAMD's website (www.epa.gov/airmarkets), and from the final NO_x SIP Call EGU inventory.

Each Coal-fired control case is summarized below in Table 1.

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[3] www.epa.gov/airmarkets/emissions/raw/index.html

[4] "Information Collection Request (ICR) for the Electric Utility Steam Generating Unit Mercury Emissions Information Collection Effort", OMB Control Number 2060-0396.

Table 1
Coal-fired Control Cases

Control Case	Control Action Taken	Major Assumptions/Notes
1a	Installation of current NO_x combustion controls for units with no prior controls, or which had controls installed before 1997. For units with controls installed in or after 1997, install incremental controls if a complete set of combustion controls was not installed (LNBO or LNC3). For Cyclone units, apply Coal Reburn if no prior controls installed. For Cell Burners, install Current Combustion Controls if the unit had no controls or controls were installed before 1997. For Stokers install overfire air (OFA). Do not include existing SCR or SNCR units in the Control Case NO_x Rate.	If the 2004 NO_x rate was less than the floor rate or the new controlled rate, no controls added. Used average heat input from 2002 - 2004 to calculate an Average NO_x Rate. Assume 10,000 BTU/ kWh heat rate for coal-fired boilers. The heat rate is a measure of how much fuel energy needed to get electric energy out. Therefore, 1,000,000 Btu/yr divided by 10,000 Btu/kWh = 100 kWh-yr. Multiply Avg Heat Input (mmBtu) by 100 to get kWh-yr.
1d	Install SCR, unless unit already has SCR installed or the 2004 NO_x rate is already at or below the SCR floor rate.	
1e	Install rotating opposed fire air (ROFA), unless unit already has SCR or the 2004 NO_x Rate is already at or below the ROFA floor rate. Also, for Cyclone units, install SCR. Do not include units with existing SCR/SNCR in the Control Case NO_x Rate.	

The data and calculations performed in the Coal-fired worksheet are summarized in Table 2 below for each control case. The sources of data referenced under columns Y (Fraction of Removal) and AB (Floor NO_x Emission Rate) were developed by EPA and include fraction of removal efficiencies for each coal type as well as floor rates by fuel type.

Table 2
Summary of Data and Calculations

Column	Column Header	Description	Source of Data
A	State	State where unit is located.	BART Eligible Coal-fired EGU List.xls.
B	Plant Name	Name of the plant.	BART Eligible Coal-fired EGU List.xls.
C	ORISPL	ORIS code of the facility/plant.	BART Eligible Coal-fired EGU List.xls.
D	Unit ID	Unit ID assigned.	BART Eligible Coal-fired EGU List.xls.
E	Boiler Type	Boiler type.	CAMD Database.
F	2004 NO_x Controls	CAMD controls reported by the unit.	CAMD Database.
G	Action	Control action taken, if any.	See Table 1.
H	Hg ICR Primary Coal	Coal type.	Hg ICR.
I	Pre Control NO_x Emission Rate	Baseline emission rate.	Summary of NO_x Database, September 30, 1996
J	2004 NO_x Rate (lbs/mmBtu) Boiler Level	2004 NO_x emission rate from CAMD.	Scorecard data.
K	Nameplate Capacity (kW)	Nameplate capacity in kW.	BART Eligible Coal-Fired EGU List.xls.
L	Effective Control Case NO_x Emission Rate	New NO_x emission rate after the controls added, if any.	From Column AA.
M	Scaling Factor 1	Calculation of scaling factors for capital and fixed operating and maintenance (O&M) costs.	See footnotes 1 and 2.
N	Scaling Factor 2	Calculation of scaling factors for variable O&M cost for SCR installations.	See footnotes 1 and 2.
O	Capital Cost- $/kW	Capital cost in $/kW.	See footnotes 1 and 2.
P	Total Capital Cost	Total capital costs of the combustion control types added, if any, in dollars.	Column K x Column M x Column O

(cont.)

Table 2
Summary of Data and Calculations (cont.)

Column	Column Header	Description	Source of Data
Q	Annual Capital Cost	Annualized capital cost. Use capital recovery factor of 12%.	Column P x 12%
R	Fixed O&M - $/kWyr	Fixed O & M cost per kW-yr.	See footnotes 1 and 2.
S	Annual Fixed O&M Cost	Annual fixed operating and maintenance costs of the combustion control type.	Column K x Column M x Column R.
T	Variable O&M - mills/kW-hr	Variable O & M cost in mills/kW-hr.	See footnotes 1 and 2.
U	Avg Heat Input Used (mmBtu)	Average HI using 2002, 2003, 2004 data.	Scorecard data.
V	kWh-Yr (10,000 Btu/kWh)	Assume 10,000 Btu/kWhr heat rate. Heat input (1,000,000 Btu/yr) divided by Heat Rate (10,000 Btu/kWhr) = 100 kWhr/yr.	Column U x 100 = kWhr/yr.
W	Annual Variable O&M Cost	Calculation for the annual variable O & M cost of the combustion control technology.	(Column V x Column T x Column N)/1000. Divide by 1000 to convert mills to dollars. Not all control cases apply scaling factor to variable O&M cost (Column N).
X	Control Case Total Annual Cost	Sum of Annual Capital Cost, Annual Fixed O&M Cost and Annual Variable O&M Cost.	Column W + Column S + Column Q.
Y	Fraction of Removal	Calculation based on coal type, boiler type and control used.	See footnotes 1 and 2.
Z	Controlled NO_x Emission Rate	New NO_x emission rate after the controls added, if any.	Pre Control Rate x (1 - Fraction of Removal). For Pre Control Rate, use Column J. Fraction of Removal is calculated in Column Y.
AA	Effective Control Case NO_x Emission Rate	Actual control rate used to calculate Effective Control Case NO_x Tons (column AF).	Column AD x 2000/Column U
AB	Floor NO_x Emission Rate	Floor rates established given boiler type and coal type.	See footnotes 1 and 2.

(cont.)

Table 2
Summary of Data and Calculations (cont.)

Column	Column Header	Description	Source of Data
AC	Base Case NO_x Tons	Multiply 2004 NO_x Emission Rate (lbs/mmBtu) by Average HI, then divide by 2000 to get tons.	(Column J x Column U)/2000.
AD	Effective Control Case NO_x Tons	This value is calculated using the NO_x Rate in Column AC, unless this value is less than the floor rate, then the floor rate is used. Multiply Controlled NO_x Rate times Average HI, then divide by 2000 to get tons.	Minimum of 1: (Maximum of Column AB or Column Z) x Column U)/2000, or 2: Column J x Column U/2000.
AE	Effective Tons Removed	Number of tons removed by using the new control technology.	Column AC - Column AD.
AF	Effective Cost/Ton Removed	Cost effectiveness per ton removed.	Column X/Column AE.

The SCR cost and performance assumptions in Coal-fired Case 1d are summarized in Table 3. The source of the assumptions used is EPA document entitled "Updating Performance and Cost of NOx Control Technologies in the Integrated Planning Model, Paper # 137," and is located in the docket. See footnote 1.

Table 3
Updated SCR Cost Algorithm For IPM

SCR Cost Category	New Cost Factor
Capital Cost	100 ($/kW)
Fixed O&M	0.66 ($/kW-yr)
Variable O&M	0.60 (mills/kWh)
Capital & Fixed O&M Cost Scaling Factor	(243/MW)^0.27 (Apply up to maximum of 600 MW. For units larger than 600 MW, use the cost factor determined for the 600 MW unit).
Variable O&M Cost Scaling Factor	(243/MW)^0.11 (Apply up to maximum of 600 MW. For units larger than 600 MW, use the cost factor determined for the 600 MW unit).
Fraction of Removal	90%
Floor NO_x Rate	0.06 lb/mmBtu

II. Oil and Gas-fired Control Cases

The last three worksheets (Oil and Gas-fired Cases 2a, 2d, and 2e) show the detailed calculations and assumptions used in each of these control cases. The list of units and unit characteristics (boiler type, fuel type, controls installed, nameplate capacity) are consistent among these three cases and are limited to those Oil and Gas-fired units that may be BART-eligible (or possibly BART-eligible) and that have a Nameplate Capacity (MW) greater than or equal to 25 MW. The list of BART-eligible Oil and Gas-fired units was developed by EPA. See "Oil and Gas BART-eligible units" in the docket. The list was based on units with a "commence commercial operation date" (as reported in Part 75 EDR) that falls within the BART time frame. In addition, for units that commenced operation after the BART time frame but may have commenced construction within the BART time frame, EPA attempted to identify a commenced construction date based on New Source Review permit information (comparable to the approach used for coal units). The EPA evaluated all units with a reported commenced operation date prior to 1987.

This file then indicates that a unit does or may fall within the BART time frame based on the Part 75 data and this additional research. EPA eliminated any units with a maximum design heat input capacity less than 250 mmBtu/hr (based on EDR data) and units with a potential to emit less than 250 tons per year. For the latter cutoff, EPA identified 40 units that had <250 tons per year of actual emissions (SO_2 and NO_x) in any year (from 1995 through 2002). Of these units, four units were identified that had a potential to emit less than 250 tons per year of either SO_2 or NO_x. The potential to emit analysis used the ratio of actual heat input to maximum design heat input capacity to adjust actual emissions up to a potential to emit basis.

For nameplate capacity, the data represents primarily information in the MDC inventory database, consistent with the approach taken for coal-fired units. For a few units with missing capacity data, EPA used EIA (Inventory of U.S. Power Plants) data.[5]

NO_x controls and emissions data for each of these units were queried from CAMD data. Fuel type information came from the CAMD database. The Pre Control Rate (see column AV in the Oil and Gas-fired control cases) was calculated with the assumption that the existing NO_x controls achieved the maximum efficiency (see Column AW). Given that assumption, the Oil and Gas Pre Control Rate was calculated by dividing: (1 - Column AW) by the Base Case 2002 - 2004 NO_x Rate (Column X). The Pre Control Rate was only calculated for units with existing controls installed before 1997 (adding state of the art controls requires use of the Pre Control Rate to calculate new controlled rate). For the remainder of the units, the Base Case Avg 2002 - 2004 NO_x Rate was used to calculate the

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[5] Inventory of Electric Utility Power Plants in the United States 1999, http://www.eia.doe.gov/cneaf/electricity/ipp/ipp99_sum.html; and, Inventory of Non-Utility Electric Power Plants in the United States, 2000, http://www.eia.doe.gov/cneaf/electricity/ipp/ipp_sum2.html

controlled rate (either because the unit had no controls or was installing incremental controls -- if incremental controls were installed, the upper boundary fraction of removal was an incremental percent removed).

Each Oil and Gas-fired control case is described in Table 4.

Table 4
Oil/Gas-fired Control Cases

Control Case	Control Action Taken	Major Assumptions/Notes
2a	Installation of current combustion control technology for units with no prior controls, or which had controls installed before 1997. For units with controls installed in or after 1997, install incremental controls if a complete set of current combustion controls was not installed. Do not include existing SCR or SNCR units in the Control Case NO_x Rate.	If the Base Case NO_x rate was less than the floor rate or the new controlled rate, no controls added. Used average heat input and NO_x tons from 2002-2004 to calculate a Base Case NO_x Rate.
2d	Install SCR, unless unit already has SCR installed or the Base Case NO_x rate is already at or below the SCR floor rate.	
2e	Install ROFA, unless unit already has SCR installed or the Base Case NO_x rate is already at or below the ROFA floor rate. Also, for Cyclone Boilers, install SCR. Do not include units with existing SCR or SNCR units in the Control Case NO_x Rate.	

The data and calculations performed in the Oil and Gas-fired worksheets are summarized in Table 5 below (for Control Cases 2a - 2e).

Table 5
Summary of Data and Calculations

Column	Column Header	Description	Source of Data
A	State	State where unit is located.	Oil and Gas BART-eligible List Nov 12.xls.
B	ORISPL	ORIS Code of the facility/plant.	Oil and Gas BART-eligible List Nov 12.xls.
C	Unit ID	Unit ID assigned.	Oil and Gas BART-eligible List Nov 12.xls.
D	Plant Name	Name of the plant.	Oil and Gas BART-eligible List Nov 12.xls.
E	Boiler Type	Boiler type.	CAMD Database.
F	Primary Fuel	Primary fuel type.	CAMD Database.
G	2004 NO_x Control	CAMD controls reported by the unit.	CAMD Database.
H	Control Technology Added	Control action taken, if any.	See Table 4.
I	Nameplate Capacity (kW)	Nameplate capacity.	MDC inventory data (MW x 1000 = kW).
J	Scaling Factor	Calculation of scaling factors.	See footnote 1 and 2.
K	Capital Cost - $/kW	Capital cost in $/kW.	See footnote 1 and 2.
L	Total Capital Cost	Total capital costs of the combustion control types.	Column I x Column J x Column K
M	Annual Capital Cost	Annualized capital cost. Use capital recovery factor of 12%.	Column L x 12%
N	Fixed O&M $/kW-yr	Fixed O & M cost per kW-yr.	See footnote 1 and 2.
O	Annual Fixed O&M Cost	Annual fixed O & M costs of the combustion control type.	Column I x Column J x Column N.
P	Variable O&M - mills/kW-hr	Variable O & M cost in mills/kW-hr.	See footnote 1 and 2.
Q	Avg Heat Input Used (mmBtu)	Average HI from 2002, 2003, 2004.	Scorecard data.

(cont.)

Table 5
Summary of Data and Calculations (cont.)

Column	Column Header	Description	Source of Data
R	kWh-Yr (10,000 Btu/kWh)	Assume 10,000 Btu/kWhr heat rate. Heat input (1,000,000 Btu/yr) divided by Heat Rate (10,000 Btu/kWhr) = 100 kWhr/yr.	Column Q x 100 = kWhr/yr.
S	Annual Variable O&M Cost	Calculation for the annual variable O & M cost of the combustion control technology.	(Column R x Column P)/1000. Divide by 1000 to convert mills to dollars.
T	Total Annual Cost	Sum of Annual Capital Cost, Annual Fixed O&M Cost and Annual Variable O&M Cost.	Column O + Column M + Column S.
U	Fraction of Removal	Calculation based on coal type, boiler type and control used.	See footnote 1 and 2.
V	Controlled NO_x Emission Rate	New NO_x emission rate after the controls added, if any.	Pre Control Rate x (1 - Fraction of Removal). For Pre Control Rate, use Column Y if no controls previously installed or if incremental controls installed. Otherwise use Column AX. Fraction of Removal is calculated in Column U.
W	Floor NO_x Emission Rate	Floor rates established given boiler type, and fuel type.	See footnote 1 and 2.
X	Effective Control Case NO_x Emission Rate	Actual NO_x rate used to determine the control case NO_x tons (in column AA).	Column AA x 2000/Column Q.
Y	Base Case Avg NO_x Rate	Average NO_x Rate from 2002 - 2004.	Scorecard data.
Z	Base Case NO_x Tons	Multiply Base Case NO_x Emission Rate (lbs/mmBtu) by Average HI, then divide by 2000 to get tons.	(Column X x Column Q)/2000.

(cont.)

Table 5
Summary of Data and Calculations (cont.)

Column	Column Header	Description	Source of Data
AA	Effective Control Case NO_x Tons	This value is calculated using the NO_x Rate in Column X, unless this value is less than the floor rate, then the floor rate is used. Multiply Controlled NO_x Rate by Average HI, then divide by 2000 to get tons.	Minimum of 1: ((Maximum of Column V or Column W) x Column Q)/2000),or 2: Column Z
AB	Effective Tons Removed	Number of tons removed by using the new control technology.	Column Z - Column AA.
AC	Effective Cost/Ton Removed	Cost effectiveness per ton removed.	Column T/Column AB.

The SCR cost and performance assumptions used in Case 2d are summarized in Table 6. The source of the assumptions EPA used is a memorandum from Andover Technology Partners dated November 5, 2004 and is located in the docket. See footnote 2.

Table 6
SCR Oil and Gas-fired Cost & Performance Algorithms

SCR Cost Category	New Cost Factor
Capital Cost	Residual Oil = 50 (\$/kW) Diesel & PNG = 35 (\$/kW)
Fixed O&M	Residual Oil = 0.66 (\$/kW-yr) Diesel & PNG = 0.33 (\$kW-yr)
Variable O&M	Residual Oil = 0.45 (mills/kWh) Diesel & PNG = 0.30 (mill/kWh)
Capital & Fixed O&M Cost Scaling Factor	Residual Oil = (550/MW)^0.27 (Apply up to maximum of 600 MW. For units larger than 600 MW, use the cost factor determined for the 600 MW unit). Diesel & Pipeline Natural Gas (PNG) = (320/MW)^0.27 (Apply up to maximum of 600 MW. For units larger than 600 MW, use the cost factor determined for the 600 MW unit).

(cont.)

Table 6
SCR Oil and Gas-fired Cost & Performance Algorithms (cont.)

SCR Cost Category	New Cost Factor
Variable O&M Cost Scaling Factor	None
Fraction of Removal	90%
Floor NO_x Rate	Residual Oil = 0.04 lb/mmBtu Diesel & PNG = 0.01 lb/mmBtu

June 15, 2005

TECHNICAL SUPPORT DOCUMENT
METHODOLOGY FOR DEVELOPING BART NO_x PRESUMPTIVE LIMITS

Attachment A

Memorandum: Summary of BART Source Analyses

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MEMORANDUM

TO: Chad Whiteman

FROM: Bill Balcke, Doran Stegura

RE: Summary of BART Source Analyses

DATE: March 24, 2003

I. Introduction

Under Work Assignment #3, PQA has conducted a number of analyses to develop a database and related information on sources that may be subject to controls under EPA's Proposed Guidelines for Best Available Retrofit Technology (BART) Determinations Under the Regional Haze Regulations (66 FR 38108, July 20, 2001). The main elements of this work include identifying BART units, providing summary information on each unit, and analyzing the cost of retrofitting units with flue gas desulfurization (FGD) controls. The following memorandum explains what tasks and analyses were performed, key assumptions and data sources that were used, and potential further analyses that could be conducted. These issues are organized into the following eight sections: Identification of BART Units, Compiling the Data, Plant Summary Sheets, Creating FGD Scorecards, BART Control Costs, Units Potentially Affected under BART (< 750 MW), Summary of Key Findings for All Coal Units, and Next Steps.

Enclosed with this memorandum are several materials that document the analyses conducted under this task. These materials are:

- An Excel database with BART applicability status and other information for coal-fired units (see Section III, below)
- A compilation report of BART plant summary sheets (see Section IV, below)
- FGD "scorecards" (see Section V, below)
- An Excel file with control cost information (see Section VI, below)

II. Identification of BART Units

Units potentially affected under the proposed BART rule include sources for which construction was started by August 7, 1977, that were not in operation prior to August 7, 1962, and have the potential to emit more than 250 tons per year of pollutants that contribute to regional haze. EPA has interpreted the statutory requirement under Section 169A(b) of the CAA to require that States follow the BART guidelines for power plants built within this timeframe that have a total capacity exceeding 750 MW (see 1980 document entitled "Guidelines for Determining Best Available Retrofit Technology for Coal-fired Power Plants and Other Existing Stationary Facilities").

EPA requested that PQA create a master file to identify the potentially affected units at plants that could meet these criteria. To identify potentially affected units, PQA began with a list of coal-fired units that had been developed for a congressional response on the NSPS status of coal-fired, Acid Rain Program units (the "AR file"). This file included information on the nameplate capacity and online dates for most coal-fired boilers. The data are from Clean Air Markets Division (CAMD) database sources. The nameplate capacity (in MW), online date, and NSPS status comes primarily from the NO_x Boiler Database compiled as part of the Acid Rain Program Phase II NO_x rule. There were a few units for which the nameplate capacity data were not available in that file, and for those we used other available sources (EIA Inventory, SIP Call Inventory, and 40 CFR Part 75 monitoring plan data).

Note that nameplate capacity in the NO_x Boiler Database file is the sum of the generating capacity of each generator serving the applicable unit. Thus, the sum of generating capacity for units will exceed actual capacity because generators that serve multiple units will be counted more than once.

As part of developing the AR file, the online dates were compared to data from the Emissions & Generation Resource Integrated Database (E-GRID), and in some instances revised because the E-GRID data appear more accurate for some pre-NSPS units based on a review of EIA Inventory information. The online date information also reflects comments from EIA and OAQPS staff.

As stated above, we identified as BART units those that came online after August 7, 1962, were under construction (i.e. a construction permit was issued) prior to August 7, 1977, and, when summed with other affected units at the same plant, have a nameplate capacity that exceeds 750 MW. At plants that meet the size criteria but have units with online dates between 1978 and 1985, the BART rule could apply if construction on these units commenced prior to August 7, 1977. For these plants, PQA undertook the following steps to determine the commence construction date of the 1978 - 1985 vintage units:

- Reviewed the RACT/BACT/LAER Clearinghouse, State Part 70 permit, or other Internet search information to determine the BART applicability status; or

- Contacted the appropriate State environmental agencies to verify when the construction permit was issued.

In evaluating this information, we made the following assumptions. First, units in this time period identified as subject to Part 60, Subpart D cannot be excluded because this NSPS subpart applies to sources that have started construction after August 17, 1971. Second, because NSPS Subpart Da requirements only apply to sources that started construction after September 18, 1978, we assumed that units subject to Subpart Da are outside the applicable BART time period. Third, if a unit received a PSD permit (with a BACT requirement), the unit was assumed to be outside the BART time period. In all cases, we were able to make a BART applicability determination for this subset of units based on the information gathered or provided by state agency contacts.

III. Compiling the Data

After the BART-applicability status was determined for each unit, we compiled an Excel file for all Acid Rain Program coal-fired units, both BART and Non-BART. This file has basic information on BART applicability status, the plant name, plant ID, unit ID, online dates, NSPS status, nameplate capacity, 2001 NO_x and SO_2 data, emission controls currently applied, and projected SO_2 controls (the "BART-AR file"). The file has separate worksheets for:

- All coal-fired Acid Rain units
- BART units at the > 750 MW plants
- A list of units that are within 30 MW of the 750 MW cutoff
- A list of all data fields and the source of the data (see Table 1 below)
- A sheet that defines the control device abbreviations used in the file

The data fields are derived primarily from the AR file as described above. Some information, such as 2001 emissions data, and primary and secondary NO_x and SO_2 controls, were obtained from the most recent 2002 EDR submittals as of early December 2002 (includes second and third quarter submittals). EPA also recently quality checked this information, and the final version of the BART_AR file reflects this recent quality assurance activity.

Also, data on projected SO_2 controls were obtained from the file "s100d_2010_Pech_BART.xls" (the "Pechan file") as received by PQA from Chad Whiteman on November 12, 2002. This file consists of the IPM 2000 base case results for the model run year 2010 and includes two separate worksheets, one for all units and one for the coal units. Existing and projected scrubber information are included in the file as well, which are highlighted in yellow and red, respectively. PQA also identified projected scrubbers from Internet search information and compliance strategies under North Carolina's new SO_2 regulations.

Table 1
Data Fields Included in BART Applicability File
Acid Rain Program Coal-Fired Units

Data Field	Source of Information
State	AR File
Facility Name	
ORIS	
Unit ID	
Online Year	
BART Unit	Based on Online Year & Nameplate Capacity
Located at Plant with BART Unit	Based on Determination of BART Units at Plant
NSPS	AR File
Nameplate Capacity	
2001 NO_x Tons	
2001 SO_2 Tons	
Primary NO_x Control	EDR Data (2nd and 3rd quarter 2002)
Secondary NO_x Control	
Primary SO_2 Control	
Secondary SO_2 Control	
Primary Particulate Control	
Secondary Particulate Control	
Projected Retrofit Scrubbers (IPM)	Pechan File
Other Announced Scrubbers	Internet search information Compliance Data on NC Regulations (SB 1078) Other information as received from EPA
Latitude/Longitude	EDR Data (2nd and 3rd quarter 2002)
Nearest Class 1 Area	Calculated based on latitude/longitude data and OAQPS Class 1 centroid data

PQA used latitude/longitude for each facility to calculate the distance to the nearest Class I area. These data are listed in both minutes/degrees and decimal format in the master file described above. PQA used the latitude/longitude data and the Class I area centroid data (as provided by Tim Smith) to determine the distance of each facility to the nearest Class I area. ArcView was used to populate this information automatically based on the underlying datasets.

IV. Plant Summary Sheets

Based primarily on the BART-AR file, PQA generated and formatted individual summary sheets for the BART-affected units at each facility. The first draft of these sheets was delivered to EPA on January 9, 2003. PQA has prepared and submitted a revised report that contains all of the plant summary sheets in conjunction with this memorandum. In addition to the BART-AR file, the summary sheets also rely on projected 2010 SO_2 and NO_x emissions from the Pechan file, and on information provided by Chad Whiteman on planned NO_x controls. We also prepared miscellaneous notes to identify any special considerations about a particular plant. As an example, one of these summary sheets is presented below.

Plant:	**James H Miller, ORIS 6002, Units 1 and 2**
Location:	**Jefferson County, AL**
Nearest Class I Area:	**Sipsey Wilderness, AL (52 miles)**

Data Elements	Unit 1	Unit 2
Nameplate Capacity (MW) ***[Total: 1,412]***	706	706
Online Date	1978	1985
2001 SO_2 Tons	9,612	12,242
2010 SO_2 Tons	25,898	24,001
FGD	No	No
FGD: IPM 2010 Base Case Projected	No	No
2001 NO_x Tons	5,694	7,510
2010 NO_x Tons	8,910	7,266
NO_x Controls Installed	None	None
NO_x Controls Planned	No data	No data
Miscellaneous Notes	The construction of Units 1 and 2 predates the August 7, 1977 cutoff for BART units. These units do not have a PSD permit. (Source: AL DEM)	

V. Creating FGD Scorecards

After compiling the basic information on each BART-affected source, PQA compiled the aggregate information for both BART and Non-BART sources in order to create a series of "FGD Scorecards" which present data on nameplate capacity and projected 2010 SO_2 data for all the coal units in relation to the presence of FGD control equipment on the units. In addition, these data were used to proceed with the scrubber cost analysis based on cost algorithms provided by EPA. The compilation of information for the FGD Scorecard is described below. We also used this information to compile the cost information discussed in Section VI., below.

A. Aggregated Nameplate Capacity and 2010 Emissions Data

If available, we used the nameplate capacity data from the AR file. However, for those coal units that are not currently identified as AR units, we used the nameplate capacity data in the Pechan file. The nameplate capacity data for all BART affected units were obtained from the BART-AR file. Note that the total nameplate capacity for the coal units listed in the AR file was significantly higher than the total for corresponding units in the Pechan file. As stated above, this could be due to the fact that nameplate capacity in the BART-AR file is the sum of the generating capacity of each generator serving the applicable unit.

It can be difficult to determine which units share a generator, especially if there are numerous generators and units at the facility. However, we analyzed the BART-affected units to ensure that no units were included in this category due to inflated nameplate capacity data. There are two plants with BART-affected units, for which we determined that the nameplate capacity should be reduced by half since the units share a generator. These are Joliet 29 (ORIS 384, Units 71, 72, 81, and 82) and Powerton (ORIS 879, Units 51, 52, 61, and 62), both in Illinois. The nameplate capacity reduction for these units did not impact the BART applicability determination. Further investigation would be necessary to determine which non-BART units share a generator.

We aggregated the projected 2010 SO_2 emissions for all the coal units based on the Pechan file.

B. Missing Units

There were 29 non-BART units and three BART units in the AR file that we could not locate in the Pechan file. We assumed that these units are projected to be retired or will be converted to a unit that relies on fuel other than coal. Thus, we did not include these units in the calculation of total nameplate capacity or projected 2010 SO_2 emissions. In addition, for five of the non-BART units, nameplate capacity and projected SO_2 emissions data were not listed in the Pechan file and were not included in the overall calculations.

C. Results

Based on the nameplate capacity and projected 2010 SO_2 emissions data, FGD "scorecards" (presented as Excel charts) were created to summarize information for BART and non-BART units in terms of the existence of FGD (i.e. existing, projected or none) in the BART-AR file. Information on nameplate capacity for all BART and non-BART units is presented in Table 2 below and is divided into categories based on the existence of FGD.

Table 2
Nameplate Capacity of Coal Fired Electric Generating Units
(in terms of BART Status and Existing/Projected SO_2 Controls)

Data Element	Total (MW)	BART Affected		Not BART Affected	
		MW	Percent of Total	MW	Percent of Total
FGD Projected (IPM 2010 Base Case)*	24,811	18,478	75%	6,333	25%
FGD Existing	94,637	42,658	45%	51,979	55%
Total FGD (Existing & Projected)	119,448	61,136	51%	58,312	49%
No FGD (Existing or Projected)	213,814	87,786	41%	126,028	59%
Total Nameplate Capacity	333,262	148,922	45%	184,340	55%

* FGD Projected includes projected FGD as included in IPM 2010 and other announced or planned scrubbers, including the NC units expected to install FGD to comply with SB 1078 (12,397 MW Total).

Note: The total nameplate capacity associated with existing and projected FGD at all coal units, BART-affected coal units, and not BART-affected coal units comprise 36%, 41%, and 32% of the corresponding total nameplate capacity, respectively.

Similarly, Table 3 below presents information on projected 2010 SO_2 emissions for all BART and non-BART units and, as in Table 2 above, is divided into categories based on the existence of FGD.

Table 3
Projected 2010 SO_2 Emissions from Coal Fired Electric Generating Units
(in terms of BART Status and Existing/Projected SO_2 Controls)

Data Element	Total Projected 2010 SO_2 (tons)	BART Affected		Not BART Affected	
		Projected 2010 SO_2 (tons)	Percent of Total	Projected 2010 SO_2 (tons)	Percent of Total
FGD Projected (IPM 2010)*	833,583	607,558	73%	226,025	27%
FGD Existing	1,142,396	445,906	39%	696,490	61%
Total FGD (Existing & Projected)	1,975,979	1,053,464	53%	922,515	47%
No FGD (Existing or Projected)	7,718,783	3,407,064	44%	4,311,719	56%
Total Projected 2010 SO_2 (tons)	9,694,762	4,460,528	46%	5,234,234	54%

* FGD Projected includes projected FGD as included in IPM 2010 and other announced or planned scrubbers, including the NC units expected to install FGD to comply with SB 1078 (323,239 2010 SO_2 tons total).

Note: The total 2010 SO_2 emissions (tons) associated with existing and projected FGD at all coal units, BART-affected coal units, and not BART-affected coal units comprise 20%, 24%, and 18% of the corresponding total 2010 SO_2 emissions, respectively.

The FGD scorecards use the information in Tables 2 and 3 to present a pre-BART control scenario. For a post-BART scenario, the FGD scorecards assume the use of FGD on all BART-affected units. The scorecards present the information both in terms of nameplate capacity and projected 2010 SO_2 emissions for the universe of coal-fired units. For the nameplate capacity scorecards, we removed all MW capacity from the BART, No FGD category and added this capacity to the BART, FGD Projected category in order to show the post-BART scenario.

For the scorecards that present SO_2 emissions in a pre- and post-BART control scenario, the emissions from the BART, No FGD category in the pre-BART scenario were added to the Projected FGD category as controlled emissions. The following section on evaluating control costs summarizes the method used to apply FGD types to each unit and then calculate controlled 2010 SO_2 emissions. PQA applied two scenarios to evaluate which FGD type should be applied to each unit. The first scenario was based on IPM assumptions while the second was based on suggestions from EPA staff. Both scenarios are presented in the FGD scorecards for SO_2 emissions in separate worksheets. The approach for these two scenarios is described in greater detail in the following section.

VI. BART Control Costs

A. Overview of Results

We calculated cost effectiveness (dollars per ton of SO_2 removed) for the projected BART FGD installations based on the FGD cost model spreadsheets provided by Chad Whiteman and Tim Smith. The cost models in the spreadsheets are from *Controlling SO_2 Emissions: A Review of Technologies*, EPA/600/R-00/093, November 2000.

We performed two sets of cost calculations. Both sets of calculations use 2010 unit information (coal sulfur content and heat input, and coal usage) from the Pechan file (the IPM 2000 Base Case run for 2010, performed as part of EPA's Clear Skies analysis).

For the first set of calculations, we assigned the scrubber type for the unit based on the coal sulfur content and unit size in the same manner as the IPM model runs (summarized below in Table 4). Note that if there was more than one affected unit at a plant, we applied the scrubber type for the largest unit to all of the BART-affected units at the plant.

Table 4
Determination of FGD Type
Based on Capacity and Sulfur Content

Coal Sulfur Content (%)	**Unit Nameplate Capacity (MW)**			
	< 100	**≥ 100, and ≤ 550**	**> 550, and ≤ 1,000**	**> 1000**
≤2.0	None	MEL	LSD	LSFO
≤2.5	None	MEL	LSFO	LSFO
>2.5	None	LSD	LSFO	LSFO

Note: LSD - Lime Spray Drying (90% Control)
LSFO - Limestone Forced Oxidation (95% Control)
MEL - Magnesium Enhanced Lime (95% Control)

For the second set of calculations, we modified the approach by assigning an LSFO scrubber type to all units greater than 550 MW. This scenario increased the control efficiency to 95% for units greater than 550 and less than or equal to 1,000 MW with coal sulfur contents less than or equal to 2.0%. This modification affected all 106 units which had previously been assigned an LSD scrubber at 90% control.

Table 5, below, presents the overall cost, emissions reduction, and cost effectiveness for both the first and second scenarios. The cost effectiveness for each unit under the two FGD scenarios are provided in the file BART FGD Cost Calculation Summary.xls. The second scenario is more cost effective than the first, has lower annual costs, and reduces emissions overall by 95% compared to 91%. Applying the LSFO FGD type in the second scenario also is less costly on a unit basis, both in terms of total annual cost and cost effectiveness, for all of the units which had been assigned an LSD scrubber in the first scenario.

Table 5
BART Unit FGD Cost Effectiveness
Control Scenario 1 vs. Control Scenario 2

Control Scenario	Total Annual Cost	2010 PreControl Emissions	2010 Tons Reduced	Cost Effectiveness ($/ton)	Overall Control
1	$3,244,156,622	3,407,064	3,097,896	$1,047	91%
2	$2,640,714,012	3,407,064	3,235,880	$816	95%

B. <u>Cost Spreadsheet Variables</u>

Other variables that we included in the FGD cost calculations for BART units include:

1. <u>2010 - Heat Input (trillion Btus), SO_2 Emissions (tons), and Heat Rate (Btu/kWh)</u>

   We obtained the 2010 heat input (trillion btus), sulfur dioxide emissions (tons), and heat rate (btu/kWh) from the Pechan file. This file contains the 2000 base case results for the year 2010 IPM model run performed as part of EPA's Clear Skies analysis. The file, EPA Base Case 2000 Parsed for 2010, is available at: http://www.epa.gov/airmarkets/epa-ipm/results.html#downloadresults

2. <u>2010 - Capacity Factor</u>

   We calculated the capacity factors used in the cost spreadsheets for each unit as follows (calculation does not include unit conversion factors): [Heat Input (Btu)/Heat Rate (Btu/kWh)]÷[Nameplate Capacity (kW) X 8,760 (hrs/yr)]. As described above, the nameplate capacity was divided in half for the four pairs of units at the Powerton and Joliet 29 plants in Illinois with shared generators.

3. 2010 - Coal Heat Content

We used three coal heat contents for the cost calculation spreadsheet, and to back out coal sulfur content as described in item 4. below. We obtained the heat contents from Section 5 of the IPM Model Run Documentation Report, which can be found at: http://www.epa.gov/airmarkets/epa-ipm/index.html#documentation. The three heat contents are:

- Bituminous: 23.8 mmBtu/ton (11,900 Btus/lb)
- Sub-bituminous: 17.1 mmBtu/ton (8,550 Btus/lb)
- Lignite: 12.8 mmBtu/ton (6,400 Btus/lb)

4. 2010 Coal Percent Sulfur:

We calculated the projected 2010 sulfur content data for each of the three types of coal listed above based on the 2010 heat input, SO_2 emissions, and the coal heat content from item c. above: [SO_2 (tons)/(2 tonsSO2/tonS)/0.97] ÷ [coal heat input (Btus)/(coal heat content (Btus/lb)]. This calculation does not include unit conversion factors.

VII. Units Potentially Affected under BART at Plants < 750 MW

A. Overview

In addition to analyzing the BART units at plants that exceed the 750 MW cutoff, there are a number of other units that, based on the BART time frame alone, could potentially be subject to the BART requirements. Table 6 summarizes the number of units, nameplate capacity and SO_2 emissions associated with all the coal units previously identified as non-BART (i.e. for which the sum of the units' nameplate capacity is less than 750 MW) that either:

- Fall within the BART time frame (online 1962-1977), or
- Potentially fall within the BART time frame (online 1978-1985).

Note that the data in Tables 6 and 7 only include Acid Rain Program units. While the Pechan file includes other coal-fired units, that file does not include online dates. Therefore, additional, non-Acid Rain Program units are not included in the data summarized in Tables 6 and 7. The information in Table 6 is divided into AR units that have existing FGD, projected FGD, or no FGD.

Table 6
Potential BART Units (AR file)
Sum of Units < 750 MW and Online 1962 - 1985

Online	Data Element	Existing FGD	Projected FGD	No FGD	Total
1962-1977	Number of Units	35	13	146	194
	Nameplate Capacity (MW)	8,689	3,993	31,642	44,324
	2010 SO_2 (tons)	113,529	150,246	1,193,328	1,457,103
1978-1985	Number of Units	51	3	44	98
	Nameplate Capacity (MW)	19,119	1,376	19,336	39,831
	2010 SO_2 (tons)	326,739	30,659	568,746	926,144

B. Potential Control Impacts

In order to evaluate the controls that may be applied to the potential BART units that do not have existing or projected scrubbers, we compiled summary data on the number of units, nameplate capacity, and 2010 SO_2 emissions for both the group of units with online dates between 1962 and 1977 and the group with online dates between 1978 and 1985. Table 7 summarizes these results. The table presents the data in terms of the size groupings that correspond with the control assumptions used in the cost spreadsheet as described above. The table identifies the assumed type of scrubber and control efficiency, based on the size of the unit and an assumed sulfur content of the coal.

Table 7
Potential BART Units at Plants < 750 MW
with No FGD (AR file) and Online 1962 to 1985

Online	Data Element	Size of Units (MW)			
		< 100	≥ 100 < 550	≥ 550 < 1,000	> 1,000
1962-1977	Number of Units	44	90	12	0
	Nameplate Capacity (MW)	2,923	21,644	7,075	0
	2010 SO_2 (tons)	85,644	822,195	285,489	0
	Type of FGD	No FGD	MEL	LSFO*	LSFO
	Control Efficiency	0 %	95 %	95 %	95 %
1978-1985	Number of Units	6	16	21	1
	Nameplate Capacity (MW)	928	5,221	11,887	1,300
	2010 SO_2 (tons)	32,481	156,880	350,499	28,885
	Type of FGD	No FGD	MEL	LSFO*	LSFO
	Control Efficiency	0 %	95 %	95 %	95 %

*Note: LSD or LSFO was originally assumed for units greater than or equal to 550 but less than 1,000 in the cost spreadsheet depending on the sulfur content. The cost calculations previously assumed that if the sulfur content is less than or equal to 2%, then LSD would be applied, with LSFO applied for this group of units only if the sulfur content is greater than 2%. A second cost analysis scenario, as described in the cost section above, assigns LSFO for all units above 550 MW, and that assumption is used in this table as well.

As summarized in Table 6, the projected 2010 SO_2 emissions for the 1962 to 1977 group and the 1978 to 1985 group, were 1,193,328 tons and 568,745 tons, respectively. If the assumed FGD types listed in Table 7 are applied, the revised projected 2010 SO_2

emissions would be 141,027 tons and 41,769 tons, respectively. If the original IPM Base Case control assumptions are applied, it is likely that all the units between 550 and 1,000 MW would have an LSD scrubber applied with a 90 percent control efficiency assumption. In this case, the reductions would result in projected 2010 SO_2 emissions of 155,302 and 59,294 tons, respectively, for the 1962-1977 and 1978-1985 units.

C. Non-Acid Rain Units

In addition to the non-BART Acid Rain units, there are also 245 non-Acid Rain units with a total nameplate capacity of 8,697 MW that are included in the Pechan file but not in the AR file. Table 8 below summarizes the total nameplate capacity of these units and the number of units with existing or projected FGD. There are 87 units with a nameplate capacity greater than 25 MW, and 20 of these have existing or projected FGD. All 87 units are listed as coal fired units in the Pechan file. However, monitoring plan data and/or EIA data indicate that for the 67 units greater than 25 MW with no existing or projected FGD, four are natural gas-fired, one is wood-fired, and one uses petroleum coke as its primary fuel.

We were able to obtain online dates from monitoring plan data, EIA data, or the SIP EGU inventory, for 62 of the 67 units with a nameplate capacity greater than 25 MW. Only two of these units were found to have an online date that falls between the 1962 and 1985 time frame. However, one of these units (Orrville, OH, ORIS 2935, Unit 13, online 1971), has projected 2010 SO_2 emissions of zero. The other unit (Long Beach Generation LLC, CA, ORIS 341, unit ST9, online 1977) has a primary fuel of natural gas, according to EIA data. Therefore, the impact of adding these units into to the analysis of BART affected sources appears to be relatively small. The remaining five units for which online dates could not be confirmed, may fall within the time frame but would have a minimal impact. Based on monitoring plan data, one of these units is deferred. The nameplate capacity and projected 2010 SO_2 emissions for the other four units total only 119 MW and 3,078 tons, respectively.

Table 8
Potential BART Units in Pechan File

Rated Nameplate Capacity (MW)	Number of Units	Total Nameplate Capacity (MW)	Number of Units with Existing FGD	Number of Units with Projected FGD
> 25 MW	87	6,743	19	1
≤ 25 MW	158	1,954	1	0
Total	245	8,697	20	1

There are five units that are listed in the Pechan file but do not have any associated nameplate capacity or 2010 SO_2 data, and therefore, were not included in the calculations for these data or for the overall calculations for the nameplate capacity and 2010 projected SO_2 data in the FGD scorecard charts. These units are Savannah River Mill (GA), ORIS 10361, units GEN3 and GEN4; Silver Bay Power Company (MN), ORIS 10849, units GEN1 and GEN2; and Piqua (OH), ORIS 2937, unit 10.

VIII. Summary of Key Findings for All Coal Units

We analyzed a total of 1,298 coal units in terms of BART applicability and the existence of FGD. Table 9 below lists the number of units in each file in terms of these criteria. These totals do not include the five units for which no information was listed in the Pechan file or the 29 units that were included in the AR file but not in the Pechan file as described in Section V.B. The SO_2 control data were obtained from the Pechan file, while the nameplate capacity data were obtained from this file only for the non-AR units. The data source for the nameplate capacity is included to show, for each category, the number of units for which data were obtained from the AR or Pechan files.

Table 9
Summary of BART and FGD Status for Coal Units

Existence of FGD	BART Units (>750 MW)		Non-BART Units	
	Number of Units	Data Source for Nameplate Capacity	Number of Units	Data Source for Nameplate Capacity
No FGD	138	AR file	865	AR file (641 units) Pechan file (224 units)
Existing FGD	77	AR file	168	AR file (149 units) Pechan file (19 units)
Projected FGD	26	AR file	24	AR file (23 units) Pechan file (1 unit)
All Units	241	AR file	1,057	AR file (812 units) Pechan file (245 units)

IX. Next Steps

A. Determine Potential BART Applicability of Units at Plants < 750 MW

We could determine the potential applicability under the BART rule for the AR units that are less than 750 MW, have an online date between 1978 and 1985, do not have existing or projected scrubbers, and have a rated nameplate capacity greater than 100 MW.

This analysis is relevant because these units could be affected under the BART rule and required to install controls. Table 10 summarizes these 38 units, which could have been issued a construction permit prior to the August 7, 1977 cutoff. As with the AR units greater than 750 MW that have an online date between 1978 and 1985, the appropriate state agency contact could provide this information.

Table 10
Non-BART Units Potentially Affected by Proposed BART Rule
Online 1978 to 1985

ST	Plant Name	Plant ID	Unit ID	Total SO2 Emission (2010 Tons/yr)	Nameplate Capacity (MW)	Online
AR	Flint Creek	6138	1	18,109	558	1978
AR	Independence	6641	2	24,008	850	1984
CO	Pawnee	6248	1	13,097	500	1981
CO	Ray D Nixon	8219	1	5,425	207	1980
DE	Indian River	594	4	15,761	442	1980
FL	Deerhaven	663	B2	8,279	251	1981
GA	McIntosh	6124	1	9,444	178	1979
IA	Council Bluffs	1082	3	16,884	726	1978
IA	George Neal South	7343	4	23,400	640	1979
IA	Louisa	6664	101	18,085	738	1983
IA	Ottumwa	6254	1	20,240	726	1981
IL	Havana	891	9	14,145	488	1978
IN	Rockport	6166	MB1	28,885	1,300	1984
KS	Nearman Creek	6064	N1	5,789	261	1981
KY	Ghent	1356	3	17,889	557	1981
KY	Ghent	1356	4	16,593	556	1984
LA	Big Cajun 2	6055	2B3	15,387	560	1984

(cont.)

Table 10
Non-BART Units Potentially Affected by Proposed BART Rule
Online 1978 to 1985 (cont.)

ST	Plant Name	Plant ID	Unit ID	Total SO2 Emission (2010 Tons/yr)	Nameplate Capacity (MW)	Online
LA	Rodemacher	6390	2	19,410	558	1982
MO	Iatan	6065	1	15,261	726	1980
NE	Platte	59	1	2,846	616	1979
NE	Whelan Energy	60	1	2,105	110	1982
NV	North Valmy	8224	1	6,534	254	1981
OH	Killen Station	6031	2	22,944	666	1982
OK	GRDA	165	1	14,247	490	1982
OK	Hugo	6772	1	11,425	400	1982
OK	Muskogee	2952	6	14,124	572	1984
OR	Boardman	6106	1SG	15,187	561	1980
TX	Coleto Creek	6178	1	16,489	600	1980
TX	Harrington Station	6193	062B	8,352	360	1978
TX	Harrington Station	6193	063B	8,328	360	1980
TX	Tolk Station	6194	171B	12,330	568	1982
TX	Tolk Station	6194	172B	12,214	568	1985
TX	W A Parish	3470	WAP7	15,452	615	1980
WI	Edgewater	4050	5	11,078	380	1985
WI	J P Madgett	4271	B1	10,201	387	1979
WI	Pleasant Prairie	6170	1	16,825	617	1980
WI	Pleasant Prairie	6170	2	16,825	617	1985
WI	Weston	4078	3	12,670	350	1981

B. Additional Analyses for the Units at Plants < 750 MW

For the units identified in Section IX.A. that are within the BART time period, we could conduct a separate analysis to evaluate the cost of compliance for these units. In addition, we also could calculate the distance to the nearest Class I area for each of these units.

C. Determine which non-BART Units Share a Generator

This determination would not affect the BART-applicability status of these units but may help present a more accurate picture of the total nameplate capacity represented by this subset of units. Note that the total nameplate capacity for the BART-affected units in the AR file were approximately 10 percent higher than the corresponding nameplate capacity data in the Pechan file.

D. Perform Additional Cost Analyses

Performing additional cost analyses may be helpful and there are several additional control scenarios we could test in this context. The most basic approach would be to optimize the scrubber type on a unit basis by modeling each one and assigning the least expensive type to each unit. However, in some cases, this approach would result in the application of FGD types that vary between the units located at the plant. Another approach would be to apply one large scrubber as the control strategy for all of the BART units at a plant. Of the 135 BART units, 125 are at plants with multiple BART units. Modeling this scenario would be more time consuming, and would require additional calculations to normalize unit capacity factors, heat rate, and fuel sulfur content on a plant basis before performing the cost calculations. If this approach is used in a cost analysis, the basis upon which IPM estimates cost (i.e. on a unit or plant basis) should be verified to ensure consistency with other cost analyses. It may be helpful to test this approach on one or two plants prior to its application to all BART units.

Enclosures
DLS/eab

June 15, 2005

TECHNICAL SUPPORT DOCUMENT
METHODOLOGY FOR DEVELOPING BART NO_x PRESUMPTIVE LIMITS

Attachment B

Memorandum: Follow-Up on Units Potentially Affected by BART

PERRIN QUARLES ASSOCIATES, INC.
675 PETER JEFFERSON PARKWAY, SUITE 200
CHARLOTTESVILLE, VIRGINIA 22911
VOICE: (434) 979-3700 • FAX: (434) 296-2860
EMAIL: pqa@pqa.com

MEMORANDUM

TO: Roman Kramarchuk

FROM: Doran Stegura

RE: Follow-Up on Units Potentially Affected by BART

DATE: July 19, 2004

On March 24, 2003, PQA delivered an analysis of sources that may be subject to controls under EPA's Proposed Guidelines for Best Available Retrofit Technology (BART) Determinations. This analysis provided a list of BART units, additional information on the location and control technologies for each unit, and control cost information. The March 2003 analysis only focused on the units for which construction was started by August 7, 1977 and that were not in operation prior to August 7, 1962. Based on EPA guidance, the original analysis also assumed that BART-eligible units are only those that are located at a plant where the total capacity of all units within the BART timeframe exceeds 750 MW.

This follow-up analysis provided additional information on units that are below the 750 MW threshold, but that are potentially within the specified BART timeframe. The approach and assumptions used to identify whether units below the 750 MW threshold could potentially be BART-eligible are consistent with the March 2003 analysis. The units that required additional follow-up research in this regard are those with an online date on or after 1979 since the BART rule could apply if construction on these units commenced prior to August 7, 1977. It was assumed that units with a 1977 or 1978 online date started construction prior to the 1977 cutoff and thus, are considered to be within the BART timeframe. Hunter, unit 1 (UT) is the only exception since it has a PSD permit with an online date of 1978. For the units in question, PQA reviewed the RACT/BACT/LAER Clearinghouse and other internet search information and contacted the appropriate State environmental agencies to verify when the construction permit was issued. Note that the date the construction permit was issued is used as an indication of when construction began for purposes of this analysis. However, actual construction on these units may have started well after the date the permit was issued.

In evaluating the list of units below the 750 MW threshold and with an online date in 1979 or later, PQA assumed that: 1) units subject to Part 60, Subpart D cannot be excluded because this NSPS subpart applies to sources that have started construction after August 17, 1971; 2) units subject to NSPS Subpart Da requirements are outside the applicable BART time period since these requirements apply to sources that started construction after September 18, 1978; and 3) units that received a PSD permit (with a BACT requirement) are outside the BART time period. If a PSD permit was issued, PQA researched the issue date in order to confirm that the unit is outside the BART time period.

Using the above assumptions, a list of 61 units was compiled that required follow-up with the State environmental agency to confirm whether construction began prior to August 7, 1977. Of these 61 units, 43 are located in States covered under the Clean Air Interstate Rule (CAIR) and 18 are located in States not covered under CAIR. Per EPA guidance, initial priority was given to those units not located in a State affected by CAIR. Follow-up with the State environmental agencies revealed that of the 61 units that required follow-up, 24 units are within the BART time period, 24 units are outside the BART time period, and 13 units require further follow-up since the State environmental agency was not able to provide the information needed to determine whether the unit started construction prior to August 7, 1977.

Table 1 summarizes the 61 units analyzed by PQA. The table provides an indication of whether the unit is located in a state affected by CAIR, whether the unit has been identified as within the BART timeframe, and whether additional follow-up with the State agency for information on construction permit dates is required to determine BART eligibility.

Table 1: Potential BART Units Identified for Follow-Up Analysis

State	Plant Name	ORIS Code	Unit ID	Online	NSPS	CAIR	In BART timeframe?	Follow-up Needed	Nameplate (MW)
AL	Charles R Lowman	56	2	1979	D	X	X		233
AL	Charles R Lowman	56	3	1980	D	X	X		233
AZ	Apache Station	160	2	1979	D		X		194.7
AZ	Apache Station	160	3	1979	D		X		194.7
AZ	Springerville	8223	1	1985	D				397
AZ	Springerville	8223	2	1990	D				397
CO	Pawnee	6248	1	1981	D			X	500
CO	Ray D Nixon	8219	1	1980	D		X		207
DE	Indian River	594	4	1980	D	X	X		442.4
FL	C D McIntosh	676	3	1982	D	X			334

(cont.)

Table 1: Potential BART Units Identified for Follow-Up Analysis (cont.)

State	Plant Name	ORIS Code	Unit ID	Online	NSPS	CAIR	In BART timeframe?	Follow-up Needed	Nameplate (MW)
FL	Deerhaven	663	B2	1981	D	X			250.75
GA	McIntosh (6124)	6124	1	1979	PRE	X	X		177.66
IA	Ames	1122	8	1982	D	X			65
IA	George Neal South	7343	4	1979	D	X	X		639.9
IA	Louisa	6664	101	1983	D	X			738.09
IA	Ottumwa	6254	1	1981	D	X	X		726
IN	A B Brown Generating Station	6137	1	1979	D	X	X		265.23
KS	Nearman Creek	6064	N1	1981	D	X	X		261
KY	East Bend	6018	2	1981	D	X		X	669.28
KY	R D Green	6639	G1	1979	D	X		X	263.7
KY	R D Green	6639	G2	1981	D	X		X	263.7
KY	Trimble County	6071	1	1990	D	X		X	566.1
LA	Dolet Hills	51	1	1986	D	X			720.75
LA	R S Nelson	1393	6	1982	D	X	X		614.6
LA	Rodemacher	6190	2	1982	D	X	X		558
MD	Brandon Shores	602	1	1984	D	X	X		685.08
MD	Brandon Shores	602	2	1991	D	X	X		685.08
MI	Presque Isle	1769	9	1979	D	X	X		90
MI	Wyandotte	1866	7	1982	D	X			73
MN	Clay Boswell	1893	4	1980	D	X	X		558
MO	Iatan	6065	1	1980	D	X	X		725.85
MO	Sikeston	6768	1	1981	D	X	X		261
NC	Elizabethtown Power	10380	UNIT1	1985	D	X			35
NC	Elizabethtown Power	10380	UNIT2	1985	D	X			35
NC	Lumberton Power	10382	UNIT1	1985	D	X			35
NC	Lumberton Power	10382	UNIT2	1985	D	X			35
NC	Mayo	6250	1A	1983	D	X			735.84
NC	Mayo	6250	1B	1983	D	X			735.84
ND	Antelope Valley	6469	B1	1984	D				435
ND	Antelope Valley	6469	B2	1986	D				435
ND	Coyote	8222	B1	1981	D				450
NE	Gerald Whelan Energy Center	60	1	1981	D				76.3
NE	Nebraska City	6096	1	1979	D		X		615.87
NE	Platte	59	1	1982	D				109.8
NV	North Valmy	8224	1	1981	D			X	254.26
OH	Killen Station	6031	2	1982	D	X	X		666.45
OK	Grand River Dam Authority	165	1	1982	D				490
OK	Hugo	6772	1	1982	D				400
OR	Boardman	6106	1SG	1980	D		X		560.5
TX	Coleto Creek	6178	1	1980	D	X	X		600.39
TX	Gibbons Creek	6136	1	1983	D	X			443.97
TX	Pirkey	7902	1	1985	D	X			720.75
TX	San Miguel	6183	SM-1	1982	D	X			410
TX	Sandow	6648	4	1981	D	X	X		590.64
UT	Hunter (Emery)	6165	1	1978	D			X	446.4
UT	Hunter (Emery)	6165	2	1980	D			X	446.4
WI	Edgewater (4050)	4050	5	1985	D	X		X	380
WI	J P Madgett	4271	B1	1979	D	X		X	387
WI	Pleasant Prairie	6170	1	1980	D	X		X	616.59
WI	Pleasant Prairie	6170	2	1985	D	X		X	616.59
WI	Weston	4078	3	1981	D	X		X	350.46

DLS/jlj