

US EPA ARCHIVE DOCUMENT

Technical Support Document  
for the  
Rulemaking on Section 126 Petition from North Carolina to Reduce Interstate Transport  
of Fine Particulate Matter and Ozone;  
Federal Implementation Plans to Reduce Interstate Transport of  
Fine Particulate Matter and Ozone; Revisions to the Clean Air  
Interstate Rule; Revisions to the Acid Rain Program  
(70 FR 49708; August 24, 2005)

**Waste Coal-Fired Units in the CAIR and CAIR FIP**

EPA Docket number: OAR-2004-0076  
March 2006

U.S. Environmental Protection Agency  
Office of Air and Radiation

## **Introduction**

This technical support document (TSD) presents analysis the United States Environmental Protection Agency (EPA) performed to support its response to commenters' request for an exemption for waste coal-fired units from the CAIR SO<sub>2</sub> annual program. (The complete response maybe found in the Response to Comment document for the Clean Air Interstate Rules Federal Implementation Plan (CAIR FIP) and preamble to today's rule.) This TSD examines the potential financial impacts of CAIR on waste coal-fired units in CAIR SO<sub>2</sub> annual program when they (1) have power purchase agreements in place and (2) once the power purchase agreement expire. The first two analyses (in section 1) pertain to when waste coal-fired units have a power purchase agreement (PPA) in place and, because they are exempt from title IV, can take advantage of the title IV opt-in provisions. The third analysis (in section 2) evaluates the potential financial impacts to waste coal-fired units for the period beginning when their power purchase agreements have expired and they are free to participate in the electricity markets.

The analysis presented in this TSD demonstrates that the commenters have not shown that, as a category, the CAIR SO<sub>2</sub> program would make waste coal-fired units economically unviable. In fact, EPA analysis presented in this TSD shows that a typical waste coal-fired unit would remain viable. The analysis presented in this TSD support EPA's response to commenters request for an exemption from the CAIR SO<sub>2</sub> annual program only because waste coal-fired units have not indicated any difficulty in complying with the CAIR NO<sub>x</sub> annual and ozone season programs.

## **Background**

The CAIR model trading rules regulate waste coal-fired units. While commenters have not expressed concern that these units will be part of the CAIR NO<sub>x</sub> annual and ozone season programs, they have requested that they be exempt from the CAIR SO<sub>2</sub> annual program. This is, in part, related to the fact that the CAIR SO<sub>2</sub> annual program builds upon the successful title IV SO<sub>2</sub> cap-and-trade program and relies upon the existing trading program infrastructure and emission allowance allocations. The title IV allowance allocation system is permanent with some portion being auctioned each year. Waste coal-fired facilities have not received a title IV SO<sub>2</sub> allowance allocation because they have been exempt from title IV under the IPP exemption. Title IV's IPP exemption applies to units that had power purchase agreements with fixed prices in place on November 15, 1990 and includes units other than waste coal-fired facilities. The purpose of the exemption is to protect IPP facilities subject to contract prices that were set before passage of the Clean Air Act Amendments of 1990 (including the Acid Rain Program in title IV) and that did not allow pass through of the costs of Acid Rain Program compliance. However, EPA believes that this exemption was aimed at easing the transition of such facilities into the Acid Rain.

While waste coal-fired units have a valid power purchase agreement (and, subsequently, an exemption from title IV), they may choose to opt in to the title IV program and receive SO<sub>2</sub> allowances. The title IV opt-in provisions provide units with SO<sub>2</sub> allowances based

upon their heat input (i.e., the average of their annual heat input for the years 1985 through 1987 or, for facilities that commenced operation after January 1, 1985, their first three whole years of operation) and their emission rate (i.e., the lesser of their actual emission rate during the first baseline year or their lowest permitted emission limit in year they apply that will be effective that year or any time after).

When the waste coal-fired units' power purchase agreements expire, the units lose their title IV exemption. As title IV affected units, they lose their title IV opt-in status and can no longer receive title IV allowances under the title IV opt-in provisions. These units are no longer locked into their power purchase contracts and are free to participate in the wholesale electricity markets.

Under CAIR, waste coal-fired units meet the applicability requirements that define which units are affected as electricity generating units (EGUs). EPA has not extended the title IV exemption for units with power purchase agreements. As explained in the preamble and response to comment document that are supported by this TSD, EPA believes that waste coal-fired units should not be exempt from the requirements to comply with CAIR that control emissions from the power sector.

## **1. Waste Coal-Fired Units under CAIR with Title IV Opt-In**

As mentioned above, waste coal-fired units may choose to opt in to the title IV program and receive SO<sub>2</sub> allowances while they have a valid power purchase agreement in effect. Commenters believe that even with SO<sub>2</sub> allowances from the opting into title IV, they would not be economically viable. To evaluate this claim, EPA conducted the two analyses presented in this section. The first examines the limited analysis that commenter submitted on the ratio of the cost of CAIR compliance for SO<sub>2</sub> emissions to electric generation revenues. The second analysis examines, based on the limited data that commenters provided, the potential allocations that waste coal-fired units may receive under the title IV opt-in provisions.

### **Evaluation of Commenters' Cost to Revenue Ratio Analysis**

Some limited analysis of the ratio of the cost of CAIR compliance for SO<sub>2</sub> emissions to electric generation revenues was provided by commenters to support their claim that CAIR would make their units economically unviable. Presented below in Table 1 is EPA's evaluation of the commenter-provided analysis. The commenters developed their estimate of the cost of compliance under CAIR using their own estimate of their SO<sub>2</sub> emissions and what they believed to be EPA's projected allowance price. However, inaccuracies in the commenters' assumptions about EPA's projected cost per ton resulted in an overestimation of their cost of compliance estimates. One specific assumption made by the commenters is that the projected cost per ton were allowance prices. As a result, they multiplied the projected cost per ton by the CAIR SO<sub>2</sub> programs retirement ratios (i.e., 2-to-1 in 2010 and 2.86-to-1 in 2015). In fact, EPA modeling has projected the cost of emitting one ton of SO<sub>2</sub> under the CAIR to be \$616/ton and \$892/ton in 2010

and 2015, respectively.<sup>1</sup> (The modeling, and resulting cost per ton, already incorporates the CAIR SO<sub>2</sub> retirement ratios.) Based upon the same revenue and emissions reported by the commenters, EPA recalculated the cost to revenue ratios using the appropriate cost per ton for CAIR compliance.

Table 1: EPA Evaluation of Commenters' Cost to Revenue Ratios

Waste Coal Power Plants	Commenter Estimated Compliance Cost/Revenue		EPA Estimated Cost/Revenue*		Percent Commenter Estimate Is Greater Than EPA Estimate	
	2010	2015	2010	2015	2010	2015
Cambria CoGen	12%	15%	2%	4%	556%	325%
Colver	8%	10%	1%	2%	636%	377%
Ebensburg	11%	14%	2%	4%	461%	270%
Gilberton	7%	9%	1%	2%	487%	291%
NEPCO	6%	7%	1%	2%	453%	234%
Northampton	2%	2%	<1%	1%	578%	251%
Panther Creek	2%	3%	<1%	1%	357%	255%
Piney Creek	10%	12%	2%	4%	437%	234%
Schuykill	7%	9%	1%	3%	423%	248%
Scrubgrass	6%	8%	1%	2%	650%	418%
Westwood	4%	5%	1%	1%	418%	235%
Wheelabrator	4%	4%	1%	1%	456%	188%
Average	7%	8%	1%	2%	493%	277%

\* Estimate is based upon EPA recalculation of CAIR compliance cost and commenter-provided estimates of emissions and revenue. CAIR compliance cost was calculated by multiplying the commenter's reported SO<sub>2</sub> emissions by the cost of emitting one SO<sub>2</sub> ton under CAIR (i.e., \$616/ton and \$892/ton in 2010 and 2015, respectively). The cost of emitting one ton of SO<sub>2</sub> is based upon IPM modeling. The EPA recalculated CAIR compliance cost does not include the cost of complying with title IV. As a result, the incremental cost associated with CAIR (that is, additional to the cost that would have been borne for title IV compliance) is roughly 1/2 and 2/3 of the total reported emissions. For facilities with PPAs in effect, this can reflect a unit that receives title IV opt-in allowances equal to all of its current emissions. For facilities with expired PPAs that can not receive title IV opt-in allowances, this represents the incremental cost of CAIR (i.e., the cost beyond that the facility would already incurred from title IV compliance).

These recalculated ratios range from under 1% to 4%. The commenter overestimated the ratio for their units by an average of close to 500% and 300% in 2010 and 2015, respectively. As a result, the commenters have not shown that the cost to revenue ratios, especially when recalculated to appropriately account for costs, would result in their units being, as they claim, “economically unviable.”

### EPA Evaluation of Title IV Potential Opt-In Allocation Levels

While under a power purchase agreement, waste coal-fired units can opt in to title IV program and receive allowances through the title IV individual unit opt-in provisions. However, commenters expressed concern that their allocation of title IV opt-in

<sup>1</sup> EPA modeling run “IPM Run-CAIR/CAMR/CAVR” that can be found at <http://www.epa.gov/airmarkets/mp/>.

allowances would be less than their current emissions, because they may operate more in the future than they did during the baseline years. As mentioned earlier, the title IV opt-in provisions provide units with SO<sub>2</sub> allowances based upon their heat input and their emission rate. More specifically, the heat input used for this determination is the average of their heat input during the years 1985 through 1987 or, for facilities commencing operation after January 1, 1985, the average of their first 3 full years of operation. The commenters believe that, as a result, EPA estimates based upon these units receiving title IV opt-in allowances equal to their current emission levels and, potentially, sufficient to offset one allowance needed under CAIR for each ton emitted (e.g., under Phase I sources would have to buy only one additional allowance), are inaccurate. Again, according to commenters, this would vary greatly from plant to plant.

To evaluate the commenters concern, EPA examined some limited information on the potential financial impacts of CAIR and the title IV opt-in provisions. While this information was limited to only 4 facilities, EPA examined whether the commenter-provided estimates of their title IV opt-in allocations would compare to their current emissions. Table 2 shows that, even by the commenter-reported estimates, these facilities would likely receive title IV SO<sub>2</sub> allowances that are 88 percent or greater of their current emissions, with one facility having coverage of 46 percent.

Table 2: EPA Evaluation of Commenters Potential Title IV Opt-In Allocations

	Commenter- Provided SO <sub>2</sub> Emissions (2001-2005 Ave)**	Commenter-Provided Estimate of Allocation from Title IV Opt-in**	% Current Emissions Covered by Title IV Opt-in Allocations
Facility 1*	543	480	88%
Facility 2*	3,668	1,688	46%
Facility 3*	1,171	1,142	98%
Facility 4*	2,163	1,900	88%

\* Facility names have not been provided to comply with commenters request that information be considered confidential.  
 \*\* Data provided in letters from Steven Shimberg (March 1, 2006) and Lisa Jaeger (March 8, 2006). Source of data was not specified.

As a result, the limited data that the commenters submitted to support their claim that EPA had overestimated the amount of title IV opt-in allowances they would receive (i.e., the title IV opt-in provisions would not provide sufficient SO<sub>2</sub> allowances to account for their current emission levels) has shown that some, if not many, of the facilities would receive title IV opt-in allocations very similar to their current emission levels. This data further illustrates that, because the terms of the contracts can vary greatly, the potential impacts of title IV and the CAIR on waste coal-fired facilities will also vary. This supports EPAs point that the commenters have not demonstrated that, as a category of sources, CAIR would make them economically unviable and justify exempting the entire group.

EPA also notes that, as with the commenters' analysis of the cost to revenue ratios (discussed earlier in this document), the commenters developed their estimate of the cost of compliance under CAIR using their own estimate of their SO<sub>2</sub> emissions and what they believed to be EPA's projected allowance price. The limited material submitted as part of the title IV opt-in allocation analysis (presented in this section) included the same

inaccuracies in the commenters' assumptions about EPA's projected cost per ton. Again, the commenters assumed that the projected cost per ton were allowance prices multiplied the projected cost per ton by the CAIR SO<sub>2</sub> programs retirement ratios (i.e., 2-to-1 in 2010 and 2.86-to-1 in 2015).

## **2. Waste Coal-Fired Units Under CAIR without Title IV Opt-in**

EPA also analyzed the potential impacts to waste coal-fired units when their PPAs have expired (i.e., the units have lost the exemption from title IV and can not receive title IV opt-in allowances) and the units are free to participate in the electricity. The analysis presented in this section assumes that the waste coal-fired units do not receive any title IV SO<sub>2</sub> allowances and must purchase SO<sub>2</sub> allowances to account for all of their emissions.

### **EPA Evaluation of Title IV Potential Opt-In Allocation Levels**

Because the unit-specific information and analysis provided by the commenters was limited, EPA conducted an analysis using generally available information to evaluate the potential impact of the cost of complying with CAIR for a typical circulating fluidized bed (CFB) combusting waste coal. This analysis examined how the potential cost to operate a typical waste coal-fired CFB unit (including the cost of complying with CAIR) compares to the potential price it would receive on the electricity market in the MAAC region, where most of the waste coal units operate.

As shown in Table 3, the estimated cost of producing electricity for a typical waste coal-fired CFB would be significantly less than the EPA projected wholesale price and the forecasted price of electricity. Specifically, the analysis estimated the potential cost of producing electricity for a waste coal-fired CFB to be approximately \$17.00/MWh and \$17.74/MWh in 2010 and 2015, respectively. Even with the cost of complying with CAIR factored in, the EPA estimated cost of production is significantly less than the EPA projected wholesale price, which is a good indicator of the price that waste coal-fired units would receive for their electricity on the market. Specifically, the waste coal-fired facilities are projected have a profit margin of \$10.10/MWh and \$18.29/MWh in 2010 and 2015, respectively. This is 37% and 50% of the projected wholesale electricity price in 2010 and 2015, respectively. This analysis shows that the waste coal-fired facilities will continue to operate and be profitable, even when factoring in the cost of complying with CAIR.

Table 3: Costs of Operating a Typical CFB Plant Burning Waste Coal

Components of Operating Costs	Cost to Operate 2010 (\$/MWh)	Cost to Operate 2015 (\$/MWh)
Variable O&M	\$2.11	\$2.11
Fixed O&M	\$5.31	\$5.31
Fuel Cost	\$7.28	\$7.20
SO <sub>2</sub> Allowance Cost	\$1.53	\$2.17
NO <sub>x</sub> Allowance Cost	\$0.77	\$0.95
Total Operating Cost*	\$17.00	\$17.74

Base Case Wholesale Electricity Price**	\$25.43	\$33.46
CAIR Wholesale Electricity Price**	\$27.10	\$36.06
* The total operating cost estimate, as well as component costs, are based on analysis presented in ICF memorandum (Attachment A to this TSD).		
** IPM projected wholesale electricity prices in the under the Base Case and CAIR (EPA 2006).		



Attachment 1



**MEMORANDUM**

**To:** Sam Waltzer, CAMD, EPA  
**From:** Barry Galef and Jason Lee, ICF  
**Date:** March 1, 2006  
**Subject:** Economic Viability of ARIPPA Plants Under CAIR

In response to your request, we have made a brief assessment of the impacts of CAIR on the ARIPPA plants located in Pennsylvania. Since these plants consume waste coal as fuel, we looked into the operating cost structure of plants in Pennsylvania consuming waste coal. We estimated total operating (or “avoidable”) cost, including fixed and variable O&M costs, fuel costs, and the cost of purchasing SO<sub>2</sub> and NO<sub>x</sub> allowances, in terms of \$/MWh, and compared it to the electricity revenue that can be earned under the CAIR regime. We found that, even with the cost of SO<sub>2</sub> and NO<sub>x</sub> allowances, the plants will still earn net revenues over their operating cost, in part because the wholesale electricity price increases under the CAIR regime. Thus, there is no reason to expect them to be shut down.

**OPERATING COSTS FOR PLANTS USING WASTE COAL**

In general, much of the “all-in” cost of coal-fired generation is in the capital investment, which is a “sunk” cost which cannot be avoided by closing down. The costs of continuing to operate, on the other hand, are relatively low. Thus, small changes in their costs will generally not drive their variable costs above their revenues, and so they will stay open. Exhibit 1 shows cost components of running plants burning waste coal in Pennsylvania. The dollar values in this exhibit, and in the rest of this memo, are presented in terms of 1999 dollars.

**Exhibit 1**  
**Cost Structure for Plants Using Waste Coal in Pennsylvania**

Variable O&M, \$/MWh	\$2.11
Fixed O&M, \$/kW-yr	\$39.55

Source: “Economic Impact of Renewable Energy in Pennsylvania, Black and Veatch, F. Analysis of the Advanced Energy Portfolio Standards,” Table F-3, p. F-7, November 19, 2004, available at [http://www.cfalleghenies.org/images/Energy\\_Study\\_11-04.pdf](http://www.cfalleghenies.org/images/Energy_Study_11-04.pdf) converted to 1999\$ from 2003\$.

Assuming the plants' capacity factor is 85%, the fixed O&M cost translates to \$5.31/MWh. Combining the fixed and variable O&M costs yields a total of \$7.42/MWh.

In addition to these operating and maintenance costs, the plants also incur fuel costs. The ARIPPA plants in Pennsylvania should have particularly low fuel costs because they run on waste coal. We have EIA estimates for cost of waste coal per ton in 2010 and 2015, and a heat content estimate of 8,000 Btu/lb from Black and Veatch (p. F-31). Translating the fuel cost into \$/MMBtu yields about \$0.714/MMBtu and \$0.706/MMBtu in 2010 and 2015 respectively, which is less than cost of bituminous coal for conventional coal plants. Using a heat rate of 10.2 MMBtu/MWh (again, from Table F-3 of Black and Veatch), the fuel cost becomes \$7.28/MWh in 2010 and \$7.20/MWh in 2015. (Note also that these fuel costs are probably flexible in the long run – because the waste coal has no other economically viable use, if the power plants could not operate competitively at existing prices, we would be more likely to see a drop in the price of the waste coal than a power plant closure.)

Another component of operating cost is the cost of allowances. Since waste coal plants are typically circulating fluidized bed plants, we can assume that most of the sulfur in the coal is removed, with an SO<sub>2</sub> control efficiency of about 90%. Using the SO<sub>2</sub> allowance cost of \$700/ton in 2010 and the heat rate for the waste coal, the per-unit SO<sub>2</sub> allowance cost becomes \$1.53/MWh. We use the NO<sub>x</sub> allowance cost of \$1206 in 2010 and the heat rate to estimate the per-unit NO<sub>x</sub> allowance cost to be \$0.77/MWh.

Summing these cost components, we estimated the total operating cost of running waste coal plants to be \$17.00/MWh in 2010. In 2015, IPM projects increase in the SO<sub>2</sub> allowance cost to \$1,000/ton and the NO<sub>x</sub> allowance cost to \$1481/ton raising the total operating cost to \$17.74/MWh.

**Exhibit 2  
Cost Components of Running a CFB Plant Burning Waste Coal**

Cost Components	\$/MWh in 2010	\$/MWh in 2015
Variable O&M	\$2.11	\$2.11
Fixed O&M	\$5.31	\$5.31
Fuel Cost	\$7.28	\$7.20
SO <sub>2</sub> Allowance Cost	\$1.53	\$2.17
NO <sub>x</sub> Allowance Cost	\$0.77	\$0.95
Total Operating Cost	\$17.00	\$17.74

## WHOLESALE ELECTRICITY PRICE UNDER CAIR

Tightening a cap in a trading program for EGUs drives up the price of electricity by increasing the marginal cost of generation. The increase in the electricity price helps

<sup>2</sup> [http://www.eia.doe.gov/oiaf/aeo/supplement/pdf/suptab\\_112.pdf](http://www.eia.doe.gov/oiaf/aeo/supplement/pdf/suptab_112.pdf)

<sup>3</sup> The NO<sub>x</sub> allowance costs are based on IPM Run BART 13.

EGUs by increasing their electricity revenues. Thus, CAIR should raise electricity prices at the same time it increases costs for the ARIPPA units. In earlier analysis for CAIR, we projected that the MACW region's wholesale electricity prices would rise on the order of \$1.50/MWh in 2010 and \$2.00/MWh in 2015 compared to the base case. This increase suggests that requiring the waste coal plants to buy allowances is merely leveling the playing field, not imposing a burden that will cause them to shut down. Specifically, we projected the electricity prices under CAIR to be \$27.06/MWh and \$35.74/MWh in 2010 and 2015 respectively.<sup>4</sup> Thus, expected revenue from electricity sales is well above the anticipated operating cost, including waste coal prices, fixed and variable O&M, and the costs of SO<sub>2</sub> emissions allowances, leaving the ARIPPA plants economically viable under the CAIR regime.<sup>5</sup> Furthermore, even if, due to unfavorable contracts, the plants had to declare bankruptcy, we can expect that the new owners or receivers will prefer to operate these plants and reduce their losses rather than close them, given that their costs are lower than the expected value of their outputs.

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<sup>4</sup> The value of the capacity these plants provide to the system would add still more to these estimated revenues.

<sup>5</sup> This result is, apparently, supported by ICF's most recent IPM base case runs, which show the plants running under CAIR even under the assumption that they had to use standard bituminous coal rather than waste coal.