

Certification

Application No. PSD-FL-010(B)

I HEREBY CERTIFY that the engineering features described in the above referenced application and subject to the proposed permit conditions provide reasonable assurance of compliance with applicable provisions of Chapter 403, Florida Statutes, and Florida Administrative Code 62-209 through 62-297. However, I have not evaluated and I do not certify aspects of the proposal outside of my area of expertise (including but not limited to the electrical, mechanical, structural, hydrological, and geological features).



(signed)

April 30, 1996

(date)

(seal)

asf

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CERTIFIED MAIL

EV 960328

April 4, 1996

Mr. Al Linero
Bureau of Air Regulation
Florida Dept. of Environmental Protection
2600 Blair Stone Road
Mail Station 5505
Tallahassee, FL 32399-2400

RE: Jacksonville Electric Authority (JEA)
St. Johns River Power Park (SJRPP), Units 1 & 2
Permit File No. PSD-FL-010, PA 81-13
Petroleum Coke

Dear Mr. Linero:

We are in receipt of your March 25, 1996 letter requesting additional information in order to continue your processing of the petroleum coke application submitted to your agency on March 01, 1996. The application was submitted to amend the above referenced permit and to allow burning of up to 20 percent petroleum coke with coal in SJRPP Units 1 & 2.

The following is the listing of the requested information with responses:

1. The test burn of the petroleum coke-coal blends were limited to 20 percent petroleum coke, by weight. The application requests 20 percent of petroleum coke on heat input basis. Please provide the relationship between percent petroleum coke by weight and percent petroleum coke by heat.

Response: We appreciate your pointing out the conflict on heat rate versus weight percent for establishing the petroleum coke to coal ratios. SJRPP proposes to determine petroleum coke input as a percentage of weight rather than heat input. It is noted that formulas for emission rates are based on heat input so no formulas in our submittal will change. Due to the heating value difference between petroleum coke and coal, a 20 percent by weight for petroleum coke is equivalent to 23.4 percent by heat input. For this reason emission rates will decrease slightly from our original submittal and scrubbing percentage will increase. This decrease in emission rate is due to the fact that we must maintain an emission rate of 0.4 lb/mmBtu for the petroleum coke portion and that 95 percent scrubbing is now required for 23.4 percent of the heat input as opposed to 20 percent. For example, when co-firing petroleum coke with coals having sulfur contents of 2 percent or less, the revised emission limit is 0.55 lb/mmBtu and a minimum 76 percent reduction based on 20 percent petroleum coke by weight. In contrast, based on 20 percent heat input, the proposed emission limit was 0.56 lb/mmBtu and a 75 percent reduction. We



have amended the applicable pages and tables of our application to reflect this change to weight percent. (See Attachment 1R)

2. The application states that a temporary hopper and conveyor will be used to load petroleum coke with coal on the reclaim conveyor prior to transporting the mixture to the crusher house and then to the coal storage silos. What assurances are provided to the Department that a maximum of 20 percent mix by heat of petroleum coke with coal is taking place once the blended fuel is sent to the coal storage silo.

Response: Since we propose to change to weight percent for blending purposes, determining the percent of the blend will be straight forward. The petroleum coke will be fed onto the reclaim conveyor via the temporary hopper and conveyor. The petroleum coke will be blended, by weight, with coal at the transfer "crusher building" in the surge bin. The tonnage of petroleum coke to establish the percentage (up to 20%) will be determined based on the feeder rate. The petroleum coke will be weighed by belt scale to establish the feeder rate. The coal is fed to the transfer "crusher building" surge bin via a separate belt. The tonnage of coal will be determined based on the feeder rate. The coal will be weighed by belt scale to establish the feeder rate. Records will be kept on hourly petroleum coke and coal feed rates as well as belt scale calibrations. These records will be maintained on site.

3. Will the sulfur content of the petroleum coke or the blend ever exceed 4 percent, by weight?

Response: Although the sulfur content of the petroleum coke may exceed 4 percent, SJRPP proposes that the sulfur content of the petroleum coke and coal blend shall not exceed 4 percent by weight to maintain consistency with the existing above referenced permits. (See pages 25, 26, 27, & 28 of the Application)

4. Please describe the procedures that can be implemented by the facility for an inspector to determine if the facility is in compliance with the different scenarios for SO₂ removal efficiency. Describe how the proposed conditions for SO₂ are enforceable as a practical matter.

Response: SJRPP proposes to demonstrate compliance in the same manner as currently required by 40 CFR 60 subpart Da, (i.e. 30 day rolling average method). As referenced in Attachment 1 Section 2.1 Item 6 of the application, SJRPP Units 1 & 2 feature an inlet continuous emission monitoring system (CEMS) to monitor inlet SO₂ levels prior to the flue gas desulfurization system (FGDS) as required by 40 CFR Subpart Da and an outlet CEMS which records SO₂ emissions as required by Subpart Da and 40 CFR Part 75. These SO₂ data are quality assured pursuant to Subpart Da and Part 75 requirements. The percent reduction requirements and the SO₂ emissions limitations for coals blended with petroleum coke shall be ensured by operating in accordance with the data from the inlet and outlet CEMS. The sulfur content of the coal shall be ensured by utilizing the "as received" coal analytical data or on-site sampling and analysis.

FGDS unit operators monitor the real-time percent reductions and SO2 lb/MMBtu values from the quality assured inlet and outlet SO2 analyzers. The unit operators shall adjust removal efficiency based on these real-time inlet and outlet SO2 values as dictated by the coal's representative sulfur content

Please refer to Attachment 1, Section 2.1 a and b of the Application. Based on the coal's representative sulfur content, the FGDS unit operator shall adjust the real-time removal efficiency to ensure the combined emission limit based on Table 2 of the Application which will be available to the FGDS unit operator.

The above mentioned data will be available for inspectors on site. In addition quarterly CEMs submittals are made to the Department as part of our Title IV reporting requirements.

5. Please quantify the CO emissions in ppm, lb/hr and TPY for the past two years for the two units. Provide a range of CO emissions based on the historical data. How will you assure the Department that this range and the total annual emissions for the past two years are not exceeded when burning a blend of petroleum coke and coal?

Response: CO emissions from the SJRPP units vary greatly depending on the coal type and specific unit operating parameters. It should be noted that unlike many coal plants SJRPP burns a great variety of coals which results in a significant variability in CO emissions. 1995 data from non-certified CO-monitors indicate that daily maximum hourly CO values ranged from less than 10 ppm to 511 ppm for Unit 1 and less than 10 ppm to 484 ppm for Unit 2. It is noted that we did not optimize combustion parameters during our petroleum coke test burn and we expect a significant decrease in CO emissions during future petroleum coke burns. We are confident that these emissions will be well within the above mentioned ranges.

Currently, we do not feel that there is sufficient credible data to develop a meaningful TPY CO number for our units. It is noted, however, that 511 ppm corresponds to approximately to 3194 lb/hr. This CO issue is further addressed on page 6 of attachment one of our application.

Please contact Jay Worley at (904) 751-7729 if you have any additional questions. We appreciated your efforts to expedite the approval of this project.

Sincerely


Richard Breitmoser, P.E.
Vice President
Environmental Health & Safety Group

/pja

cc: Hamilton S. Oven, Siting Coordinator, DEP
Jay Worley, SJRPP

cc: EPA
NPS
J. Braswell, OGC
C. Kirfts, NED
J. Manning, RESD

Segment Description and Rate Information: Segment 2 of 2

1. Segment Description (Process/Fuel Type and Associated Operating Method/Mode): Coal and Petroleum Coke (Weight Basis)	
2. Source Classification Code (SCC): 1-01-001-04	
3. SCC Units: Tons	
4. Maximum Hourly Rate: 243	5. Maximum Annual Rate: 2,129,013
6. Estimated Annual Activity Factor:	
7. Maximum Percent Sulfur: 4	8. Maximum Percent Ash: 18
9. Million Btu per SCC Unit: 25	
10. Segment Comment: Maximum hourly and annual rate based on maximum percentage of petroleum coke when co-firing (i.e., 20% weight). Heat content and sulfur content of petroleum coke based on typical values of 29.6 MMBtu/ton and 6% sulfur. (See Segment 1 of 2 for coal values). Maximum Percent Ash: <18. Million Btu per SCC Unit: 25.3.	

E. POLLUTANT INFORMATION

For the emissions unit addressed in this Emissions Unit Information Section, a separate set of pollutant information must be completed for each pollutant required to be reported. See instructions for further details on this subsection of the Application for Air Permit.

Pollutant Potential/Estimated Emissions: Pollutant 1 of 1

1. Pollutant Emitted: SO2		
2. Total Percent Efficiency of Control:	95	%
3. Primary Control Device Code:	067	
4. Secondary Control Device Code:		
5. Potential Emissions:	575.5 lbs/hr	2,521 tons/yr
6. Synthetically Limited? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
7. Range of Estimated Fugitive/Other Emissions:		
<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 _____ to _____ tons/yr		
8. Emission Factor:	0.4 lb/MMBtu	
Reference: See Comment		
9. Emissions Method Code (check one):		
<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5		
10. Calculation of Emissions:		
6,144 MMBtu/hr x 0.234 % heat input (Pet Coke) x 0.4 lb/MMBtu = 575.5 lb/hr		
11. Pollutant Potential/Estimated Emissions Comment:		
Emission Factor Reference: Proposed Emission Limit for Petroleum Coke only. Potential emissions for petroleum coke only and based on assuring no increase in 'actual emissions' based on the definition in 62-212.200 (See Attachment 1).		

Emissions Unit Information Section 1 of 2
Allowable Emissions (Pollutant identification on front page)

A.

1. Basis for Allowable Emissions Code: RULE		
2. Future Effective Date of Allowable Emissions:		
3. Requested Allowable Emissions and Units: 0.4 lb/MMBtu		
4. Equivalent Allowable Emissions:	575.5 lbs/hr	2,521 tons/yr
5. Method of Compliance: CEMS		
6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode): Proposed emission limit for petroleum coke only. See Attachment 1R.		

B.

1. Basis for Allowable Emissions Code:		
2. Future Effective Date of Allowable Emissions:		
3. Requested Allowable Emissions and Units:		
4. Equivalent Allowable Emissions:	lbs/hr	tons/yr
5. Method of Compliance:		
6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode):		

Segment Description and Rate Information: Segment 2 of 2

1. Segment Description (Process/Fuel Type and Associated Operating Method/Mode): Coal and Petroleum Coke (Weight Basis)	
2. Source Classification Code (SCC): 1-01-001-04	
3. SCC Units: Tons	
4. Maximum Hourly Rate: 243	5. Maximum Annual Rate: 2,129,013
6. Estimated Annual Activity Factor:	
7. Maximum Percent Sulfur: 4	8. Maximum Percent Ash: 18
9. Million Btu per SCC Unit: 25	
10. Segment Comment: Maximum hourly and annual rate based on maximum percentage of petroleum coke when co-firing (i.e., 20% weight). Heat content and sulfur content of petroleum coke based on typical values of 29.6 MMBtu/ton and 6% sulfur. (See Segment 1 of 2 for coal values). Maximum Percent Ash: <18. Million Btu per SCC Unit: 25.3.	

E. POLLUTANT INFORMATION

For the emissions unit addressed in this Emissions Unit Information Section, a separate set of pollutant information must be completed for each pollutant required to be reported. See instructions for further details on this subsection of the Application for Air Permit.

Pollutant Potential/Estimated Emissions: Pollutant 1 of 1

1. Pollutant Emitted:	SO ₂	
2. Total Percent Efficiency of Control:	95	%
3. Primary Control Device Code:	067	
4. Secondary Control Device Code:		
5. Potential Emissions:	575.5 lbs/hr	2,521 tons/yr
6. Synthetically Limited?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
7. Range of Estimated Fugitive/Other Emissions:		
	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 _____ to _____ tons/yr	
8. Emission Factor:	0.4 lb/MMBtu	
Reference:	See Comment	
9. Emissions Method Code (check one):		
	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	
10. Calculation of Emissions:	6,144 MMBtu/hr x 0.234 % heat input (Pet Coke) x 0.4 lb/MMBtu = 575.5 lb/hr	
11. Pollutant Potential/Estimated Emissions Comment:	Emission Factor Reference: Proposed Emission Limit for Petroleum Coke only. Potential emissions for petroleum coke only and based on assuring no increase in 'actual emissions' based on the definition in 62-212.200 (See Attachment 1).	

Emissions Unit Information Section 2 of 2
Allowable Emissions (Pollutant identification on front page)

A.

1. Basis for Allowable Emissions Code: RULE		
2. Future Effective Date of Allowable Emissions:		
3. Requested Allowable Emissions and Units: 0.4 lb/MMBtu		
4. Equivalent Allowable Emissions:	575.5 lbs/hr	2,521 tons/yr
5. Method of Compliance: CEMS		
6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode): Proposed emission limit for petroleum coke only. See Attachment 1R.		

B.

1. Basis for Allowable Emissions Code:		
2. Future Effective Date of Allowable Emissions:		
3. Requested Allowable Emissions and Units:		
4. Equivalent Allowable Emissions:	lbs/hr	tons/yr
5. Method of Compliance:		
6. Pollutant Allowable Emissions Comment (Desc. of Related Operating Method/Mode):		

ATTACHMENT 1R

ATTACHMENT 1

1.0 PROJECT DESCRIPTION

The St. Johns River Power Park (SJRPP) proposes to co-fire a mixture of up to 20 percent petroleum coke ~~by weight~~ with coal in a manner that would ensure that there is not a significant net increase in actual emissions of any regulated pollutant and, therefore, the Prevention of Significant Deterioration (PSD) Rules in 62-212.400, Florida Administrative Code (F.A.C.) would not apply. This would be accomplished through a limitation on sulfur dioxide (SO₂) emissions when co-firing petroleum coke that includes both an emission limit and a percent SO₂ reduction requirement. In addition, SJRPP proposes to accept a condition for carbon monoxide (CO) that would demonstrate that an net significant emission increase would not occur.

This permit application is associated with a modification request of the site certification for the units (PA 81-13). Approval from the FDEP is being sought to use up to 20 percent (~~weight~~ basis) of petroleum coke with coal. No new facilities or equipment are required to burn petroleum coke. Minor amendments to PSD permit are required. There will be no substantial changes made in the fuel handling facilities or the emission units to accommodate co-firing of petroleum coke. A temporary hopper and conveyor will be used to load petroleum coke with coal on the reclaim conveyor prior to transporting to the crusher house. From the crusher house, the blended fuel will be conveyed to the coal storage silos. Petroleum coke can be co-fired with coal as soon as approval is obtained from FDEP and it is received in the coal yard.

2.0 TRIAL BURN TEST RESULTS

A trial test burn for co-firing petroleum coke and coal was authorized by the Florida Department of Environmental Protection (FDEP) and conducted August 8-19, 1995. A copy of the trial test burn results is attached. A summary of the trial test burn results and a statistical comparison of the baseline tests (coal only) and co-firing petroleum coke and coal are presented in Table 1. A statistical analysis was performed using Appendix C to Part 60 (of 40 CFR).

The results of the trial test burn and the statistical analysis indicate that there are no emission rate increases for particulate matter or nitrogen oxides. The emission rates of sulfur dioxide, sulfuric acid mist, and CO were lower in the baseline tests than in the tests performed while the unit was co-firing petroleum coke and coal. The remainder of this attachment discusses these pollutants.

2.1 SULFUR DIOXIDE

A federally enforceable permit condition is proposed that prevents PSD applicability by preventing actual SO₂ emissions associated with the petroleum coke fraction of the blended fuel from exceeding past actual SO₂ emissions associated with burning coal. In this manner, there will be no prospective increase in SO₂ emissions caused by the proposed change (i.e., utilization of petroleum coke). Pursuant to EPA's June 21, 1992, WEPCO regulations (57 Federal Register 32314), increases in air emissions not caused by proposed changes must be excluded from steam electric power plants' future actual emissions in assessing PSD applicability. EPA emphasized in the preamble statement that new source review "applies only where the emissions increase is cause by the change" [57 Federal Register 32325]. The approach comports with the WEPCO regulations and corresponding state rules by eliminating the possibility that the petroleum coke portion of prospective fuel blends will exceed "past actual" SO₂ emissions associated with coal burning. Consistent with the WEPCO regulations, future increases in SO₂ emissions caused solely by enhanced electricity demand or caused by permissible variations in coal sulfur content should not count toward PSD applicability.

The emission limitation has the following components:

- a. When blends of petroleum coke and coal with a sulfur content of up to or equal to 2 percent are fired in Units 1 or 2, the SO₂ emissions shall not exceed 0.55 pound per million British thermal units (lb/MMBtu) and a minimum of 76 percent reduction in the flue gas desulfurization system.
- b. When co-firing petroleum coke with coals having a sulfur content between 2 and 3.63 percent, the emission limitation shall be based on the following formula:

$$\text{SO}_2 \text{ emission limit (lb/MMBtu)} = (0.2 \times C/100) + 0.4$$

where: C = percent of coal co-fired on a heat input basis.

- c. When coals with a sulfur content greater than 3.63 percent are co-fired with petroleum coke, the SO₂ emissions shall not exceed the following formula:

$$\text{SO}_2 \text{ emission limit (lb/MMBtu)} = (0.1653 \times C \times S - 0.4 \times C + 40) \times 1/100$$

where: C = percent of coal co-fired on a heat input basis

- d. The maximum SO₂ emission rate when firing petroleum coke shall not exceed ~~0.676~~ lb/MMBtu.
- e. Compliance with the SO₂ emissions limit shall be based on a 30-day rolling average for those days when petroleum coke is fired. Any use of petroleum coke during a 24-hour period shall be considered 1 day of the 30-day rolling average. The 30-day rolling average shall be calculated according to the New Source Performance Standards (NSPS) codified in 40 CFR Part 60 Subpart Da, except as noted above.

The proposed emission limits for SO₂ were developed from the two fundamental requirements of the PSD approval and the specific conditions of the site certification and to assure no net increase in annual emissions. The PSD approval and site certification require that the NSPS Subpart Da be met and that emissions do not exceed 0.76 lb/MMBtu (30-day rolling average). The emission limits proposed for co-firing are supported by the following rationale:

1. The NSPS codified in 40 CFR Part 60 Subpart Da requires, in the range of coals to be fired, either 0.6 lb/MMBtu or a 70 percent reduction in the potential SO₂ combustion concentration. For coals with a sulfur content greater than 1.2 percent, the 0.6 lb/MMBtu emission limit would govern. For coals with sulfur contents of 1.2 percent or less, the 70 percent reduction requirement would govern. This is illustrated in the attached Table 2 which presents in the sixth and seventh columns the NSPS emission limit and the percent SO₂ removals as a function of the coal sulfur content (first column). In terms of practical application, under Subpart Da: (1) when the inlet air to the scrubber has SO₂ concentrations under 2.0 lb/MMBtu, 70 percent SO₂ reduction is required; (2) when the inlet SO₂ concentration is higher than 2.0 but less than 6.0 lb/MMBtu, required SO₂ scrubbing must result in emissions of 0.6 lb/MMBtu or less; (3) at higher concentrations, 90 percent removal is required. It should be noted that the facility has a 0.76 lb SO₂/MMBtu emission limit established as BACT for coal firing. The proposed emission limit for co-firing petroleum coke and coal could not exceed this limit, since this is inherent in the proposed limit.
2. The representative actual annual SO₂ emission rate for Units 1 and 2 over the last 2 years has been 0.4 lb/MMBtu. By ensuring that the emission rate when firing petroleum coke does not exceed 0.4 lb/MMBtu, the "representative actual annual emissions" as defined in 40 CFR 52.21(b)(33) would not exceed the past actual

emissions. To achieve a 0.4 lb/MMBtu emission rate with the typical sulfur content for petroleum coke (e.g., 6 percent), a 95 percent reduction is required. This is shown on the last column of the Table 2.

3. Except for coals with a sulfur content of greater than 2 percent, the proposed percent reduction requirement and the emission limit are based on co-firing 20 percent petroleum coke with coal (on a weight basis). This is the worst-case mixture proposed and ensures that when co-firing lower percentages of petroleum coke with coal, the resulting emission rate would be lower than could be allowed by meeting only the NSPS and the "actual" emission rate. For example, if a 10 percent mixture of petroleum coke is co-fired with a 1.2 percent sulfur coal, then the resulting emissions rate to meet NSPS and 0.4 lb/MMBtu would be 0.58 lb/MMBtu. In contrast, the proposed condition would limit the SO₂ emissions to 0.55 lb/MMBtu.
4. The effect of the proposed SO₂ emission limitation is shown on Table 2 (second and third columns). As shown, for coals with sulfur content less than 1.2 percent, the 76 percent reduction requirement would produce emission rates less than 0.55 lb/MMBtu while meeting the NSPS reduction requirement of 70 percent and the "actual" emission rate of 0.4 lb/MMBtu for petroleum coke. For coals with a sulfur content of 1.2 to 2 percent, the proposed emission limit of 0.56 lb/MMBtu would meet the NSPS limit of 0.6 lb/MMBtu for coal and 0.4 lb/MMBtu for petroleum coke.
5. The equation for an SO₂ emission limit for coals above 2 percent sulfur content would allow some flexibility for petroleum coke/coal mixtures. This formula would be applicable for sulfur contents from 2.0 to 3.63 percent, since coals in this range would be required to meet the 0.6 lb/MMBtu limit in Subpart Da. The proposed equations for SO₂ emission limitations for coal above 2 percent sulfur content would allow some flexibility for petroleum coke/coal mixtures (see Table 3 for derivation of equations). The equation in Paragraph b above will achieve compliance with the governing Subpart Da limit of 0.6 lb/MMBtu and 0.4 lb/MMBtu for petroleum coke. The equation in Paragraph c above accounts for the governing Subpart Da requirement of 90 percent SO₂ reduction and 0.4 lb/MMBtu for petroleum coke. The maximum SO₂ emission rate associated with firing only coal, regardless of coal sulfur content, cannot exceed 0.76 lb/MMBtu as required by PSD and Power Plant Siting

Act (PPSA) approval. Therefore, mixtures of petroleum coke and coal can never exceed 0.676 lb/MMBtu.

6. SJRPP Units 1 and 2 feature an inlet continuous emission monitoring system to monitor inlet SO₂ levels prior to the flue gas desulfurization system as required by Subpart Da and an outlet continuous emission monitoring system which records SO₂ emissions as required by Subpart Da and 40 CFR Part 75. These SO₂ data are quality assured pursuant to Subpart Da and Part 75 requirements. The percent reduction requirements and the SO₂ emissions limitations for coals blended with petroleum coke that have a sulfur content less than 3.63 percent shall be ensured by operating in accordance with the data from the inlet and outlet continuous emissions monitoring system. The sulfur content of the coal shall be ensured by utilizing the "as received" coal analytical data or onsite sampling and analysis.

The proposed emission limitation meets the letter and intent of the WEPCO regulations. Also, this condition comports with EPA's "federal enforceability" guidance because it is enforceable both as a matter of law and as a practical matter; simply put, this condition obviates the possibility of an increase in actual emissions attributable to petroleum coke. Moreover, this proposal comports with good environmental policy. As shown in Figures 1 and 2, under the proposed permit condition, co-firing petroleum coke will be subject to lower emissions limitations than the limitations applicable when utilizing only coal. These graphs compare the emission limits and reduction percentages currently applicable to coal firing and proposed for petroleum coke co-firing. With the proposed permit condition, co-firing petroleum coke will not require PSD analysis pursuant to Rules 62-212.400 and 62.212.200(2)(d), F.A.C.

2.2 SULFURIC ACID MIST

The trial test values for sulfuric acid mist were a direct result of an associated increase in SO₂ emissions. Table 4 presents a comparison of the SO₂ and SO₃ emissions between the baseline tests and the co-firing test. The ratios of the blend to baseline test results are 1.78 and 1.70 for SO₂ and SO₃ emissions, respectively. This indicates that the SO₃ increase was in the relatively same proportion for both SO₃ and SO₂ (actually slightly greater for SO₂). In addition, the amount of SO₂ removal for both the baseline test and blend test was almost identical at about 73 percent.

The proposed SO₂ emission limit, if implemented during the test burn, would have ensured lower SO₂ emissions and concomitantly lower SO₃ emissions that would ensure no significant increase in the emission rates for both pollutants. Overall reduction in SO₂ emissions would have likely been 20 to 30 percent higher. For these reasons, no condition for sulfuric acid mist should be required.

2.3 CARBON MONOXIDE

The CO emissions during the baseline tests were lower than those observed during the blend tests. Since there was no attempt to control CO emissions during the co-firing tests, the combustion conditions were not "fine tuned" to optimize combustion of the petroleum coke and coal blend. Many factors, such as the grindability of the petroleum coke/coal blend and combustion controls (e.g., oxygen concentrations, NO_x control systems, load, etc.) can significantly influence CO concentrations. Data from other petroleum coke/coal co-firing test burns indicate no changes in CO emission rates. In addition, a review of the last several months of CO data from the SJRPP indicates CO values in the range reported for the co-firing test burn. For these reasons, SJRPP proposes to optimize combustion of co-firing petroleum coke and coal to ensure no net increase in emissions. A condition is proposed that has been issued in other Department permits approving co-firing of petroleum coke and coal:

- (a) The applicant shall maintain and submit to the Department on an annual basis for a period of 5 years from the date the unit is co-fired with petroleum coke, information demonstrating that the co-firing did not result in significant emission increases of CO. The CO emissions shall be based on test results using EPA Method 10.

Table 1. Statistical Analysis of Petroleum Coke Trial Burn, St. John's River Power Park

Test Case	Date	PM (lb/hr)	SO3 (ppm)	CO (ppm)	NOx out (lb/MMBtu)	SO2 in (lb/MMBtu)	SO2 out (lb/MMBtu)
Baseline	07/18/95	44.14	6.96	10.29	0.468	1.029	0.283
Baseline	07/19/95	21.50	5.19	45.16	0.502	1.026	0.282
Baseline	07/20/95	64.92	5.55	67.00	0.474	1.031	0.282
Baseline	08/08/95	61.85	7.04	21.15	0.549	0.973	0.270
	Average	48.1	6.19	35.9	0.498	1.015	0.279
	Std. Dev.	20.0	0.95	25.3	0.0369	0.0279	0.0062
	Sample Var	398.4	0.91	642.1	0.0014	0.0008	0.0000
	n	4	4	4	4	4	4
Blend	08/11/95		7.54	312.96	0.502	1.636	0.457
Blend	08/12/95		9.21	497.58	0.494	1.709	0.485
Blend	08/13/95		14.03	745.64	0.463	1.728	0.482
Blend	08/14/95	80.76			0.498	1.757	0.477
Blend	08/15/95	42.95			0.503	1.730	0.471
Blend	08/16/95	28.98			0.535	1.720	0.477
Blend	08/17/95	63.28			0.559	1.938	0.521
Blend	08/18/95		11.37	467.90	0.498	2.244	0.566
Blend	08/19/95	23.47			0.470	2.376	0.545
	Average	47.9	10.54	506.0	0.502	1.871	0.498
	Std. Dev.	24.0	2.81	179.1	0.030	0.264	0.037
	Sample Var	573.9	7.88	32071.4	0.001	0.070	0.001
	n	5	4	4	9	9	9
Degrees of Freedom		7	6	6	11	11	11
t prime at 95%		1.895	1.943	1.943	1.796	1.796	1.796
Sp		22.33	2.10	127.89	0.032	0.225	0.032
t calc		-0.0143188	2.937	5.198	0.220	6.322	11.406
Result		OK	Sig Diff	Sig Diff	OK	Sig Diff	Sig Diff

Table 2. Combined Emissions Limit and Scrubber Efficiency for Co-firing Petroleum Coke and Coal at St. Johns River Power Park (Revised)

Coal Sulfur Content	Combined Emission Limit (lb/mmBtu)	Minimum Combined Scrubber Efficiency	Uncontrolled Emissions		Coal SO2 NSPS Limit (lb/mmBtu)	Coal SO2 Removal (lb/mmBtu)	Pet Coke SO2 Removal (lb/mmBtu)
			Coal SO2 (lb/mmBtu)	Pet Coke SO2 (lb/mmBtu)			
0.80%	0.40	75.87%	1.32	8.11	0.40	70.00%	95.07%
0.90%	0.44	75.87%	1.49	8.11	0.45	70.00%	95.07%
1.00%	0.47	75.87%	1.65	8.11	0.50	70.00%	95.07%
1.10%	0.51	75.87%	1.82	8.11	0.55	70.00%	95.07%
1.20%	0.55	75.87%	1.98	8.11	0.60	70.00%	95.07%
1.30%	0.55	77.46%	2.15	8.11	0.60	72.08%	95.07%
1.40%	0.55	78.99%	2.31	8.11	0.60	74.07%	95.07%
1.50%	0.55	80.31%	2.48	8.11	0.60	75.80%	95.07%
1.60%	0.55	81.47%	2.64	8.11	0.60	77.31%	95.07%
1.70%	0.55	82.49%	2.81	8.11	0.60	78.65%	95.07%
1.80%	0.55	83.40%	2.98	8.11	0.60	79.83%	95.07%
1.90%	0.55	84.21%	3.14	8.11	0.60	80.89%	95.07%
2.00%	0.55	84.95%	3.31	8.11	0.60	81.85%	95.07%
2.10%	0.55	85.61%	3.47	8.11	0.60	82.71%	95.07%
2.20%	0.55	86.21%	3.64	8.11	0.60	83.50%	95.07%
2.30%	0.55	86.76%	3.80	8.11	0.60	84.22%	95.07%
2.40%	0.55	87.26%	3.97	8.11	0.60	84.88%	95.07%
2.50%	0.55	87.72%	4.13	8.11	0.60	85.48%	95.07%
2.60%	0.55	88.15%	4.30	8.11	0.60	86.04%	95.07%
2.70%	0.55	88.55%	4.46	8.11	0.60	86.56%	95.07%
2.80%	0.55	88.92%	4.63	8.11	0.60	87.04%	95.07%
2.90%	0.55	89.26%	4.79	8.11	0.60	87.48%	95.07%
3.00%	0.55	89.58%	4.96	8.11	0.60	87.90%	95.07%
3.10%	0.55	89.88%	5.12	8.11	0.60	88.29%	95.07%
3.20%	0.55	90.16%	5.29	8.11	0.60	88.66%	95.07%
3.30%	0.55	90.42%	5.45	8.11	0.60	89.00%	95.07%
3.40%	0.55	90.67%	5.62	8.11	0.60	89.32%	95.07%
3.50%	0.55	90.90%	5.79	8.11	0.60	89.63%	95.07%
3.60%	0.55	91.12%	5.95	8.11	0.60	89.92%	95.07%
3.63%	0.55	91.19%	6.00	8.11	0.60	90.00%	95.07%
3.70%	0.56	91.19%	6.12	8.11	0.61	90.00%	95.07%
3.80%	0.57	91.19%	6.28	8.11	0.63	90.00%	95.07%
3.90%	0.59	91.19%	6.45	8.11	0.64	90.00%	95.07%
4.00%	0.60	91.19%	6.61	8.11	0.66	90.00%	95.07%

Assumptions: 12,100 Btu/lb for Coal
14,800 Btu/lb for Petroleum Coke
6% sulfur content of Petroleum Coke
20% Petroleum Coke firing (Weight basis)
0.40 lb/mmBtu for Petroleum Coke

Table 3. Derivation of Formulas (Page 1 of 2)

Fundamental Requirements:

1. Coal - Meet NSPS Subpart Da and BACT Emission Limit
 - a. 0.6 lb / MMBtu or 70% SO₂ Reduction (NSPS),
 - b. 1.2 lb / MMBtu or 90% SO₂ Reduction (NSPS), and
 - c. 0.76 lb / MMBtu (30-day rolling average).

2. Petroleum Coke - Meet 0.4 lb / MMBtu; Equivalent to 95% Reduction

$$\begin{aligned} \text{Calculation: } & \frac{0.06 \text{ lb S}}{\text{lb fuel}} \times \frac{\text{lb fuel}}{14,800 \text{ Btu}} \times \frac{2 \text{ lb SO}_2}{\text{lb S}} \times \frac{10^6}{\text{MM}} \times (1 - 0.95) \\ & = 0.4 \text{ lb / MMBtu} \end{aligned}$$

Proposed Limits:

1. Coals - ≤2% Sulfur; Assume 20% (*by weight*) Petroleum Coke Co-Firing at All Times

- a. NSPS = 0.6 lb / MMBtu

$$\begin{aligned} \text{Calculation: } & \frac{0.0121 \text{ lb S}}{\text{lb fuel}} \times \frac{\text{lb fuel}}{12,100 \text{ Btu}} \times \frac{2 \text{ lb SO}_2}{\text{lb S}} \times \frac{10^6}{\text{MM}} \times (1 - 0.7) \\ & = 0.6 \text{ lb / MMBtu} \end{aligned}$$

- b. Petroleum Coke = 0.4 lb / MMBtu

$$\begin{aligned} \text{c. } \text{Coal Heat Input} & = 0.8 \times 12,100 \text{ Btu / lb} = 9,680 \text{ Btu / lb-fuel (76.6\%)} \\ \text{Petroleum Coke Heat Input} & = 0.2 \times 14,800 \text{ Btu / lb} = 2,960 \text{ Btu / lb-fuel (23.4\%)} \\ & \quad \quad \quad 12,640 \text{ Btu / lb-fuel (100\%)} \end{aligned}$$

$$\begin{aligned} \text{d. Result: } & \left(\frac{76.6}{100} \times 0.6 \text{ lb / MMBtu} \right) + \left(\frac{23.4}{100} \times 0.4 \text{ lb / MMBtu} \right) \\ & = 0.55 \text{ lb / MMBtu and 76\% reduction} \end{aligned}$$

2. Coals >2% Sulfur and ≤ 3.63% Sulfur; Variable Amount of Petroleum Coke

- a. NSPS = 0.6 lb / MMBtu

$$\begin{aligned} \text{Calculation: } & \frac{3.63 \text{ lb S}}{100 \text{ lb fuel}} \times \frac{\text{lb fuel}}{12,100 \text{ Btu}} \times \frac{2 \text{ lb SO}_2}{\text{lb S}} \times \left(1 - \frac{90}{100} \right) \\ & = 0.6 \text{ lb / MMBtu} \end{aligned}$$

- b. Petroleum Coke = 0.4 lb / MMBtu

Table 3. Derivation of Formulas (Page 2 of 2)

Proposed Limits, continued:

- c. Let C = % Coal Fired (
- Btu basis*
-)

$$\text{Equation: } \left(\frac{C}{100} \times 0.6 \text{ lb / MMBtu} \right) + \left[\left(1 - \frac{C}{100} \right) \times 0.4 \text{ lb / MMBtu} \right]$$

$$\text{SO}_2 \text{ Limit} = \frac{0.6C}{100} - \frac{0.4C}{100} + 0.4 = \frac{0.2C}{100} + 0.4$$

3. Coals > 3.63% Sulfur; Variable Amount of Petroleum Coke

- a. NSPS = 90% Reduction
 b. Petroleum Coke = 0.4 lb / MMBtu
 c. Let C = % Coal Fired (*Btu basis*) and S = % Sulfur in Coal

$$\text{Equation: } \left[\frac{C}{100} \times \frac{S}{100} \times \frac{1}{12,100} \times 2 \times \left(1 - \frac{90}{100} \right) \times 10^6 \right]$$

$$+ \left[\left(1 - \frac{C}{100} \right) \times 0.4 \right]$$

$$= \left(\frac{C}{100} \times S \times 0.1653 \right) + \left(0.4 - 0.4 \times \frac{C}{100} \right)$$

$$\text{SO}_2 \text{ Limit} = \frac{1}{100} \times (0.1653 \times C \times S - 0.4C + 40)$$

Example: 80% Coal (*Btu basis*) and 3.8% Sulfur

$$(0.1653 \times 80 \times 3.8 - 0.4 \times 80 + 40) \times \frac{1}{100} = 0.58 \text{ lb / MMBtu}$$

4. Maximum Limit When Co-Firing

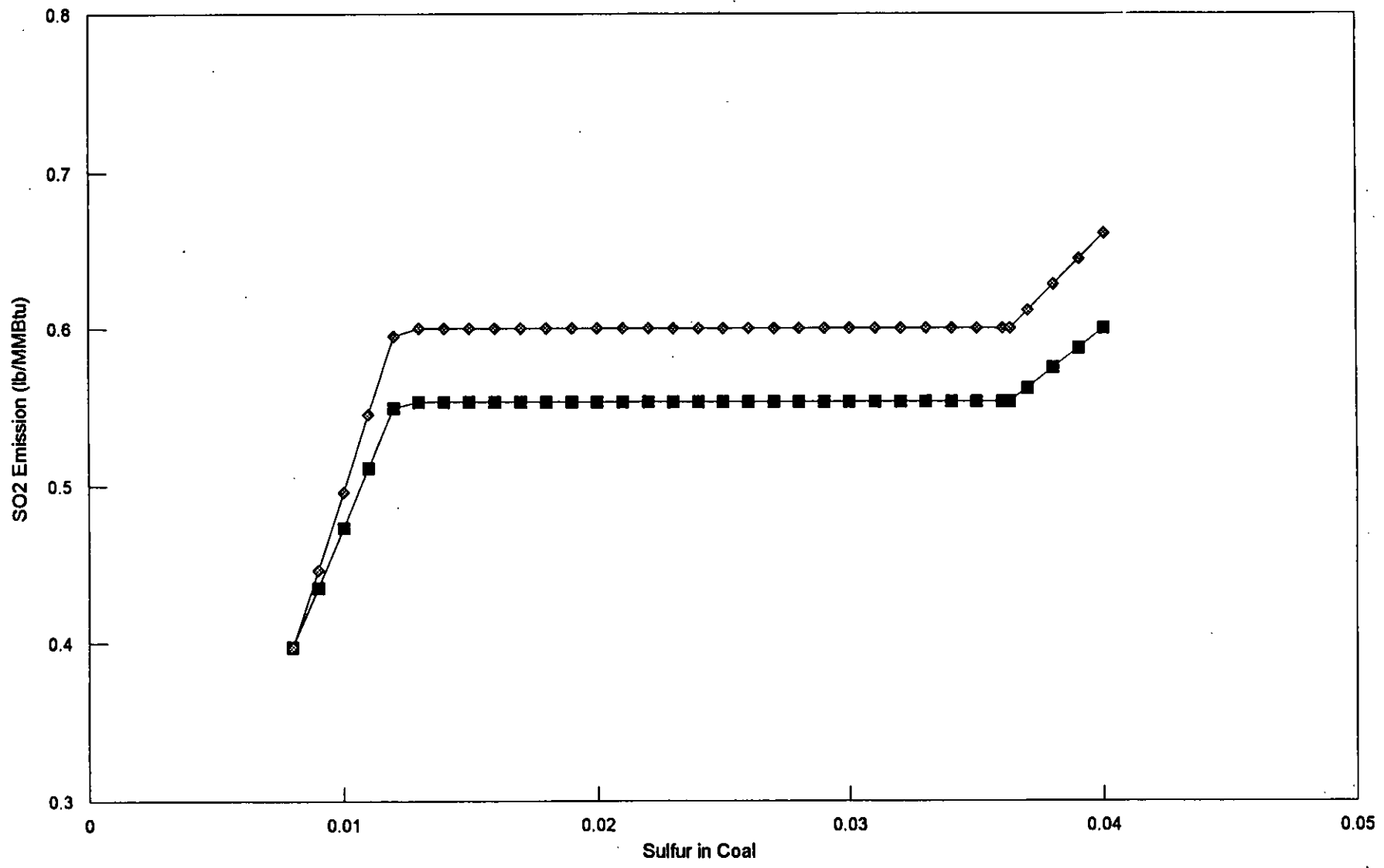
- a. Coal at 0.76 lb / MMBtu, and
 b. Petroleum Coke at 0.4 lb / MMBtu

Calculation:

$$\left(\frac{76.6}{100} \times 0.76 \text{ lb / MMBtu} \right) + \left(\frac{23.4}{100} \times 0.4 \text{ lb / MMBtu} \right) = 0.676 \text{ lb / MMBtu}$$

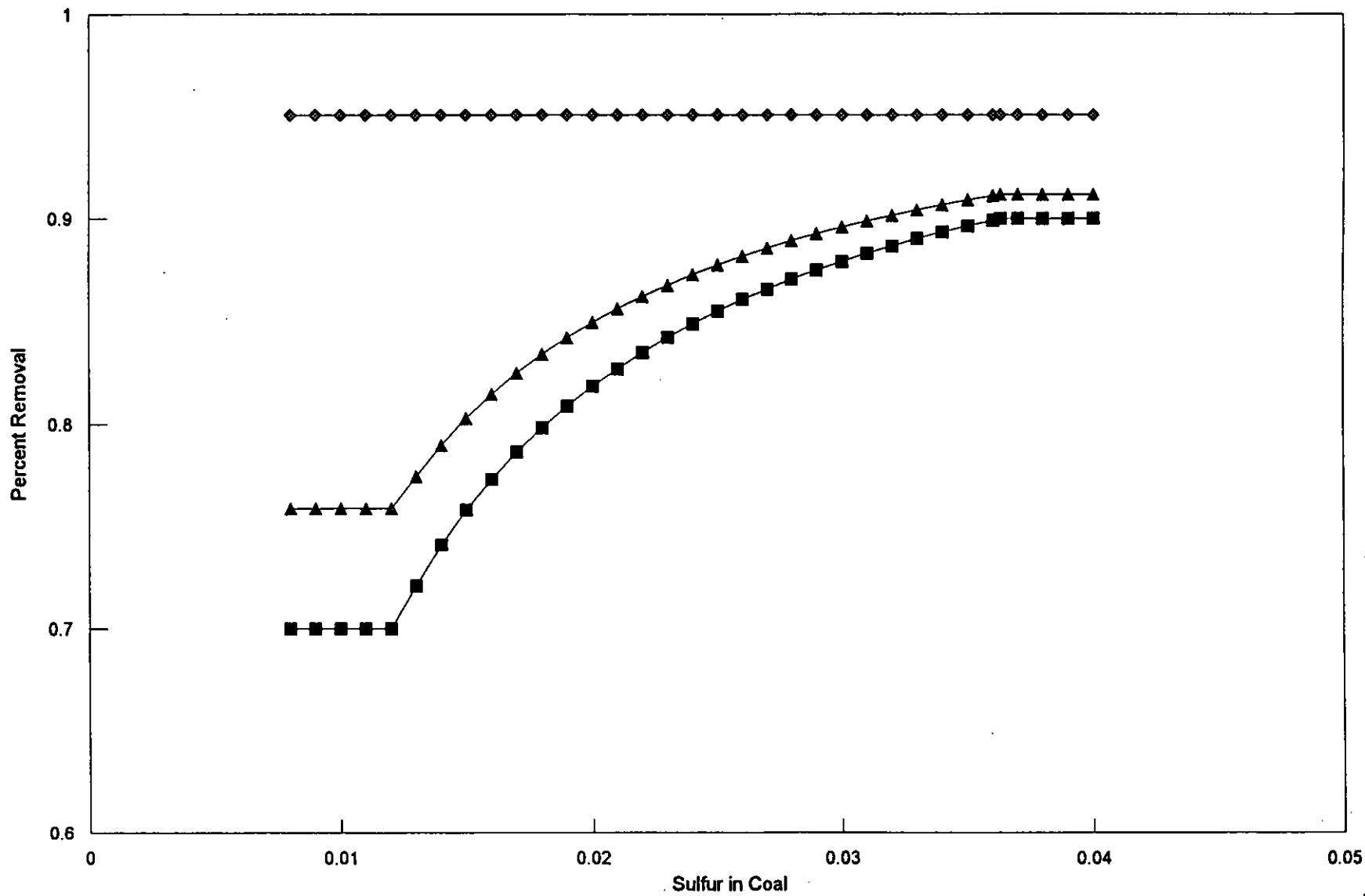
Emission Limits

SO2 Emission Rate vs. Percent Sulfur in Coal



■ Combined Emission Limit ♦ Coal SO2 NSPS Limit

Percent Removal
SO₂ Removal vs. Percent Sulfur in Coal



■ Coal SO₂ Removal ◇ Pet Coke SO₂ Removal ▲ Combined Scrubber Efficiency