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Cedar Bay Cogeneration Project
Air Quality Analysis
November, 1992

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ENSR Consulting and Engineering

Acton, Massachusetts

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EXECUTIVE SUMMARY

The objective of the information presented in this document is to provide data useful for assessing:

1) whether, on balance, the air pollutant emissions and air quality impacts of the Cedar Bay Cogeneration Project (CBCP), as proposed to be modified, and the addition of the three new yet-to-be-proposed package boilers scheduled for the Seminole Kraft Corporation (SKC) site necessary to provide 640,000 lb. of steam per hour for SKC's use, will be less than the emissions and air quality impacts of the future SKC recycling operation, providing 640,000 lb. of steam per hour for SKC's use without the CBCP.

2) whether, on balance, the permitted air pollutant emissions and air quality impacts of the CBCP, as proposed to be modified, and the addition of the three new yet-to-be-proposed package boilers scheduled for the SKC site at their permitted capacity, will be less than the emissions and air quality impacts of the CBCP as certified;

3) whether, on balance, the permitted air pollutant emissions and air quality impacts of the CBCP, as proposed to be modified, and the addition of the three new yet-to-be proposed package boilers scheduled for the SKC site at their permitted capacity, will be less than the emissions and air quality impacts of the future SKC recycling operation at permitted capacity without the power plant;

4) whether CBCP, as proposed to be modified, would either cause or contribute to a violation of an ambient air quality standard (AAQS) or cause or contribute to a violation of the allowable Prevention of Significant Deterioration (PSD) increments, in either the region surrounding the facility (a PSD Class II area) or the two distant PSD Class I areas. The two PSD Class I areas are the Okefenokee and Wolf Island Wilderness areas in Georgia. In addition, information is presented to provide data useful for assessing whether the CBCP would produce air toxics concentrations above the Draft Florida No Threat Levels (NTLs); and

5) updated information on air emission controls and emission rates. The lower air pollutant emission rates for the CBCP CFB boilers, and the inclusion of a new add-on technology (selective non-catalytic reduction) may require some changes to the original conditions of certification and air permit. To provide the State and EPA with accurate and updated information on the project for review of the proposed changes, ENSR, on behalf of U.S.

Generating Company, developed a technical review of the air emission controls and emission rates.

The "CBCP as certified" refers to the facility as described in the Final Order and Power Plant Site Certification PA 88-24 dated February 11, 1991 and the March 28, 1991 Final Determination by the FDER, Permit No. PSD-FL-137. The "CBCP as proposed to be modified" refers to the facility as described in the Amended Petition for Modification of Certification filed with the Division of Administrative Hearings on July 22, 1992, plus further improvements proposed by the CBCP.

The "future SKC Recycling Operation without the power plant" refers to the two bark and three oil-fired boilers presently at the SKC site as they would be operated should the CBCP not be. As currently permitted, the three power boilers would fire Grade No. 6 residual fuel oil with a maximum sulfur content of 1.0%. In this hypothetical future case, without the CBCP, it is ENSR's understanding that the exhausts of the three power boilers would be combined and exhausted through a newly constructed 125-foot stack to lessen susceptibility to aerodynamic downwash effects caused by nearby structures.

The addition of the three new yet-to-be-proposed package "boilers scheduled for the SKC site necessary to provide the 640,000 lb of steam for SKC's use" refers to three package boilers to be proposed by SKC capable of producing a total of 375,000 lb/hr of steam. For purposes of the technical analyses, it is assumed that the 640,000 lb/hr steam requirement is met by the CBCP supplying 380,000 lb/hr and the SK package boilers supplying 260,000 lb/hr.

The addition of "the three new yet-to-be-proposed package boilers scheduled for the SKC site at their permitted capacity" refers to these same boilers producing a total of 375,000 lb/hr of steam.

The yet-to-be proposed SK package boilers will be capable of accommodating either fuel oil or natural gas. Not yet permitted, these boilers will, according the current SKC plans, fire No. 2 distillate fuel oil with a maximum sulfur content of 0.5% and an annual average of 0.3%.

In making the assessments for pollutant emissions, the maximum annual emissions of health criteria pollutants, other regulated pollutants, and non-regulated air toxics pollutants are compared. To compare the air quality impacts and evaluate compliance with the AAQS and PSD increments and to compare the air quality impacts to the draft NTLs, comprehensive atmospheric dispersion modeling was performed in accordance with EPA and Florida DER Guidelines.

Table ES-1 illustrates the difference in annual pollutant emissions between CBCP as proposed to be modified plus the SKC package boilers, and the future SKC recycling operation (both cases at 640,000 lb/hr steam usage by to SKC). This table demonstrates the decreases achieved in

TABLE ES-1

CBCP as Proposed to be Modified Plus SK Package Boilers
vs.
SKC Recycling
(Both Cases at 640,000 lb/hr Steam for SK)
Net Change in Annual Emissions Due To CBCP and SK Package Boilers Firing Oil

Pollutants Category	Net Change
Health Criteria and PSD Increments	Decrease 159 tons
Total Regulated	Decrease 18 tons
Total Non-Regulated Air Toxics	Decrease 2 tons
Total Pollutants	Decrease 20 tons

the actual annual emissions of four categories of pollutants by operating the CBCP and the SK package boilers and shutting down the SKC power and bark boilers. The health criteria and PSD increment pollutants are those for which ambient air quality standards or PSD increments have been established. The total regulated pollutants include the criteria and all PSD regulatory pollutants. Non-regulated air toxics represent twenty different compounds emitted by the sources in question which are included in the list of 751 compounds cited in Florida's Draft Air Toxics Permitting Strategy. In aggregating health criteria, PSD increment and regulated pollutants, TSP and PM-10 are treated as individual pollutants exclusive of one another, although PM-10 are a portion of TSP. Because PM-10 and TSP are also treated exclusively when comparing ambient impacts (the health criteria standards address PM-10 while the PSD increments address TSP), the emissions comparisons treats them as different pollutants for consistency with the standards and PSD increments.

The comparisons of annual emissions shown in Table ES-1 assume that the SK package boilers always fire fuel oil. To the extent that they fire natural gas on an annual basis, the decreases in emissions would be greater. As shown in Table ES-1 decreases in air pollutant emissions are achieved by the CBCP, as proposed to be modified, in each category.

A comparison of air quality impacts between the CBCP, as proposed to be modified plus the SK package boilers, and the SKC recycling operation without the CBCP (both cases at 640,000 lb/hr steam usage by SKC) is summarized in Table ES-2. The table summarizes the changes due to the CBCP as proposed to be modified and the SKC package boilers for each criteria pollutant as well as total air toxics. Three values are listed for each pollutant: 1) the change to the maximum predicted concentration of the pollutant anywhere (higher, lower or insignificant maximum concentration); 2) the net effect on air quality on a regional basis in terms of the highest predicted pollutant concentrations (improved, insignificant, or degraded); and 3) the percent of locations for which modeling was performed which showed a net benefit in terms of the highest concentrations. A total of 1008 locations, referred to as "model receptors," were addressed. The majority of these fall within 10 kilometers of the CBCP, but a portion extend as far as 25 kilometers. As shown in Table ES-2, the CBCP as proposed to be modified and the SKC package boilers result in either lower or insignificant maximum concentrations of all criteria pollutants and total air toxics, a net improvement or insignificant change in the highest concentrations on a regional basis, and a net air quality benefit at virtually all locations.

A summary of the comparison of the maximum permitted annual pollutant emissions between CBCP as certified and CBCP as proposed to be modified plus the SK package boilers is presented in Table ES-3. This table illustrates the decrease in emissions resulting from CBCP as proposed to be modified plus the SK package boilers for the four pollutant categories. As shown in the table, decreases are achieved in all four categories of pollutants.

TABLE ES-2

CBCP as Proposed to be Modified Plus SK Package Boilers vs. SKC Recycling (Both Cases at 640,000 lb/hr Steam) Air Quality Changes Due to CBCP Plus SK Package Boilers Firing Oil[a]

Pollutant	Maximum Concentration	Net Regional Air Quality Effect	Percent of Locations with Air Quality Benefit
3-hour SO_2	Lower	Improved	98.4
24-hour SO_2	Lower	Improved	98.4
Annual SO_2	Lower	Improved	99.6
24-hour PM-10	Lower	Improved	99.6
Annual PM-10	Lower	Insignificant	97.1
1-hour CO	Insignificant	Insignificant	Not applicable
8-hour CO	Insignificant	Insignificant	Not applicable
Annual NO_2	Lower	Improved	99.7
24-hour Pb	Lower	Improved	96.6
Annual Pb	Lower	Improved	96.7
8-hour Air Toxics	Lower	Improved	99.7
24-hour Air Toxics	Lower	Improved	99.7
Annual Air Toxics	Lower	Improved	99.6

[a] See Section 2

TABLE ES-3

CBCP as Certified vs. CBCP as Proposed to be Modified Plus SK Package Boilers
Net Change in Permitted Annual Emissions Due to CBCP as Proposed to be Modified Plus SK Package Boilers

Pollutants Category	Net Change
Health Criteria and PSD Increments	Decrease 1,373 tons
Total Regulated	Decrease 2,551 tons
Total Non Regulated Air Toxics	Decrease 34 tons
Total Pollutants	Decrease 2,585 tons

A summary of the differences in air quality impacts at permitted capacity between CBCP as certified and CBCP as proposed to be modified plus the SK package boilers is presented in Table ES-4. Lower or insignificant maximum concentrations are shown to result from Cedar Bay as proposed to be modified for most pollutants with the exception of SO_2. However, the net effect on highest SO_2 concentrations is insignificant on a regional basis. Impacts of CO are insignificant in each case, so a meaningful comparison cannot be made. Annual average PM-10 impacts, although lower in terms of the maximum concentrations, are not significantly affected on a regional basis with a small number of locations experiencing a benefit. Although there is an average improvement, the magnitude of the improvement is not significant.

Table ES-5a summarizes the comparison of maximum permitted emissions between CBCP as proposed to be modified plus the SK package boilers, and the SKC recycling operation. This table shows an increase in each of the four pollutant categories. However, these changes do not account for substantial additional decreases that are asociated with the shutdown of recovery boilers, lime kilns and smelt dissolving tanks at SKC as a result of SKC converting to a recycling operation.

According to preliminary estimates provided by KBN Engineering and Applied Sciences in documentation being prepared in support of the PSD permit application for the SKC package boilers, substantial decreases in baseline emissions will be achieved. These are listed in Table ES-5b. As shown in the table, the overall result is a net decrease in the first three pollutant categories. Decreases in non-regulated air toxics were not estimated for the application, but these would also offset the increases shown in Table ES-5a at least to some extent.

Notwithstanding the above calculated emission increases, as shown in Table ES-6, with the exception of annual average lead, maximum pollutant concentrations are lower for the CBCP as proposed to be modified. In addition, for all pollutants, a net regional air quality benefit results and the vast majority of locations experience a benefit with the CBCP as proposed to be modified, compared to the SKC recycling operation.

Table ES-7 summarizes the results of the modeling for compliance with AAQS and PSD increments and for comparison to the Draft Air Toxics NTLs. For the applicable AAQS and PSD increment pollutants, the predicted compliance status is listed. "Compliance" indicates that an evaluation of all major sources in Duval County in addition to Cedar Bay demonstrates compliance with the standard. "Insignificant Impacts" indicates that no evaluation of the standard was performed since Cedar Bay impacts were insignificant. "Does not cause or contribute to a violation" indicates that all major sources in Duval County were modeled but only those total concentrations to which the Cedar Bay facility contributed a significant concentration were

TABLE ES-4

CBCP as Certified vs. CBCP as Proposed to be Modified Plus SK Package Boilers Air Quality Changes Due to CBCP as Proposed to be Modified Plus SK Package Boilers Firing Oil[a]

Pollutant	Maximum Concentration	Net Regional Air Quality Effect	Percent of Locations with Air Quality Benefit
3-hour SO_2	Higher	Insignificant	80.1
24-hour SO_2	Higher	Insignificant	66.6
Annual SO_2	Lower	Insignificant	45.7
24-hour PM-10	Lower	Insignificant	47.5
Annual PM-10	Lower	Insignificant	10.5
1-hour CO	Insignificant	Insignificant	Not Applicable
8-hour CO	Insignificant	Insignificant	Not Applicable
Annual NO_2	Lower	Insignificant	49.1
24-hour Pb	Lower	Improved	97.3
Annual Pb	Lower	Improved	97.3
8-hour Air Toxics	Lower	Improved	96.6
24-hour Air Toxics	Lower	Improved	96.6
Annual Air Toxics	Lower	Improved	97.0

[a] See Section 2

TABLE ES-5a

CBCP as Proposed to be Modified Plus SK Package Boilers vs. SKC Recycling Net Change in Permitted Annual Emissions Due to CBCP as Proposed to be Modified Plus SK Package Boilers

Pollutants Category	Net Change
Health Criteria and PSD Increments	Increase 370 tons
Total Regulated	Increase 531 tons
Total Non Regulated Air Toxics	Increase 3 tons
Total Pollutants	Increase 534 tons

TABLE ES-5b

Net Changes Due To Additional Sources Shutting Down[a] at SKC for Conversion to Recycling Operation

Pollutants Category	Net Change	Combined Net Change with CBCP
Health Criteria and PSD Increments	Decrease 4,668 tons	Decrease 4,298 tons
Total Regulated	Decrease 4,754 tons	Decrease 4,220 tons
[a] Recovery Boilers, Lime Kilns, Smelt Dissolving Tanks		

TABLE ES-6

CBCP as Proposed to be Modified Plus SK Package Boilers at Permitted Capacity
vs.
SKC Recycling at Permitted Capacity
Air Quality Changes Due to CBCP Plus SK Package Boilers[a]

Pollutant	Maximum Concentration	Net Regional Air Quality Effect	Percent of Locations with Air Quality Benefit
3-hour SO_2	Lower	Improved	97.8
24-hour SO_2	Lower	Improved	98.2
Annual SO_2	Lower	Improved	99.6
24-hour PM-10	Lower	Improved	99.3
Annual PM-10	Lower	Improved	97.0
1-hour CO	Insignificant	Insignificant	Not Applicable
8-hour CO	Insignificant	Insignificant	Not Applicable
Annual NO_2	Lower	Improved	99.7
24-hour Pb	Lower	Improved	94.9
Annual Pb	Higher	Improved	96.7
8-hour Air Toxics	Lower	Improved	99.6
24-hour Air Toxics	Lower	Improved	99.6
Annual Air Toxics	Lower	Improved	99.6

[a] See Section 2

TABLE ES-7

CBCP as Proposed to be Modified Compliance with Ambient Air Quality Standards (AAQS) and PSD Increments, and Comparison to Draft Air Toxics No Threat Levels (NTLs)

Pollutant	Standard	Predicted Compliance Status
SO_2	AAQS PSD Class II PSD Class I	Does Not Cause or Contribute to a Violation Does Not Cause or Contribute to a Violation Compliance
PM-10	AAQS	Compliance
TSP	PSD Class II PSD Class I	Compliance Compliance
CO	AAQS	Insignificant Impacts
NO_2	AAQS PSD Class II PSD Class I	Insignificant Impacts Insignificant Impacts Compliance
Pb	AAQS	Compliance
Air Toxics	NTL's	Compliance with 51 NTLs for 20 Compounds

evaluated, and those concentrations were predicted to be below the standards. As shown in the table, the predicted compliance status for each criteria pollutant and standard is favorable. For the draft No Threat Levels, the CBCP, as proposed to be modified complies with all 51 NTLs for 20 different compounds. Some compounds have NTLs for more than one averaging period.

As demonstrated by the foregoing summary and further documented herein, the Cedar Bay Cogeneration Project as proposed to be modified, plus the new as-yet-to-be-proposed SK package boilers on balance, in terms of pollutant emissions and air quality, result in lower environmental impacts than either the SKC recycling operation or the Cedar Bay facility as originally certified. In addition, the Cedar Bay Cogeneration Project, as proposed to be modified, will comply with all applicable ambient air quality standards and prevention of significant deterioration increments, neither causing nor contributing to a violation.

PREFACE

The Air Quality Analysis prepared by ENSR Consulting and Engineering is separated into four sections. The first two sections show that, on balance, the net air quality impacts of the CBCP as proposed to be modified and the addition of the three as-yet-to-be-proposed package boilers scheduled for the Seminole Kraft facility necessary to provide 640,000 pounds of steam per hour are less than the net air quality impacts of the Seminole Kraft recycling operation without the CBCP and that the net air quality benefits of the CBCP as proposed to be modified along with the three as-yet-to-be-proposed package boilers at full capacity will be less than Cedar Bay as permitted. The third section demonstrates that the CBCP as proposed to be modified will comply with certain nonprocedural agency standards. The fourth section presents a review of air emission control technologies.

In Section 1, "Net Emissions Changes," the total annual tons of pollutants emitted are compared. This comparison is presented in terms similar to those used in the presentation before the Siting Board regarding issuance of the Board's Order Instituting Modification Proceedings.

In Section 2, "Net Air Quality Impacts," dispersion modeling of the air quality impacts at multiple receptor points is compared to demonstrate the net air quality impact improvement associated with the CBCP.

In Section 3, "Cedar Bay Compliance with Prevention of Significant Deterioration (PSD) Increments and Ambient Air Quality Standards (AAQS), and Comparison to Draft Air Toxics No Threat Levels (NTLs)," information is presented to demonstrate that the combustion sources and aggregate materials handling equipment at the CBCP as proposed to be modified will comply with PSD increments and AAQS, both of which are nonprocedural agency standards. For informational purposes, air quality impacts due to the air toxic emissions of the CBCP are compared to Florida's draft air toxics NTLs.

In Section 4, "Air Emissions Control Technology," a review of the air emissions control technologies and emission rates proposed for the combustion sources and aggregate materials handling equipment at the CBCP is presented. This section contains technical and economic analyses of the controls for air emission sources for the project. For the circulating fluidized bed boilers, these controls include: boiler design and selective non-catalytic reduction for control of nitrogen oxides, fabric filtration for control of particulate matter and trace metals, boiler design and operation for control of carbon monoxide and volatile organic compounds, and limestone injection for control of sulfur dioxide and acid gases.

1.0 COMPARISON NO. 1: NET EMISSIONS CHANGES

1.1 Introduction

The objective of the information to be presented for Comparison No. 1 is to provide data useful for assessing

1) whether, on balance, the pollutant emissions of the CBCP, as proposed to be modified, and the addition of the three new yet-to-be-proposed boilers scheduled for the Seminole Kraft Corporation (SKC) site necessary to provide 640,000 lb of steam per hour for SKC's use, will be less than the emissions of the future SKC recycling operation without the CBCP,

2) whether, on balance, the pollutant emissions of the CBCP, as proposed to be modified, and the addition of the three new yet-to-be-proposed boilers scheduled for the SKC site at their permitted capacity, will be less than the emissions of the CBCP as certified, and

3) whether, on balance, the permitted pollutant emissions of the CBCP, as proposed to be modified, and the addition of the three new yet-to-be-proposed boilers scheduled for the SKC site at their permitted capacity, will be less than the emissions of the future SKC recycling operation at permitted capacity without the CBCP.

The "CBCP as certified" refers to 3 coal-fired circulating fluidized bed (CFB) boilers capable of generating 225 MW of electricity and supplying SKC with a total steam generating capacity of 640,000 lb/hr, two limestone dryers fired by No. 2 distillate fuel oil, associated coal and other aggregate material (limestone, ash) handling equipment, and cooling tower, as described in the Final Order and Power Plant Site Certification PA 88-24 dated February 11, 1991 and the March 28, 1991 Final Determination by the FDER, Permit No. PSD-FL-137.

The "CBCP as proposed to be modified" refers to the CFB boilers generating 250 MW of electricity and supplying SKC with 380,000 lb/hr of steam, two limestone dryers fired by No. 2 distillate fuel oil, associated coal and other aggregate material (limestone, ash) handling equipment, and cooling tower, as described in the Amended Petition for Modification of Certification filed with the Division of Administrative Hearings on July 22, 1992, plus further improvements proposed by the CBCP. These collectively include proposed reductions in CFB emissions of SO_2, NO_x, TSP, PM-10, CO, Mercury, Lead, Beryllium, Sulfuric Acid Mist and Fluorides.

The "future SKC recycling operation without the CBCP" refers to the two bark and three oil-fired power boilers and bark handling operations, presently at the SKC site, as they would be operated should the Cedar Bay power plant not be operated. As currently permitted, the three power boilers would fire Grade No. 6 residual fuel oil with a maximum sulfur content of 1.0%. Power Boiler No. 1 has a steam generating capacity of 135,000 lb/hr while Power Boilers Nos. 2 and 3 each have a steam capacity of 180,000 lb/hr. In the future hypothetical case, without the Cedar Bay power plant, ENSR understands that the exhausts of the three power boilers would be combined and exhausted through a newly constructed 125 foot stack to lessen susceptibility to aerodynamic downwash effects caused by nearby structures. The bark, or "carbonaceous", fuel boilers each have a steam generation capacity of 125,000 lb/hr. They would fire mostly bark, but are also permitted to mix fuel oil when the bark is wetter than desirable, as well as fire recycle rejects, including plastic components (i.e. bale bindings: strappings and wrappings).

The addition of "the three new yet-to-be-proposed boilers scheduled for the SKC site necessary to provide 640,000 lb/hr of steam for SKC's use" refers to three package boilers to be proposed by SKC capable of producing a total of 375,000 lb/hr of steam. For purposes of the technical analyses for Comparison No. 1, it is assumed that the 640,000 lb/hr steam requirement is met by the CBCP supplying 380,000 lb/hr and the SKC package boilers supplying 260,000 lb/hr.

The addition of "the three new yet-to-be-proposed boilers scheduled the SKC site at their permitted capacity" refers to these same boilers producing a total of 375,000 lb/hr of steam.

The proposed SK package boilers are capable of accommodating either fuel oil or natural gas. Not yet permitted, the current SKC plan calls for No. 2 distillate fuel oil with a maximum sulfur content of 0.5%, and an annual average of 0.3%.

In applying Comparison No. 1, the differences in total annual pollutant emissions are compared amongst 5 cases. These are:

Case 1: the future operation of the 3 power boilers and 2 bark boilers for the SKC recycling operation at a total annualized steam production rate of 640,000 lb/hr, (which corresponds to an annual capacity factor of 85.9 percent),

Case 1a: the operation of the 3 power boilers and 2 bark boilers for the SKC recycling operation at a total annualized steam production rate of 745,000 lb/hr (their permitted capacity),

Case 2: the operation of the CBCP as certified, (at a 93 percent annual capacity factor), Case 3: the operation of the CBCP, as proposed to be modified, generating electricity and supplying a total annualized steam production rate of 380,000 lb/hr to SKC, (at an 85.5 percent annual capacity factor), plus the addition of the 3 new package boilers at the SKC recycling operation under two fuel scenarios, fuel oil or natural gas, at a total annualized steam production rate of 260,000 lb/hr, (which corresponds to an annual capacity factor of 69.3 percent) and

Case 4: the operation of the CBCP, as proposed to be modified, (permitted at an annual capacity factor of 93 percent), plus the addition of the 3 new package boilers at the SKC recycling operation under two fuel scenarios, fuel oil or natural gas (at an annual capacity factor of 100%).

To respond to the siting board order, three assessments are presented:

Assessment A: Case No. 4
vs.
Case No. 2

Assessment B: Case No. 3.
vs.
Case No. 1

Assessment C: Case No. 4
vs.
Case No. 1a

1.2 Source Data and Assumptions

The annual emissions from combustion sources for Case 1 are listed in Tables 1-1 and 1-2. Data are listed individually for each power boiler and bark boiler. The individual steam rates represent SKC's intended manner of operating these units to produce 640,000 total lb/hr of steam in 1994, without CBCP, (requiring a capacity factor of 85.9 percent). Two fuel scenarios are possible for the bark boilers, each producing different emissions levels. Scenario 1 represents allowable particulate (PM-10) emissions. Scenario 2 represents allowable SO_2 emissions. For the other pollutants, emission rates are taken from the fuel scenario producing the higher allowable emissions.

The annual emissions from combustion sources for Case 1a are listed in Tables 1-3 and 1-4. The individual steam rates represent the permitted rated steam capacity of each unit, which

TABLE 1-1

Case 1: Maximum Regulated Pollutant Emissions for Seminole Kraft Emission Sources Power and Bark Boilers at 640,000 lb/hr Total Annualized Steam Rate

Annualized Steam Rate (klb/hr)	Power Boiler #1		Power Boiler #2		Power Boiler #3		Bark Boiler #1		Bark Boiler #2		Total
	100 (1)/135(2)		145 (1)/180(2)		145 (1)/180(2)		125 (1)/72.5(2)		125 (1)/72.5(2)		640
Pollutant	(lb/hr)	(ton/yr)	(lb/hr)	(ton/yr)	(lb/hr)	(ton/yr)	(lb/hr)	(ton/yr)	(lb/hr)	(ton/yr)	Total ton/yr
SO2 (2)	203.5	891.3	270.6	1185.2	270.6	1185.2	34.3	150.2	34.3	150.2	3,562.3
NOx (2)	82.6	361.8	109.9	481.4	109.9	481.4	41.8	183.1	41.8	183.1	1,690.8
CO (1)	4.6	20.1	6.6	28.9	6.6	28.9	241.3	1056.9	241.3	1056.9	2,191.2
TSP (1)	13.7	60.0	19.8	86.7	19.8	86.7	38.6	169.1	38.6	169.1	571.6
PM-10 (1)	9.7	42.5	14.1	61.8	14.1	61.8	33.6	147.2	33.6	147.2	459.9
VOC (1)	0.7	3.1	1.0	4.4	1.0	4.4	32.9	144.1	32.9	144.1	300.1
Lead (1)	0.00384	1.68e-02	0.00554	0.024	0.00554	0.024	0.01737	0.076	0.01737	0.076	0.22
Mercury (1)	0.00044	1.93e-03	0.00063	0.0028	0.00063	0.0028	0.00058	0.0025	0.00058	0.0025	0.013
Beryllium (2)	0.00078	3.42e-03	0.00103	0.0045	0.00103	0.0045	0.00001	4.4e-05	0.00001	4.4e-05	0.013
Fluorides (2)	0.0218	9.55e-02	0.029	0.127	0.029	0.127	0.0066	0.029	0.0066	0.029	0.41
H2SO4 mist (2)	4.44	19.4	5.9	25.8	5.9	25.8	1.34	5.87	1.34	5.87	82.9

Notes:
Source: KBN Engineering and Applied Sciences, Inc. Memorandum to A.Hallquist (ENSR) from D.Buff (KBN) 10/22/92
Ton/yr values assume 8,760 hours/yr operation at 85.9% annualized capacity.
(1) Fuel Scenario 1 for Bark Boilers, bark only (allowable PM emissions)
(2) Fuel Scenario 2 for Bark Boilers, 50% fuel oil/50% bark on a heat input basis (allowable SO_2 emissions)

TABLE 1-2

Case 1: Maximum Non-Regulated Pollutant Emissions from Seminole Kraft Emission Sources Power and Bark Boilers at 640,000 lb/hr Total Annualized Steam Rate

Annualized Steam Rate (klb/hr)	Power Boiler #1		Power Boiler #2		Power Boiler #3		Bark Boiler #1		Bark Boiler #2		Total
	100 (1)/135(2)		145 (1)/180(2)		145 (1)/180(2)		125 (1)/72.5(2)		125 (1)/72.5(2)		640
Pollutant	**(lb/hr)**	**(ton/yr)**	**(lb/hr)**	**(ton/yr)**	**(lb/hr)**	**(ton/yr)**	**(lb/hr)**	**(ton/yr)**	**(lb/hr)**	**(ton/yr)**	**Total ton/yr**
Antimony (2)	0.00266	0.012	0.00354	0.016	0.00354	0.016	0.00081	0.0035	0.00081	0.0035	0.050
Arsenic (2)	0.00352	0.015	0.00467	0.020	0.00467	0.020	0.00011	0.0005	0.00011	0.0005	0.057
Barium (1)	0.00197	0.009	0.00285	0.012	0.00285	0.012	0.01974	0.086	0.01974	0.086	0.21
Cadmium (2)	0.0029	0.013	0.00386	0.017	0.00386	0.017	0.0006	0.0026	0.0006	0.0026	0.052
HCl (1)	0	0	0	0	0	0	4.39	19.2	4.39	19.2	38.5
Indium (1)	0.0021	0.0092	0.003	0.013	0.003	0.013	0.155	0.68	0.155	0.68	1.39
Chromium VI (1)	0.00288	0.013	0.00416	0.018	0.00416	0.018	0.00351	0.015	0.00351	0.015	0.080
Copper (2)	0.0514	0.23	0.0684	0.30	0.0684	0.30	0.0034	0.015	0.0034	0.015	0.85
Formaldehyde (1)	0.055	0.24	0.08	0.35	0.08	0.35	0.122	0.53	0.122	0.53	2.02
Manganese (1)	0.0036	0.016	0.0051	0.022	0.0051	0.022	0.011	0.048	0.011	0.048	0.16
Molybdenum (1)	0.0021	0.0092	0.003	0.013	0.003	0.013	0.3092	1.35	0.3092	1.35	2.74
Nickel (2)	0.2331	1.02	0.31	1.358	0.31	1.358	0.0068	0.030	0.0068	0.030	3.80
Phosphorous (1)	0.035	0.15	0.05	0.219	0.05	0.219	0.066	0.29	0.066	0.29	1.17
POM (1)	0.0013	0.0057	0.0018	0.0079	0.0018	0.0079	0.0483	0.21	0.0483	0.21	0.44
Selenium (2)	0.00044	0.0019	0.00059	0.0026	0.00059	0.0026	0.00013	0.0006	0.00013	0.0006	0.008
Tin (1)	0.00033	0.0014	0.00048	0.0021	0.00048	0.0021	0.19585	0.86	0.19585	0.86	1.72
Vanadium (2)	0.558	2.44	0.741	3.25	0.741	3.25	0.038	0.17	0.038	0.17	9.27
Radionuclides	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
Source: KBN Engineering and Applied Sciences, Inc. Memorandum to A.Hallquist (ENSR) from D.Buff (KBN) 10/22/92
Ton/yr values assume 8,760 hours/yr operation at 85.9% annualized capacity
NA - not available
(1) Fuel Scenario 1 for Bark Boilers, bark only (allowable PM emissions)
(2) Fuel Scenario 2 for Bark Boilers, 50% fuel oil/50% bark on a heat input basis (allowable SO_2 emissions)

TABLE 1-3

Case 1a: Maximum Regulated Pollutant Emissions for Seminole Kraft Emission Sources Power and Bark Boilers at 745,000 lb/hr Total Annualized Steam Rate

	Power Boiler #1		Power Boiler #2		Power Boiler #3		Bark Boiler #1		Bark Boiler #2		
Annualized Steam Rate (klb/hr)	135		180		180		125		125		Total 745
Pollutant	(lb/hr)	(ton/yr)	(lb/hr)	(ton/yr)	(lb/hr)	(ton/yr)	(lb/hr)	(ton/yr)	(lb/hr)	(ton/yr)	Total ton/yr
SO_2 (2)	203.5	891.3	270.6	1185.2	270.6	1185.2	59.1	258.9	59.1	258.9	3779.6
NO_x (2)	82.6	361.8	109.9	481.4	109.9	481.4	72.1	315.8	72.1	315.8	1955.7
CO (1)	6.2	27.2	8.2	35.9	8.2	35.9	241.3	1056.9	241.3	1056.9	2212.2
TSP (1)	18.5	81.0	24.6	107.7	24.6	107.7	38.6	169.1	38.6	169.1	634.7
PM-10 (1)	13.1	57.4	17.5	76.7	17.5	76.7	33.6	147.2	33.6	147.2	504.7
VOC (1)	0.9	3.9	1.3	5.7	1.3	5.7	32.9	144.1	32.9	144.1	303.3
Lead (1)	0.00518	2.27-02	0.00689	3.02-02	0.00689	3.02-02	0.01737	7.61-02	0.01737	7.61-02	0.24
Mercury (1)	0.00059	2.58-03	0.00079	3.46-03	0.00079	3.46-03	0.00058	2.54-03	0.00058	2.54-03	0.015
Beryllium (2)	0.00078	3.42-03	0.00103	4.51-03	0.00103	4.51-03	0.00002	8.76-05	0.00002	8.76-05	0.013
Fluorides (2)	0.0218	9.55-02	0.0290	1.27-01	0.0290	1.27-01	0.0114	4.99-02	0.0114	4.99-02	0.45
H_2SO_4 mist (2)	4.44	19.4	5.90	25.8	5.90	25.8	2.32	10.2	2.32	10.2	91.5

Source: KBN Engineering and Applied Sciences, Inc., Fax from D. Buff, KBN to Al Hallquist, ENSR, 11/6/92
Ton/yr values assume 8760 hrs/yr operation.
(1) Fuel Scenario 1 for Bark Boilers, bark only (allowable PM emissions)
(2) Fuel Scenario 2 for Bark Boilers, 50% fuel oil/50% bark on a heat input basis (allowable SO_2 emissions)

TABLE 1-4

Case 1a: Maximum Non-Regulated Pollutant Emissions for Seminole Kraft Emission Sources Power and Bark Boilers at 745,000 lb/hr Total Annualized Steam Rate

Annualized Steam Rate (klb/hr)	Power Boiler #1		Power Boiler #2		Power Boiler #3		Bark Boiler #1		Bark Boiler #2		
	135		180		180		125		125		Total 745
Pollutant	(lb/hr)	(ton/yr)	(lb/hr)	(ton/yr)	(lb/hr)	(ton/yr)	(lb/hr)	(ton/yr)	(lb/hr)	(ton/yr)	Total ton/yr
Antimony (2)	0.00266	0.012	0.00354	0.016	0.00354	0.016	0.00139	0.006	0.00139	0.006	0.055
Arsenic (2)	0.00352	0.015	0.00467	0.020	0.00467	0.020	0.00018	0.0008	0.00018	0.0008	0.058
Barium (1)	0.00266	0.012	0.00354	0.016	0.00354	0.016	0.01974	0.086	0.01974	0.086	0.22
Cadmium (2)	0.00290	0.013	0.00386	0.017	0.00386	0.017	0.00104	0.0046	0.00104	0.0046	0.056
HCl (1)	0.0	0.0	0.0	0.0	0.0	0.0	4.39	19.2	4.39	19.2	38.46
Indium (1)	0.0028	0.012	0.0037	0.016	0.0037	0.016	0.155	0.68	0.155	0.68	1.40
Chromium VI (1)	0.00389	0.017	0.00517	0.023	0.00517	0.023	0.00351	0.015	0.00351	0.015	0.093
Copper (2)	0.051	0.23	0.068	0.30	0.068	0.30	0.0059	0.026	0.0059	0.026	0.88
Formaldehyde (1)	0.075	0.33	0.100	0.44	0.100	0.44	0.122	0.53	0.122	0.53	2.27
Manganese (1)	0.0048	0.021	0.0064	0.028	0.0064	0.028	0.011	0.048	0.011	0.048	0.18
Molybdenum (1)	0.0028	0.012	0.0037	0.016	0.0037	0.016	0.3092	1.35	0.3092	1.35	2.75
Nickel (2)	0.233	1.02	0.310	1.358	0.310	1.358	0.0118	0.052	0.0118	0.052	3.84
Phosphorous (1)	0.047	0.21	0.062	0.27	0.062	0.27	0.066	0.29	0.066	0.29	1.33
POM (1)	0.0017	0.0074	0.0023	0.010	0.0023	0.010	0.0483	0.21	0.0483	0.21	0.45
Selenium (2)	0.00044	0.0019	0.00059	0.0026	0.00059	0.0026	0.00023	0.001	0.00023	0.001	0.009
Tin (1)	0.00044	0.0019	0.00059	0.0026	0.00059	0.0026	0.19585	0.86	0.19585	0.86	1.72
Vanadium (2)	0.558	2.44	0.741	3.25	0.741	3.25	0.065	0.28	0.065	0.28	9.51
Radionuclides	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Source: KBN Engineering and Applied Sciences, Inc., Fax from D. Buff, KBN to Al Halquist, ENSR, 11/6/92
Ton per year values assume 8760 hrs/yr operation.
NA = Not Available
(1) Fuel Scenario 1 for Bark Boilers, bark only (allowable PM emissions)
(2) Fuel Scenario 2 for Bark Boilers, 50% fuel oil/50% bark on a heat input basis (allowable SO_2 emissions)

represents a total rated steam capacity of 745,000 lb/hr. As in Case 1, the composite of two fuel scenarios is presented, with the higher allowable emissions of the two scenarios listed.

The annual emissions from combustion sources for Case 2, CBCP as certified, are listed in Tables 1-5 and 1-6. Tables 1-7 through 1-10 list the annual emissions from combustion sources for Case 3 CBCP as proposed to be modified but at 85% annual capacity; with the as-yet-to-be-proposed SK package boilers on natural gas and fuel oil, at 260,000 lb/hr annualized steam rate (a capacity factor of 69.3%), which provides the necessary 640,000 lb/hr of steam to SKC. Tables 1-11 through 1-14 list the annual combustion source emissions for Case 4, CBCP as proposed to be modified with the SK package boilers on natural gas and fuel oil, all at permitted capacity. The emissions listed for the CBCP CFB boilers represent the exclusive firing of coal. Emissions from the firing of distillate oil during start-up, or the low percentage of short-fiber rejects from SKC, will be lower.

The above tables list emissions from combustion sources only at the respective facilities. Additional particulate emissions are generated in the form of dust from aggregate materials handling and storage as well as from cooling towers in the form of suspended and dissolved solids in the drift droplets. Table 1-15 lists the total annual emissions of PM-10 and TSP associated with these operations at the respective facilities. The PM-10 and TSP emissions from the sources listed in Table 1-15 are incorporated into the comparisons presented in the following section. Details of the various sources, controls and calculations of emissions from these operations are provided in Appendix A, with the exception of PM-10/TSP emissions from aggregate materials handling for the CBCP as Certified. Those emissions were taken from Table 3.4-5 of the Site Certification Application, Amendment 3.

1.3 Findings

The results of Assessment A, Case 4 with SK package boilers on fuel oil, vs Case 2 are presented in Table 1-16. The results of Assessment A, Case 4 with the SK package boilers on natural gas, vs Case 2 are presented in Table 1-17. The total aggregate emissions shown count both TSP and PM-10 as individual pollutants, even though PM-10 are a portion of TSP. In the context of ambient standards, which are established for PM-10, and PSD increments, which are established for TSP, the air quality impacts analyses treat the two pollutants exclusively. In order to be consistent with this treatment, they are also treated individually for emissions aggregation purposes. These tables show that for Assessment A, while annual emissions of some pollutants in Case 4 are greater than for Case 2, others decrease substantially to the extent that, on balance, the aggregate annual emissions of Case 4 are lower.

TABLE 1-5

Case 2: Maximum Regulated Pollutant Emissions for Cedar Bay as Certified (a)

Pollutant	CFB		Limestone Dryers (b)		Total (tons/yr)
	(lb/MMBtu)	(tons/yr)(e)	(lb/hr)	(tons/yr)	
SO2	0.31 (c)	4,026.9	5.00	43.8	4,070.7
NOx	0.29 (d)	3,767.1	2.40	21.0	3,788.1
CO	0.19	2,468.1	0.60	5.3	2,473.4
TSP (PM)	0.02	259.8	0.25	2.2	262.0
PM-10	0.02	259.8	0.25	2.2	262.0
VOC	0.015	194.9	0.05	0.44	195.3
Lead	0.007	90.9	1.45e-03(f)	1.27e-02	90.9
Beryllium	0.00011	1.4	4.26e-05(f)	3.73e-04	1.4
Mercury	0.00026	3.4	5.11e-05(f)	4.48e-04	3.4
Fluorides	0.086	1,117.1	NA (f)	NA	1,117.1
H2SO4 mist	0.024	311.8	0.11(f)	0.96	311.9

Notes:
NA = Not Available
(a) Source: Final Order and Certification PA-88-24 (2/11/91) and Final Determination, AES/Cedar Bay Cogeneration Project, Duval County, FL Permit No. PSD-FL-137 (3/28/91).
(b) lb/hr values represent emissions limits for each of two limestone dryers
Annual emissions are for both dryers, based on permitted 8760 hrs/yr operation
(c) 12 month running average
(d) 30 day running average
(e) Calculated from total heat input rate of 3189 MMBtu/hr at 93% annualized capacity factor as stated in (a) above. Tons/yr values in permit may differ slightly due to round-off or inadvertent error.
(f) These data supplied by Bechtel, Correspondence from A. Nawaz to G. Weidenger (U.S. Generating Company), 10/23/92

TABLE 1-6

Case 2: Maximum Non-Regulated Pollutant Emissions for Cedar Bay as Certified (a)

Pollutant	CFB		Limestone Dryers (c)		Total (tons/yr)
	(lb/MMBtu)	(tons/yr)(b)	(lb/hr)	(tons/yr)	
Antimony	1.32e-05	0.2	NA	NA	0.2
Arsenic	2.94e-03	38.2	7.16e-05	6.27e-04	38.2
Barium	9.36e-04	12.2	4.60e-05	4.03e-04	12.2
Cadmium	5.54e-05	0.7	1.79e-04	1.57e-03	7.01e-01
HCl	1.81e-03	23.5	NA	NA	23.5
Indium	2.11e-07	2.74e-03	NA	NA	2.74e-03
Chromium VI	1.66e-04	2.2	8.09e-04	7.09e-03	2.2
Copper	1.21e-04	1.6	4.77e-03	4.18e-02	1.6
Formaldehyde	1.30e-04	1.7	6.90e-03	6.05e-02	1.7
Manganese	2.80e-04	3.6	2.39e-04	2.09e-03	3.6
Molybdenum	1.56e-04	2.0	8.32e-04	7.28e-03	2.0
Nickel	1.24e-04	1.6	2.90e-03	2.54e-02	1.6
Phosphorous	5.09e-04	6.6	1.81e-03	1.58e-02	6.6
POM	1.86e-05	0.24	3.83e-04	3.36e-03	0.24
Selenium	2.18e-05	0.28	1.93e-04	1.69e-03	0.28
Tin	6.13e-05	0.80	5.62e-03	4.93e-02	0.85
Vanadium	3.86e-04	5.0	3.11e-02	2.72e-01	5.3
Radionuclides (d)	8.66e-10	0.022	NA	NA	0.022

Notes:
NA - Not Available
(a) Emissions estimated based on emission factors developed by Bechtel Power (Letter from A. Nawaz, Bechtel to G. Weidinger, U.S. Generating Company, 10/23/92)
(b) Based on total heat input rate of 3189 MMBtu/hr at 93% annualized capacity factor
(c) lb/hr values represent emissions limits for each of two limestone dryers
Annual emissions are for both dryers, based on permitted 8760 hrs/yr operation
(d) Emission units expressed as curies

TABLE 1-7

Case 3: Maximum Regulated Pollutant Emissions for Cedar Bay as Proposed to be Modified (a) and SK Package Boilers Firing Natural Gas at 260,000 lb/hr Steam

	CFB		Limestone Dryers (e)		SK Package Boilers (f)		Total (tons/yr)
Pollutant	(lb/MMBtu)	(tons/yr)(d)	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)	
SO2	0.20 (b)	2388.5	5.00	14.6	0.1	1.31	2404.4
NOx	0.17 (c)	2030.2	2.40	7.0	24.3	319.3	2356.5
CO	0.175 (c)	2090.0	0.60	1.8	43.4	570.0	2661.8
TSP	0.018	214.9	0.25	0.73	0.6	7.9	223.5
PM-10	0.018	214.9	0.25	0.73	0.6	7.9	223.5
VOC	0.015	179.2	0.05	0.15	0.17	2.2	181.5
Lead	6.38e-05	0.76	1.45e-03	4.23e-03	NA	NA	0.76
Beryllium	1.25e-05	0.15	4.26e-05	1.24e-04	NA	NA	0.15
Mercury	3.04e-05	0.36	5.11e-05	1.49e-04	1.7e-06	2.2e-05	0.36
Fluorides	8.54e-04	10.2	NA	NA	NA	NA	10.2
H2SO4 mist	0.016	191.0	0.11	0.32	NA	NA	191.3

Notes:

NA = Not Applicable

(a) Source: Final Order and Certification PA-88-24 (2/11/91) and Amended Petition for Modification of Certification (July 22, 1992 Before the State of Florida, Division of Administrative Hearings, In Re: AES Cedar Bay Cogeneration Project, Power Plant Site Certification Application PA-88-24) plus proposed improvements by CBCP.

(b) 12 month running average

(c) 30 day running average

(d) Based on total heat input rate of 3189 MMBtu/hr at 85.5% annualized capacity factor

(e) Lb/hr values represent emission limits for each of two limestone dryers
Annual emissions are for both dryers and are based on maximum operation of 8 hours/day each, 365 days/yr

(f) Firing natural gas - lb/hr values for each of three boilers - emissions data from KBN Engineering (10/22/92)

TABLE 1-8

Case 3: Maximum Non-Regulated Pollutant Emissions for Cedar Bay as Proposed to be Modified (a) and SKC Package Boilers Firing Natural Gas at 260,000 lb/hr Steam

	CFB		Limestone Dryers (c)		SK Package Boilers (d)		Total (tons/yr)
Pollutant	(lb/MMBtu)	(tons/yr)(b)	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)	
Antimony	1.32e-05	0.2	NA	NA	NA	NA	0.2
Arsenic	1.56e-04	1.9	7.16e-05	2.09e-04	NA	NA	1.9
Barium	9.36e-04	11.2	4.60e-05	1.34e-04	NA	NA	11.2
Cadmium	5.54e-05	0.7	1.79e-04	5.22e-04	NA	NA	0.7
HCl	1.81e-03	21.6	NA	NA	NA	NA	21.6
Indium	2.11e-07	2.52e-03	NA	NA	NA	NA	2.52e-03
Chromium VI	5.65e-05	0.7	2.09e-04	6.10e-04	NA	NA	0.7
Copper	1.21e-04	1.4	4.77e-03	1.39e-02	NA	NA	1.5
Formaldehyde	1.30e-04	1.6	6.90e-03	2.02e-02	NA	NA	1.6
Manganese	2.80e-04	3.3	2.39e-04	6.97e-04	NA	NA	3.3
Molybdenum	1.56e-04	1.9	8.32e-04	2.43e-03	NA	NA	1.9
Nickel	1.24e-04	1.5	2.90e-03	8.46e-03	NA	NA	1.5
Phosphorous	5.09e-04	6.1	1.81e-03	5.27e-03	NA	NA	6.1
POM	1.86e-05	0.22	3.83e-04	1.12e-03	NA	NA	0.22
Selenium	2.18e-05	0.26	1.93e-04	5.62e-04	NA	NA	0.26
Tin	6.13e-05	0.73	5.62e-03	1.64e-02	NA	NA	0.75
Vanadium	3.86e-04	4.6	2.17e-02	6.39e-02	NA	NA	4.7
Radionuclides (e)	8.66e-10	0.020	NA	NA	NA	NA	0.020

Notes:
NA - Not applicable
(a) Source: emission factors developed by Bechtel Power (10/23/92)
(b) Based on total heat input rate of 3189 MMBtu/hr at 85.5% annualized capacity factor
(c) Lb/hr values represent emission limits for each of two limestone dryers
Annual emissions are for both dryers and are based on maximum operation of 8 hours/day each, 365 days/yr
(d) Firing natural gas - lb/hr values for each of three boilers - emissions data from KBN Engineering (10/22/92)
(e) Emission units expressed as curies

TABLE 1-9

Case 3: Maximum Regulated Pollutant Emissions for Cedar Bay as Proposed to be Modified (a) and SK Package Boilers Firing Distillate Oil at 260,000 lb/hr Steam

	CFB		Limestone Dryers (e)		SK Package Boilers (f)		Total (tons/yr)
Pollutant	(lb/MMBtu)	(tons/yr)(d)	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)	
SO2	0.20 (b)	2388.5	5.0	14.6	34.2	449.0	2852.1
NOx	0.17 (c)	2030.2	2.4	7.0	22.8	299.6	2336.8
CO	0.175 (c)	2090.0	0.6	1.8	41.9	550.6	2642.4
TSP	0.018	214.9	0.25	0.73	5.71	75.0	290.6
PM-10	0.018	214.9	0.25	0.73	2.85	37.4	253.0
VOC	0.015	179.2	0.05	0.15	0.16	2.1	181.4
Lead	6.38e-05	0.76	1.45e-03	4.23e-03	1.0e-03	1.3e-02	0.78
Beryllium	1.25e-05	0.15	4.26e-05	1.24e-04	2.8e-04	3.7e-03	0.16
Mercury	3.04e-05	0.36	5.11e-05	1.49e-04	3.9e-04	5.1e-03	0.36
Fluorides	8.54e-04	10.2	NA	NA	3.6e-03	4.8e-02	10.2
H2SO4 mist	0.016	191.1	0.11	0.32	1.7	22.3	213.7

Notes:
NA = Not Available
(a) Source: Final Order and Certification PA-88-24 (2/11/91) and Amended Petition for Modification of Certification (July 22, 1992 Before the State of Florida, Division of Administrative Hearings, In Re: AES Cedar Bay Cogeneration Project, Power Plant Site Certification Application PA-88-24) plus proposed improvements by CBCP.
(b) 12 month running average
(c) 30 day running average
(d) Based on total heat input rate of 3189 MMBtu/hr at 85.5% annualized capacity factor
(e) Lb/hr values represent emission limits for each of two limestone dryers
Annual emissions are for both dryers and are based on maximum operation of 8 hours/day each, 365 days/yr
(f) Firing distillate oil - lb/hr values for each of three boilers - emissions data from KBN Engineering (10/22/92)

TABLE 1-10

Case 3: Maximum Non-regulated Pollutant Emissions for Cedar Bay as Proposed to be Modified (a) and SK Package Boilers Firing Distillate Oil at 260,000 lb/hr Steam

Pollutant	CFB		Limestone Dryers (c)		SK Package Boilers (d)		Total (tons/yr)
	(lb/MMBtu)	(tons/yr)(b)	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)	
Antimony	1.32e-05	0.2	NA	NA	NA	NA	0.2
Arsenic	1.56e-04	1.9	7.16e-05	2.09e-04	5.0e-04	6.3e-03	1.9
Barium	9.36e-04	11.2	4.60e-05	1.34e-04	3.0e-04	4.0e-03	11.2
Cadmium	5.54e-05	0.7	1.79e-04	5.22e-04	1.2e-03	1.6e-02	0.7
HCl	1.81e-03	21.6	NA	NA	7.3e-02	0.95	22.6
Indium	2.11e-07	2.52e-03	NA	NA	NA	NA	2.52e-03
Chromium VI	5.65e-05	0.7	2.09e-04	6.10e-04	5.4e-03	0.07	0.8
Copper	1.21e-04	1.4	4.77e-03	1.39e-02	3.2e-02	0.42	1.9
Formaldehyde	1.30e-04	1.6	6.90e-03	2.02e-02	NA	NA	1.6
Manganese	2.80e-04	3.3	2.39e-04	6.97e-04	1.1e-03	1.5e-02	3.4
Molybdenum	1.56e-04	1.9	8.32e-04	2.43e-03	5.6e-03	0.07	1.9
Nickel	1.24e-04	1.5	2.90e-03	8.46e-03	1.9e-02	2.5e-01	1.8
Phosphorous	5.09e-04	6.1	1.81e-03	5.27e-03	1.2e-02	0.16	6.3
POM	1.86e-05	0.22	3.83e-04	1.12e-03	NA	NA	0.22
Selenium	2.18e-05	0.26	1.93e-04	5.62e-04	1.3e-03	1.7e-02	0.28
Tin	6.13e-05	0.73	5.62e-03	1.64e-02	3.8e-02	0.49	1.24
Vanadium	3.86e-04	4.6	2.17e-02	6.39e-02	NA	NA	4.7
Radionuclides (e)	8.66e-10	0.020	NA	NA	NA	NA	0.020

Notes:
NA - Not applicable
(a) Source: emission factors developed by Bechtel Power (10/23/92)
(b) Based on total heat input rate of 3189 MMBtu/hr at 85.5% annualized capacity factor
(c) Lb/hr values represent emission limits for each of two limestone dryers
Annual emissions are for both dryers and are based on maximum operation of 8 hours/day each, 365 days/yr
(d) Firing distillate oil - lb/hr values for each of three boilers - emissions data from KBN Engineering (10/22/92)
(e) Emission units expressed as curies

TABLE 1-11

Case 4: Maximum Regulated Pollutant Emissions for Cedar Bay as Proposed to be Modified (a) and SK Package Boilers Firing Natural Gas at 375,000 lb/hr Steam

	CFB		Limestone Dryers (e)		SK Package Boilers (f)		
Pollutant	**(lb/MMBtu)**	**(tons/yr)(d)**	**(lb/hr)**	**(tons/yr)**	**(lb/hr)**	**(tons/yr)**	**Total (tons/yr)**
SO2	0.20 (b)	2,598.0	5.0	14.6	0.1	1.31	2,613.9
NOx	0.17 (c)	2,208.3	2.4	7.0	34.9	459.1	2,674.4
CO	0.175 (c)	2,273.3	0.6	1.8	62.4 (g)	819.9	3,095.0
TSP	0.018	233.8	0.25	0.73	0.9	11.8	246.4
PM-10	0.018	233.8	0.25	0.73	0.9	11.8	246.4
VOC	0.015	194.9	0.05	0.15	0.24	3.2	198.2
Lead	6.38e-05	0.83	1.45e-03	4.23e-03	NA	NA	0.83
Beryllium	1.25e-05	0.16	4.26e-05	1.24e-04	NA	NA	0.16
Mercury	3.04e-05	0.39	5.11e-05	1.49e-04	2.4e-06	3.2e-05	0.39
Fluorides	8.54e-04	11.1	NA	NA	NA	NA	11.1
H2SO4 mist	0.016	207.8	0.11	0.32	NA	NA	208.1

Notes:
NA = Not Applicable
(a) Source: Final Order and Certification PA-88-24 (2/11/91) and Amended Petition for Modificaiton of Certification (July 22, 1992 Before the State of Florida, Division of Administrative Hearings, In Re: AES Cedar Bay Cogeneration Project, Power Plant Site Certification Application PA-88-24) plus proposed improvements by CBCP.
(b) 12 month running average
(c) 30 day running average
(d) Based on total heat input rate of 3189 MMBtu/hr at 93% annualized capacity factor
(e) Lb/hr values represent emission limits for each of two limestone dryers
Annual emissions are for both dryers and are based on maximum operation of 8 hours/day each, 365 days/yr
(f) Firing natural gas - lb/hr values for each of three boilers - emissions data from KBN Engineering (10/22/92)
(g) Correction due to rounding error, Letter from C. Barton, Stone Container Corporation to M. Carney, U.S. Generating Co. 11/12/92

TABLE 1-12

Case 4: Maximum Non-Regulated Pollutant Emissions for Cedar Bay as Proposed to be Modified (a) and SK Package Boilers Firing Natural Gas at 375,000 lb/hr Steam

Pollutant	CFB		Limestone Dryers (c)		SK Package Boilers (d)		Total (tons/yr)
	(lb/MMBtu)	(tons/yr)(b)	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)	
Antimony	1.32e-05	0.2	NA	NA	NA	NA	0.2
Arsenic	1.56e-04	2.0	7.16e-05	2.09e-04	NA	NA	2.0
Barium	9.36e-04	12.2	4.60e-05	1.34e-04	NA	NA	12.2
Cadmium	5.54e-05	0.7	1.79e-04	5.22e-04	NA	NA	0.72
HCl	1.81e-03	23.5	NA	NA	NA	NA	23.5
Indium	2.11e-07	2.74e-03	NA	NA	NA	NA	2.74e-03
Chromium VI	5.65e-05	0.7	2.09e-04	6.10e-04	NA	NA	0.7
Copper	1.21e-04	1.6	4.77e-03	1.39e-02	NA	NA	1.6
Formaldehyde	1.30e-04	1.7	6.90e-03	2.02e-02	NA	NA	1.7
Manganese	2.80e-04	3.6	2.39e-04	6.97e-04	NA	NA	3.6
Molybdenum	1.56e-04	2.0	8.32e-04	2.43e-03	NA	NA	2.0
Nickel	1.24e-04	1.6	2.90e-03	8.46e-03	NA	NA	1.6
Phosphorous	5.09e-04	6.6	1.81e-03	5.27e-03	NA	NA	6.6
POM	1.86e-05	0.24	3.83e-04	1.12e-03	NA	NA	0.24
Selenium	2.18e-05	0.28	1.93e-04	5.62e-04	NA	NA	0.28
Tin	6.13e-05	0.80	5.62e-03	1.64e-02	NA	NA	0.81
Vanadium	3.86e-04	5.0	2.17e-02	6.39e-02	NA	NA	5.1
Radionuclides (e)	8.66e-10	0.022	NA	NA	NA	NA	0.022

Notes:
NA - Not applicable
(a) Source: emission factors developed by Bechtel Power (10/23/92)
(b) Based on total heat input rate of 3189 MMBtu/hr at 93% annualized capacity factor
(c) Lb/hr values represent emission limits for each of two limestone dryers
Annual emissions are for both dryers and are based on maximum operation of 8 hours/day each, 365 days/yr
(d) Firing natural gas - lb/hr values for each of three boilers - emissions data from KBN Engineering (10/22/92)
(e) Emission units expressed as curies

TABLE 1-13

Case 4: Maximum Regulated Pollutant Emissions for Cedar Bay as Proposed to be Modified (a) and SK Package Boilers Firing Distillate Oil at 375,000 lb/hr Steam

Pollutant	CFB		Limestone Dryers (e)		SK Package Boilers (f)		Total (tons/yr)
	(lb/MMBtu)	(tons/yr)(d)	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)	
SO2 (b)	0.20	2,598.0	5.0	14.6	49.4	648.5	3,261.1
NOx (c)	0.17	2,208.3	2.4	7.0	32.9	432.3	2,647.6
CO (c)	0.175	2,273.3	0.6	1.8	61.0	801.5	3,076.6
TSP	0.018	233.8	0.25	0.73	8.23 (g)	108.1	342.6
PM-10	0.018	233.8	0.25	0.73	4.11 (g)	54.0	288.5
VOC	0.015	194.9	0.05	0.15	0.24	3.2	198.2
Lead	6.38e-05	0.83	1.45e-03	4.23e-03	1.5e-03	1.9e-02	0.85
Beryllium	1.25e-05	0.16	4.26e-05	1.24e-04	4.1e-04	5.4e-03	0.17
Mercury	3.04e-05	0.39	5.11e-05	1.49e-04	5.6e-04	7.3e-03	0.39
Fluorides	8.54e-04	11.1	NA	NA	5.3e-03	6.9e-02	11.2
H2SO4 mist	0.016	207.8	0.11	0.32	2.5	32.4	240.5

Notes:
NA = Not Available
(a) Source: Final Order and Certification PA-88-24 (2/11/91) and Amended Petition for Modification of Certification (July 22, 1992 Before the State of Florida, Division of Administrative Hearings, In Re: AES Cedar Bay Cogeneration Project, Power Plant Site Certification Application PA-88-24) plus proposed improvements by CBCP.
(b) 12 month running average
(c) 30 day running average
(d) Based on total heat input rate of 3189 MMBtu/hr at 93% annualized capacity factor
(e) Lb/hr values represent emission limits for each of two limestone dryers
Annual emissions are for both dryers and are based on maximum operation of 8 hours/day each, 365 days/yr
(f) Firing distillate oil - lb/hr values for each of three boilers - emissions data from KBN Engineering (10/22/92)
(g) Based on revised emission factor provided in Letter from C. Barton, Stone Container Corporation, to M. Carney, U.S. Generating Co. 11/12/92

TABLE 1-14

Case 4: Maximum Non-Regulated Pollutant Emissions for Cedar Bay as Proposed to be Modified (a) and SK Package Boilers Firing Distillate Oil at 375,000 lb/hr Steam

Pollutant	CFB		Limestone Dryers (c)		SK Package Boilers (d)		Total (tons/yr)
	(lb/MMBtu)	(tons/yr)(b)	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)	
Antimony	1.32e-05	0.2	NA	NA	NA	NA	0.2
Arsenic	1.56e-04	2.0	7.16e-05	2.09e-04	7.0e-04	9.1e-03	2.0
Barium	9.36e-04	12.2	4.60e-05	1.34e-04	4.0e-04	6.0e-03	12.2
Cadmium	5.54e-05	0.7	1.79e-04	5.22e-04	1.7e-03	2.3e-02	0.74
HCl	1.81e-03	23.5	NA	NA	1.0e-01	1.4	24.9
Indium	2.11e-07	2.74e-03	NA	NA	NA	NA	2.74e-03
Chromium VI	5.65e-05	0.7	2.09e-04	6.10e-04	7.8e-03	0.10	0.8
Copper	1.21e-04	1.6	4.77e-03	1.39e-02	4.6e-02	0.61	2.2
Formaldehyde	1.30e-04	1.7	6.90e-03	2.02e-02	NA	NA	1.7
Manganese	2.80e-04	3.6	2.39e-04	6.97e-04	1.6e-03	2.1e-02	3.7
Molybdenum	1.56e-04	2.0	8.32e-04	2.43e-03	8.0e-03	0.11	2.1
Nickel	1.24e-04	1.6	2.90e-03	8.46e-03	2.8e-02	0.37	1.97
Phosphorous	5.09e-04	6.6	1.81e-03	5.27e-03	1.7e-02	0.23	6.8
POM	1.86e-05	0.24	3.83e-04	1.12e-03	NA	NA	0.24
Selenium	2.18e-05	0.28	1.93e-04	5.62e-04	1.9e-03	2.4e-02	0.31
Tin	6.13e-05	0.80	5.62e-03	1.64e-02	5.4e-02	0.71	1.53
Vanadium	3.86e-04	5.0	2.17e-02	6.39e-02	NA	NA	5.1
Radionuclides (e)	8.66e-10	0.022	NA	NA	NA	NA	0.022

Notes:
NA - Not Available
(a) Source: emission factors developed by Bechtel Power (10/23/92)
(b) Based on total heat input rate of 3189 MMBtu/hr at 93% annualized capacity factor
(c) Lb/hr values represent emission limits for each of two limestone dryers
Annual emissions are for both dryers and are based on maximum operation of 8 hours/day each, 365 days/yr
(d) Firing distillate oil - lb/hr values for each of three boilers - emissions data from KBN Engineering (10/22/92)
(e) Emission units expressed as curies

TABLE 1-15

TSP/PM-10 Emissions from Aggregate Materials Handling and Storage and Cooling Tower Operations[a]

Facility	Operation	Annual Particulate Emissions (ton/yr)	
		TSP	PM-10
SKC	Bark Handling and Storage	5.73	2.59
Cedar Bay as Certified[b]	Coal, Ash, Limestone Handling and Storage	7.69	7.69
	Cooling Tower Drift	49.4	49.4
Cedar Bay as Proposed to be Modified	Coal, Ash, Limestone Handling and Storage	9.89	9.21
	Cooling Tower Drift	24.7	24.7

[a] See Appendix A

[b] Source: SCA, Amendment 3

TABLE 1-16

Emissions Comparison (tons/yr) Assessment A
Case 4: Cedar Bay as Proposed to be Modified with SKC Package Boilers at 375 k lb/hr Steam Firing Distillate Oil vs. Case 2: Cedar Bay as Certified

Pollutant	Case 2	Case 4	Change
SO2	4,070.7	3,261.1	-809.6
NOx	3,788.1	2,647.6	-1140.5
CO	2,473.4	3,076.6	603.2
TSP	319.1	377.2	58.1
PM-10	319.1	322.4	3.3
VOC	195.3	198.2	2.9
Lead	90.9	0.85	-90.1
Beryllium	1.4	0.17	-1.2
Mercury	3.4	0.39	-3.0
Fluorides	1,117.1	11.2	-1106.0
H2SO4 mist	308.9	240.5	-68.4
Antimony	1.71e-01	1.71e-01	0
Arsenic	3.82e+01	2.0	-36.2
Barium	1.22e+01	1.22e+01	0
Cadmium	7.01e-01	7.43e-01	4.20e-02
HCl	2.35e+01	2.49e+01	1.38
Indium	2.74e-03	2.74e-03	0
Chromium VI	2.16	0.8	-1.36
Copper	1.61	2.19	0.58
Formaldehyde	1.75	1.77	0.02
Manganese	3.64	3.66	0.02
Molybdenum	2.03	2.13	0.10
Nickel	1.64	1.97	0.33
Phosphorous	6.63	6.85	0.22
POM	2.45e-01	2.43e-01	-2.24e-03
Selenium	2.85e-01	3.09e-01	2.38e-02
Tin	8.46e-01	1.53	6.81e-01
Vanadium	5.29	5.10	-1.82e-01
Radionuclides (curies)	0.022	0.022	0
Subtotal Non-Regulated Trace Pollutants	100.9	66.6	-34.3
Total Aggregate Emissions	12,788.3	10,202.8	-2,585.5

TABLE 1-17

Emissions Comparison (Tons/yr), Assessment A
Case 4: Cedar Bay as Proposed to be Modified with SKC Package Boilers at 375 k lb/hr Steam Firing Natural Gas vs.
Case 2: Cedar Bay as Certified

Pollutant	Case 2	Case 4	Change
SO2	4,070.7	2,613.9	-1456.8
NOx	3,788.1	2,674.4	-1113.7
CO	2,473.4	3,095.0	621.6
TSP	319.1	281.0	-38.1
PM-10	319.1	280.3	-38.8
VOC	195.3	198.2	2.9
Lead	90.9	0.83	-90.1
Beryllium	1.4	0.16	-1.3
Mercury	3.4	0.39	-3.0
Fluorides	1,117.1	11.1	-1106.1
H2SO4 mist	308.9	208.1	-100.8
Antimony	1.71e-01	1.71e-01	0
Arsenic	3.82e+01	2.0	-36.2
Barium	1.22e+01	1.22e+01	0
Cadmium	7.01e-01	7.20e-01	1.9e-02
HCl	2.35e+01	2.35e+01	0
Indium	2.74e-03	2.74e-03	0
Chromium VI	2.16	0.7	-1.46
Copper	1.61	1.59	-0.02
Formaldehyde	1.75	1.71	-0.04
Manganese	3.64	3.64	0
Molybdenum	2.03	2.02	-0.01
Nickel	1.64	1.62	-0.02
Phosphorous	6.63	6.62	-0.01
POM	2.45e-01	2.43e-01	-2.0e-03
Selenium	2.85e-01	2.84e-01	-1.0e-03
Tin	8.46e-01	8.13e-01	-3.3e-02
Vanadium	5.29	5.10	-1.9e-01
Radionuclides (curies)	0.022	0.022	0
Subtotal Non-Regulated Trace Pollutants	100.9	62.9	-38.0
Total Aggregate Emissions	12,788.3	9,426.3	-3,362.0

The results of Assessment B, Case 3 vs. Case 1, are presented in Tables 1-18 and 1-19. These tables show that, for Assessment B, while annual emissions of some pollutants in Case 3 are greater than for Case 1, others decrease to the extent that, on balance, the aggregate annual emissions of Case 3 are lower.

The results of Assessment C, Case 4 vs. Case 1a, are presented in Tables 1-20 and 1-21. These tables show that, for Assessment C, while annual emissions of some pollutants in Case 4 are greater than for Case 1a, others decrease. The aggregate annual emissions are higher for Case 4 with the SK package boilers on oil and lower with the SK package boilers on gas. This comparison does not, however, account for additional substantial decreases in baseline emissions resulting from the shutdown of recovery boilers, lime kilns and smelt dissolving tanks at SKC as a result of the conversion to a recycling operation. Table 1-22 lists these changes. These are preliminary estimates provided by KBN Engineering and Applied Sciences in documentation being prepared in support of the PSD permit application for the SKC package boilers. It is shown in Table 1-22 that decreases in baseline emissions resulting from the additional SKC shutdowns more than offset the increases shown in Table 1-20. Such a comparison is a more realistic assessment of the emissions at the SKC/Cedar Bay site before conception of Cedar Bay and after the operation of Cedar Bay. In addition, as will be shown in Section 2 of the report, even though emissions of some pollutants increase for Case 4 vs. Case 1a, there will be a net benefit to air quality from Case 4 even ignoring the additional reductions in Table 1-22.

TABLE 1-18

Pollutants Emissions Comparison (Tons/yr), Assessment B Case 3: Cedar Bay as Proposed to be Modified Supplying 380 k lb/hr Steam to SKC with SKC Package Boilers at 260 k lb/hr Steam vs. Case 1: the Future Operation of the 3 Power Boilers and 2 Bark Boilers at 640 k lb/hr Steam for the SKC Recycling Operation

Pollutant	Case 1 SK Power & Bark Boilers	Case 3 Cedar Bay & SK Package Boilers			Net Change	
		Cedar Bay	SK Boilers Firing Oil	SK Boilers Firing Gas	SK Boilers Firing Oil	SK Boilers Firing Gas
SO2	3,562.3	2403.1	449.0	1.31	-710.2	-1157.9
NOx	1,690.8	2037.2	299.6	319.3	646.0	665.7
CO	2,191.2	2091.8	550.6	570.0	451.2	470.6
TSP	577.3	250.2	75.0	7.88	-252.1	-319.2
PM-10	462.5	249.5	37.4	7.88	-175.6	-205.1
VOC	300.1	179.4	2.10	2.23	-118.6	-118.5
Lead	0.22	0.76	0.013	NA	0.55	0.54
Mercury	0.013	0.36	0.005	2.2e-05	0.35	0.35
Beryllium	0.013	0.15	0.004	NA	0.14	0.14
Fluorides	0.41	10.2	0.048	NA	9.8	9.8
H2SO4 mist	82.9	191.3	22.3	NA	130.7	108.4
Subtotal Non-Regulated Trace Pollutants[a]	62.5	58.0	2.5	NA	-2.0	-4.5
Total Aggregate Emissions	8930.6	7472.0	1,438.6	908.6	-20.0	-550.0

[a] See Table 1-19

TABLE 1-19

Non-Regulated Pollutant Emissions Comparison (Tons/yr), Assessment B Case 3: Cedar Bay as Proposed to be Modified Supplying 380 k lb/hr Steam to SKC with SKC Package Boilers at 260 k lb/hr Steam vs. Case 1: the Future Operation of the 3 Power Boilers and 2 Bark Boilers at 640 k lb/hr Steam for the SKC Recycling Operation

Pollutant	Case 1 SK Power & Bark Boilers	Case 3 Cedar Bay & SK Package Boilers			Net Change	
		Cedar Bay	SK Boilers Firing Oil	SK Boilers Firing Gas	SK Boilers Firing Oil	SK Boilers Firing Gas
Antimony	0.050	0.2	NA	NA	0.15	0.15
Arsenic	0.057	1.9	0.007	NA	1.8	1.8
Barium	0.21	11.2	0.004	NA	11.0	11.0
Cadmium	0.052	0.66	0.016	NA	0.63	0.61
HCl	38.5	21.6	0.954	NA	-15.9	-16.9
Indium	1.39	0.003	NA	NA	-1.39	-1.39
Chromium VI	0.080	0.67	0.071	NA	0.66	0.59
Copper	0.85	1.46	0.419	NA	1.03	0.61
Formaldehyde	2.02	1.57	NA	NA	-0.45	-0.45
Manganese	0.16	3.34	0.015	NA	3.20	3.18
Molybdenum	2.74	1.87	0.074	NA	-0.80	-0.87
Nickel	3.80	1.49	0.255	NA	-2.06	-2.31
Phosphorous	1.17	6.08	0.159	NA	5.07	4.91
POM	0.44	0.22	NA	NA	-0.22	-0.22
Selenium	0.008	0.26	0.017	NA	0.27	0.25
Tin	1.72	0.76	0.494	NA	-0.47	-0.96
Vanadium	9.27	4.66	NA	NA	-4.61	-4.61
Radionuclides	NA	0.020	NA	NA	0.020	0.020

TABLE 1-20

Pollutants Emissions Comparison (Tons/yr)
Case 4: Cedar Bay as Proposed to be Modified Supplying 380k lb/hr Steam to SKC with SKC Package Boilers at 375k lb/hr Steam vs. Case 1a: The Future Operation of the 3 Power Boilers and 2 Bark Boilers at 745k lb/hr Steam for the SKC Recycling Operation

Pollutant	Case 1a SK Power & Bark Boilers	Case 4 Cedar Bay and SK Package Boilers			Net Change	
		Cedar Bay	SK Boilers Firing Oil	SK Boilers Firing Gas	SK Boilers Firing Oil	SK Boilers Firing Gas
SO_2	3779.6	2612.6	648.5	1.31	-518.5	-1165.7
NO_x	1955.7	2215.3	432.3	459.1	691.9	718.7
CO	2212.2	2275.1	801.5	819.9	864.4	867.5
TSP	640.4	269.1	108.1	11.8	-340.0	-359.5
PM-10	507.3	268.4	54.0	11.8	-223.2	-227.1
VOC	303.3	195.1	3.2	3.2	-105.0	-105.0
Lead	0.24	0.83	1.9E-02	NA	0.61	0.59
Mercury	0.015	0.39	7.3E-03	3.2E-05	0.38	0.38
Beryllium	0.013	0.16	5.4E-03	NA	0.15	0.147
Fluorides	0.45	11.1	6.9E-02	NA	10.7	10.7
H_2SO_4 Mist	91.5	208.1	32.4	NA	149.0	116.6
Subtotal Non-Regulated Trace Pollutants[a]	63.3	62.9	3.6	NA	3.2	-0.4
Total Aggregate Emissions	9554.0	8119.1	2083.7	1307.1	533.6	-127.8

[a] See Table 1-21

TABLE 1-21

Non-Regulated Pollutants Emissions Comparison (Tons/yr)
Case 4: Cedar Bay as Proposed to be Modified Supplying 380k lb/hr Steam to SKC with SKC Package Boiler at 375k lb/hr Steam vs. Case 1a: The Future Operation of the 3 Power Boilers and 2 Bark Boilers at 745k lb/hr Steam for the SKC Recycling Operation

Pollutant	Case 1a: SK Power & Bark Boilers	Case 4 Cedar Bay and SK Package Boilers			Net Charge	
		Cedar Bay	SK Boilers Firing Oil	SK Boilers Firing Gas	SK Boilers Firing Oil	SK Boilers Firing Gas
Antimony	0.055	0.2	NA	NA	0.145	0.145
Arsenic	0.058	2.0	9.1-03	NA	1.95	1.94
Barium	0.22	12.2	6.0-03	NA	12.0	12.0
Cadmium	0.056	0.7	2.3-02	NA	0.67	0.64
HCl	38.5	23.5	1.4	NA	-13.6	-15.0
Indium	1.40	0.003	NA	NA	-1.4	-1.4
Chromium VI	0.093	0.7	0.10	NA	0.71	0.61
Copper	0.88	1.61	0.61	NA	1.34	0.73
Formaldehyde	2.27	1.72	NA	NA	-0.55	-0.55
Manganese	0.18	3.6	2.1-02	NA	3.44	3.42
Molybdenum	2.75	2.0	0.11	NA	-0.64	-0.75
Nickel	3.84	1.6	0.37	NA	-1.87	-2.24
Phosphorous	1.33	6.6	0.23	NA	5.5	5.27
POM	0.45	0.24	NA	NA	-0.21	-0.21
Selenium	0.009	0.28	2.4-02	NA	0.30	0.271
Tin	1.72	0.82	0.71	NA	-0.19	-0.9
Vanadium	9.51	5.1	NA	NA	-4.41	-4.41
Radionuclides	NA	0.022	NA	NA	0.022	0.022

TABLE 1-22

Estimated Baseline Emissions Decreases Due To Additional Sources[a] Shutting Down at SKC from Conversion to Recycling Operation

Pollutant	Emissions Change (tons/yr)
SO_2	-31.2
NO_x	-500.6
CO	-2,816.4
TSP	-521.8
PM-10	-413.7
VOC	-384.7
Lead	0
Mercury	-0.0045
Beryllium	0
Fluoride	0
H_2SO_4	-43.9
Total Aggregate	-4,712.3

(a)Recovery Boilers, Lime Kilns, Smelt Dissolving Tanks

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2.0 COMPARISON NO. 2: NET AIR QUALITY IMPACTS

2.1 Introduction

The objective of the information to be presented for Comparison No. 2 is to provide data useful for assessing

1) whether, on balance, the air quality impacts of the CBCP, as proposed to be modified, and the addition of the three new yet-to-be-proposed package boilers scheduled for the SKC site necessary to provide 640,000 lb. of steam per hour for SKC's use, will be less than the air quality impacts of the SKC recycling operation without the CBCP,

2) whether, on balance, the air quality impacts of the CBCP, as proposed to be modified, and the addition of the three new yet-to-be-proposed package boilers scheduled for the SKC site at their permitted capacity, will be less than the air quality impacts of the CBCP as certified, and.

3) Whether, on balance, the air quality impacts of the CBCP, as proposed to be modified, and the addition of the three new yet-to-be-proposed package boilers scheduled for the SKC site at their permitted capacity, will be less than the air quality impacts of the SKC recycling operation at permitted capacity without the power plant.

In applying Comparison No. 2, the differences in air quality impacts based on atmospheric dispersion modeling are compared amongst 5 cases. These are:

Case 1: the future operation of the 3 power boilers and 2 bark boilers for the SKC recycling operation at a total annualized steam production rate of 640,000 lb/hr, (which corresponds to an annual capacity factor of 85.9 percent),

Case 1a: the operation of the 3 power boilers and 2 bark boilers for the SKC recycling operation at a total annualized steam production rate of 745,000 lb/hr (their permitted capacity)

Case 2: the operation of the CBCP as certified, (at a 93 percent annual capacity factor),

Case 3: the operation of the CBCP, as proposed to be modified, generating electricity and supplying a total annualized steam production rate of 380,000 lb/hr to SK, at the permitted annual capacity factor of 93 percent (for conservatism) plus the addition of the 3 new package boilers at the SKC recycling operation under two fuel scenarios, fuel oil or natural gas, at a total annualized steam production rate of 260,000 lb/hr, (which corresponds to an annual capacity factor of 69.3 percent), and

Case 4: the operation of the CBCP, as modified, (permitted at an annual capacity factor of 93 percent) generating 250 MW of electricity and supplying a total annualized steam production rate of 380,000 lb/hr to SKC, plus the addition of the 3 new package boilers at the SKC recycling operation under two fuel scenarios, fuel oil or natural gas, at a total annualized steam production rate of 375,000 lb/hr (100 percent capacity).

Three assessments are presented:

Assessment A: Case No. 4
vs.
Case No. 2

Assessment B: Case No. 3
vs.
Case No. 1

(This is the comparison required directly by the June 16, 1992 Order of the Siting Board.)

Assessment C: Case No. 4
vs.
Case No. 1a

2.2 Methodology

The methodology to be employed in this demonstration is the application of air quality dispersion modeling in accordance with EPA and FDER requirements for federal new source review. Air quality impacts are modeled for five individual criteria air pollutants (SO_2, PM-10, NO_2, CO and Pb), and total air toxics taken from the list included in the Draft Florida Air Toxics Permitting Strategy.

The model selected for this application is the EPA's Industrial Source Complex Short Term (ISCST2) model (Version 92062). This is the recommended model according to EPA's "Guidelines on Air Quality Models (EPA 1986, 1987)", for application to SKC and CBCP. It is applicable to elevated point sources, volume, area and line sources of non-photochemical pollutants located in areas of flat or gently rolling terrain, either urban or rural in dispersion environment. It is also capable of simulating the effects of aerodynamic building downwash on the dispersion of source plumes, where applicable. The model requires as input hourly observed meteorological conditions of surface wind speed, wind direction, temperature, atmospheric stability and boundary layer mixing depth. In accordance with EPA guidelines, this data is obtained from the nearest representative national weather service stations, preferably for a five-year historical period so as to represent a comprehensive profile of future expected conditions from year to year. For this application the meteorological data is taken from surface observations at Jacksonville International Airport and upper air observations at Ware County Airport in Waycross, Georgia, the nearest representative upper air station. Data for the years 1983 through 1987 are employed. These years are preferred by the FDER for use in tracking the PSD increments consumed or expanded by major source changes.

The ISCST model requires the specification of several application options, most of which have EPA recommended default values, but some of which must be specified by the user. Table 2-1 lists the options selected for this application. The building downwash option is used where appropriate to simulate the aerodynamic effects of nearby structures on the dispersion of emissions from stacks that could be subject to downwash. These include all combustion source stacks at Cedar Bay and SKC except for the CFB boilers' stack, which is designed in accordance with EPA Good Engineering Practice (GEP) guidelines to avoid downwash effects. The rural dispersion option is chosen based on the land-use within a 3 km radius of the facilities according to a classification scheme recommended in the EPA Guideline. This is consistent with modeling performed for the SCA. All terrain in the model application is considered to be flat, that is having the same ground-level elevation as the Cedar Bay CFB stack. This is also consistent with the SCA. All of the source input data used in the modeling is described in detail in Section 2.4.

2.3 Analysis Results to be Presented

For Comparison No. 2, the net air quality effects of Case No. 4 versus Case No. 2 (Assessment A), Case No. 3 versus Case No. 1 (Assessment B) and Case No. 4 versus Case No. 1a (Assessment C) are determined. First, the maximum predicted pollutant concentration over all receptors, for each criteria pollutant and total air toxics for applicable averaging periods, are compared between the cases.

Second, the maximum predicted concentration for each criteria pollutant and total air toxics for applicable averaging periods are identified at each receptor. For Assessment A, these maximum receptor-specific impacts of Case No. 2 are subtracted from the maximum receptor specific impacts of Case No. 4. For any receptor, a positive difference indicates a pollutant increase, a negative difference indicates a pollutant decrease. The sum of the increases are subtracted from the sum of the absolute values of the decreases. This value is then divided by the total number

TABLE 2-1

ISCST2 Modeling Options

Option Description	Value
Dispersion Parameters	Rural
*Wind Profile Exponents	0.07, 0.07, 0.10, 0.15, 0.35, 0.55
*Vertical Potential Temperature Gradient	0.02, 0.035
*Stack-Tip Downwash	Used
*Buoyancy Induced Dispersion	Used
Anemometer Height (actual)	6.1 m
*Decay Coefficient	0.0
Building Downwash	Used as applicable for CBCP and SKC sources
*Gradual Plume Rise	Not used (except for building wake effect modeling)
* Default values recommended by EPA.	

of receptor points (1,008) in the receptor grid. If this value is a positive number, then a net air quality improvement is demonstrated. This approach is consistent with the definition of net air quality improvement in Rule 17-2.510(7)(a)1, Florida Administrative Code.

For Assessment B, the same analysis is performed with the impacts of Case No. 1 subtracted from the impacts of Case No. 3. For Assessment C, the same analysis is performed with the impacts of Case No. 1a subtracted from the impacts of Case No. 4.

For the criteria pollutants, maximum ground-level concentrations, predicted by atmospheric dispersion modeling for averaging periods consistent with the Florida ambient air quality standards for each pollutant, are compared for Assessment A, B and C. For total air toxics, maximum ground-level concentrations, predicted for averaging periods consistent with the Florida Draft Permitting Strategy are compared. Table 2-2 lists the pollutants and the applicable concentration averaging periods.

Ground-level concentrations are predicted at more than 1,000 locations input as model receptors. A circular (polar) grid of receptors is represented by the intersection of 36 radials at 10° intervals and 28 concentric circles (rings) centered on the CBCP CFB stack location. The ring distances along the radials are specified at the following intervals:

Range (km)	Interval (km)
0.1 to 1.0	0.1
1.0 to 2.0	0.25
2.0 to 5.0	0.5
5.0 to 10.0	1.0
10.0 to 25.0	5.0

The radius of 25 kilometers extends well beyond the distances where maximum impacts are expected and beyond the distances where significant concentration gradient would be predicted. This receptor grid is entirely consistent with the modeling performed for the SCA, and includes receptors located within the property boundaries of the two facilities.

2.4 SKC and Cedar Bay Pollutant Source Input Data Employed in the Modeling

The ISCST2 model requires specification of hourly average pollutant emission rates and exhaust parameters, and pertinent building dimensions, where applied, for each individual source (e.g., stack) being modeled. To address the subject issue these parameters are developed for the following source configurations:

TABLE 2-2

Concentration Averaging Periods Employed In Modeling

Pollutant	Averaging Period 1-Hr	3-Hr	8-Hr	24-Hr	Annual
SO_2		X		X	X
TSP				X	X
PM-10				X	X
NO_2					X
CO	X		X		
Pb(a)				X	X
Total Air Toxics			X	X	X

(a) AAQS is 3-month averaging period, 24-hour and annual periods used for lead to bracket 3-month average.

1. CBCP as currently certified; including the CFB's at a 93 percent annual capacity factor, the limestone dryers, cooling towers and aggregate materials handling and storage operations,
2. CBCP as proposed to be modified including the same sources as above, with the CFBs at a 93 percent annual capacity factor,
3. SK Power Boilers and Bark Boilers in the future recycling mode, at 640,000 lb/steam per hour total, and at the permitted capacity of 745,000 lb/steam per hour total, and bark handling and storage operations,
4. Future SK Package Boilers firing fuel-oil at 260,000 lb/steam per hour total and 375,000 lb/steam per hour total,
5. Future SK Package Boilers firing natural gas at 260,000 lb/steam per hour total and 375,000 lb/hr.

Tables 2-3 through 2-8 list the pertinent exhaust parameters for the combustion source configurations. Physical exhaust parameters for the SK Bark Boilers are taken from the KBN memorandum cited in Section 1. Parameters for the new stack with combined power boiler exhausts were provided by KBN (fax from D. Buff, KBN to J. Yuhas, ENSR, 10/28/92). Physical exhaust parameters for CBCP as certified are taken from the SCA. Physical exhaust parameters for CBCP as proposed to be modified were provided by Bechtel.

As discussed in Section 2.2., the ISCST2 model requires building dimensions for simulating downwash effects. The plot plan provided in Figure 2-1 identifies pertinent stack and building locations for both CBCP and SKC. The building dimensions provided in the figure and the location of the individual stacks relative to these buildings were evaluated to develop dimensions for input to the model for those buildings causing downwash. These buildings were identified as the CFB Boiler Building and the SKC buildings housing the power boilers, bark boilers and recovery boilers. Based on the geometry presented in Figure 2-1, wind direction specific building parameters, including building heights and widths (normalized to the specified wind directions) were developed as input to the ISCST2 model.

Hourly emission rates used in the modeling of the combustion sources are derived from those presented in Section 1. Annual average emission rates assumed an annualized 93 percent capacity factor for the CFB boilers in the "as proposed to be modified" case. For the SK package boilers the hourly SO_2 emission rate used to model 3- and 24-hour concentrations is based on the maximum hourly emission rate of 0.5 lb/MMBtu, while the annual rate is based on a proposed 0.3 lb/MMBtu annual average used in calculating annual emissions. For the limestone dryers in the CBCP as proposed to be modified case, emission rates for averaging periods of 8-hours or less use the maximum hourly emissions and for 24-hours or more use the annual average rate. This is due to the fact that they will only operate 8 hours per day, the maximum hourly emissions

TABLE 2-3

Stack Exhaust Parameters for SKC Power Boilers and Bark Boilers In Future Recycling Mode[(a)] at 640,000 lb/hr Total Steam Generation Fuel Scenario 1 (Worst-Case PM-10)

	PB1	PB2	PB3	BB1	BB2
Steam Flow (lb/hr)	100,000	145,000	145,000	125,000	125,000
Heat Input (MMBtu/hr)	137	198	198	193	193
Fuel Type	Oil	Oil	Oil	Bark	Bark
UTM East (km)	441.871			441.849	441.856
UTM North (km)	3365.587			3365.613	3365.606
Stack height (m)	38.1			41.5	41.5
Stack diamter (m)	3.20			2.46	2.46
Temperature (deg. K)	443			332	332
Velocity (m/s)	13.78			13.08	13.08

(a) Power boilers exhausted through new common stack.
Source: Fax from D. Buff, KBN to J. Yuhas, ENSR, 10/28/92

TABLE 2-4

Stack Parameters for SKC Power Boilers and Bark Boilers In Future Recycling Mode[(a)] at 640,000 lb/hr Total Steam Generation Fuel Scenario 2 (Worst-Case SO_2)

	PB1	PB2	PB3	BB1	BB2
Steam Flow (lb/hr)	135,000	180,000	180,000	72,500	72,500
Heat Input (MMBtu/hr)	185	246	246	112	112
Fuel Type	Oil	Oil	Oil	Bark/Oil	Bark/Oil
UTM East (km)	441.871			441.849	441.856
UTM North (km)	3365.587			3365.613	3365.606
Stack height (m)	38.1			41.5	41.5
Stack diamter (m)	3.20			2.46	2.46
Temperature (deg. K)	443			332	332
Velocity (m/s)	17.48			7.59	7.59

(a) Power Boilers exhausted through new common stack
Source: Fax from D. Buff, KBN to J. Yuhas, ENSR, 10/28/92

TABLE 2-5

Stack Exhaust Parameters for SKC Power Boilers and Bark Boilers in Future Recycling Mode[a] at 745,000 lb/hr Total Steam Generation for Both Fuel Scenario 1 (Worst-Case PM_{10}) and Fuel Scenario 2 (Worst-Case SO_2)

	PB1	PB2	PB3	BB1	BB2
Steam Flow (lb/hr)	135,000	180,000	180,000	125,000	125,000
Heat Input (MMBtu/hr)	185	246	246	193	193
Fuel Type	Oil	Oil	Oil	Bark[b] Bark/Oil[c]	Bark[b] Bark/Oil[c]
UTM East (km)	441.871			441.849	441.856
UTM North (km)	3365.587			3365.613	3365.606
Stack Height (m)	38.1			41.5	41.5
Stack Diamter (m)	3.2			2.46	2.46
Temperature (K)	443			332	332
Velocity (m/s)	17.48			13.08	13.08

[a] Power boilers exhausted through new common stack

[b] Fuel scenario 1 (worst-case PM_{10})

[c] Fuel scenario 2 (worst-case SO_2)

Source: KBN Engineering and Applied Sciences, Inc. Fax from D. Buff, KBN to Al Hallquist, ENSR, 11/6/92

TABLE 2-6

Cedar Bay
Physical Stack Exhaust Parameters

Parameter	Cedar Bay As Certified		Cedar Bay As Modified (a)	
	CFBs	Limestone Dryers	CFBs	Limestone dryers
UTM East (km)	441.61	441.664	441.61	441.664
UTM North (km)	3365.54	3365.68	3365.54	3365.68
Stack Height (m)	129.54	9.14	122.68	19.21
Stack Diameter (m)	4.27	1.04	4.04	1.27
Stack Exit Velocity (m/s)	33.22	21.34	32.45	18.26
Stack Exit Temperature (K)	403.0	355	403.0	355

(a) Source: Correspondence from A. Nawaz, Bechtel to G. Harkness, ENSR, 11/6/92

TABLE 2-7

Design Parameters for New SK Package Boilers - Maximum Steam Capacity (375,000 lb/hr)

Parameter	Units	No. 2 Fuel Oil (per boiler)	Natural Gas (per boiler)
Steam Flow	lb/hr	125,000	125,000
Heat Input	MMBtu/hr	164.5	174.7
Exhaust Gas:			
Temperature	°K	447	439
Common Stack[(a)]			
Diameter	m	2.43	2.43
Velocity	m/sec	16.18	16.23
Height	m	60.96	60.96
UTM East	km	441.919	
UTM North	km	3365.538	

[(a)] All three boilers will exhaust into a common stack. Velocity shown is total all three boilers.
Source: KBN 10/22/92

TABLE 2-8

Design Parameters for New SK Package Boilers - 260,000 lb/hr Total Steam Generation

Parameter	Units	No. 2 Fuel Oil (per boiler)	Natural Gas (per boiler)
Steam Flow	lb/hr	86,663	86,663
Heat Input	MMBtu/hr	113.93	121.46
Exhaust Gas:			
Temperature	°K	435	431
Common Stack[a]			
Diameter	m	2.43	2.43
Velocity	m/sec	10.90	11.10
Height	m	60.96	60.96

[a] All three boilers will exhaust into a common stack. Velocity shown is total all three boilers.
Source: KBN 10/22/92

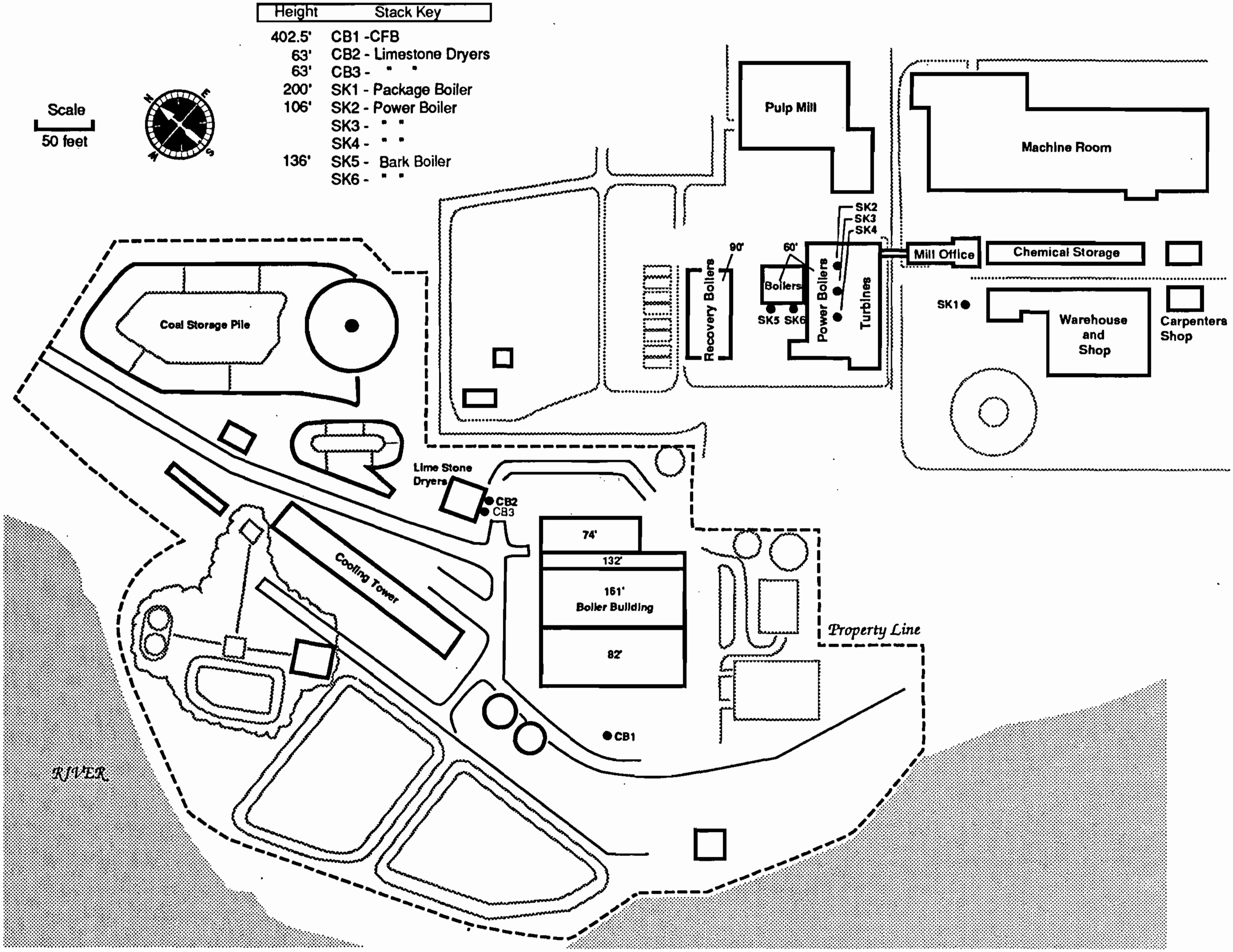

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FIGURE 2-1
STACK AND BUILDING CONFIGURATION

being three times the 24-hour average or annual average rate. For the CFB as certified case, short-term SO_2 emissions are based on the 0.6 lb/MMBtu limit, while the annual emissions are based on the 0.31 lb/MMBtu limit. For the CFB as modified case, short-term SO_2 emissions are based on 0.24 lb/MMBtu and annual emissions are based on 0.20 lb/MMBtu.

The source configurations and exhaust parameters for the CBCP cooling tower cells are listed in Table 2-9. These were assumed to be identical for both the as certified and as proposed to be modified cases. The source parameters for the aggregate material handling operation for CBCP as proposed to be modified are presented in Tables 2-10 and 2-11. Table 2-10 lists the fugitive dust sources which were modeled as area sources. Table 2-11 lists the sources controlled by dust collection which were modeled as point sources. Only those point sources with vertical exhausts were given an exit velocity and diameter. Table 2-12 lists the parameters for the SKC bark handling and storage operations. The PM-10 and TSP emission rates for the sources listed in the above tables are documented in Appendix A. The source parameters and TSP/PM-10 emission rates for the aggregate materials handling and storage operations for the CBCP as certified are listed in Table 2-13. These were obtained from Black and Veatch in the form of an ISCST2 model input file.

2.5 Findings

The findings for Assessment B, Case 3 vs Case 1, are displayed in Tables 2-14 and 2-15 for the SKC package boilers in Case 3 on fuel oil and natural gas, respectively. For each pollutant and averaging period and for each meteorological year modeled, four numbers are provided. The first is the maximum modeled concentration over all receptors for Case 1, the existing SK power and bark boilers producing 640,000 lb/hr of steam for the recycling operation. The next number is the maximum modeled concentration over all receptors for Case 3, the CBCP as proposed to be modified plus the proposed SK package boilers providing a combined 640,000 lb/hr of steam for the recycling operation. The third number demonstrates the "net air quality effect" of Case 3 replacing Case 1; that is, the sum of the increases in maximum modeled pollutant concentrations at each receptor subtracted from the sum of the absolute values of the decreases in maximum modeled pollutant concentrations at each receptor, divided by the total number of receptors. If this value is positive, a net benefit is demonstrated. If this value is negative a net degradation is demonstrated. The fourth number is the total number of receptors at which the modeled maximum concentration for Case 3 is lower than the modeled maximum concentration for Case 1.

Referring to Table 2-14, the maximum predicted concentrations for Case 3, CBCP as proposed to be modified with the SK Package Boilers on oil, are much lower than the corresponding Case 1 CBCP as certified concentrations for each pollutant and averaging period. In addition, the net air quality effect of Case 3 is positive for each pollutant and averaging period, indicating an

TABLE 2-9

Cedar Bay Cooling Tower Modeling Parameters[a]

Cell #	UTM Coordinates (km)		Height (m)	Diameter (m)	Exit Temperature (°K)	Exit Velocity (m/s)
	East	North				
1	441.593	3365.746	14.94	9.75	316.3	8.96
2	441.593	3365.729	14.94	9.75	316.3	8.96
3	441.593	3365.713	14.94	9.75	316.3	8.96
4	441.594	3365.696	14.94	9.75	316.3	8.96
5	441.594	3365.680	14.94	9.75	316.3	8.96
6	441.595	3365.663	14.94	9.75	316.3	8.96
7	441.595	3365.647	14.94	9.75	316.3	8.96

[a] Source: CBCP plot plan and Telephone Conversation between J. Yuhas, ENSR and A. Nawaz, Bechtel on 11-5-92.

TABLE 2-10

Source Parameters for Aggregate Materials Handling and Storage Operations Modeled as Areas Sources at CBCP Bay as Proposed to be Modified[(a)]

#	UTMs Coordinates of SW Corner of Area Source (km) East	UTMs Coordinates of SW Corner of Area Source (km) North	Height (m)	Length of Side of Square Area Source (m)	Sources Included
1	441.563	3365.744	1.52	153.7	Coal Reclaim by loader Limestone delivery dumping from truck Reclaim by mobile loader
2	441.563	3365.744	3.05	153.7	Limestone dozer traps (mobile loader to conveyor) Wind erosion from limestone pile
3	441.563	3365.744	4.57	153.7	Mobile loader to Feeder 2 Feeder 2 to Conveyor
4	441.563	3365.744	6.10	153.7	Railcar to Feeder 1 Feeder 1 to Conveyor 1 Conveyor 1 to Conveyor 2
5	441.563	3365.744	9.14	153.7	Wind erosion from receiving pile Wind erosion from storage pile
6	441.563	3365.744	16.76	153.7	Conveyor 2 to Lowering Well
7	441.632	3365.633	43.28	9.98	Conveyor 4 to Conveyor 5

(a)Source: CBCP plot plan and design information

TABLE 2-11

Source Parameters For Aggregate Materials Handling Operations Modeled as Point Sources at CBCP As Proposed to be Modified(a)

Source	UTM Coordinates (km)		Height (m)	Exit Temperature[b] (°K)	Exit Velocity[b] (m/sec)	Diameter (m)
	East	North				
Coal Crushers	441.613	3365.804	3.66			
Coal Silo Area	441.672	3365.614	43.28			
Lime Pulverizer 1	441.660	3365.679	19.20			
Lime Pulverizer 2	441.668	3365.682	19.20			
Storage Bin Vent	441.667	3365.602	27.43			
Bed Ash Hopper	441.651	3365.625	8.53			
Exhauster	441.581	3365.596	10.67			
Fly Ash Silo	441.581	3365.596	42.06			
Bed Ash Silo	441.581	3365.573	31.70			
Bed Ash Bin	441.541	3365.695	38.10			
Fly Ash Bin	441.541	3365.695	39.01			
Ash Recycle Tank	441.541	3365.695	36.59			
Recycle Hopper	441.541	3365.695	35.05			
Pelletizer #1 & 2	441.541	3365.695	9.14	311	19.3	0.68
Belt Conveyor Discharge	441.541	3365.695	4.57			
Screen	551.521	3365.725	7.62			
Curing Silo Outlet	441.521	3365.725	25.91			
Hydrator	441.499	3365.764	33.53	373	19.3	0.65
Curing Silo	441.499	3365.764	25.91	297	19.3	0.43
Rail Discharge	441.576	3365.758	12.19			

[a] Source: CBCP plot plan and Fax from A. Nawaz, Bechtel to G. Harkness, ENSR 11-11-92.
[b] Only used for vertically discharging dust collectors

TABLE 2-12

Source Parameters for SK Bark Handling and Storage Operations[a]

Source	UTM Coordinates (km)		Height (m)	Length of Side of Square Area Source (m)
	East	North		
Unpaved road	441.840	3365.833	1.52	71
Bark Pile	441.842	3365.795	3.05	36.6
Wood Room	441.872	3365.808	6.10	41.6
Bark Boiler Building	441.836	3365.646	6.10	23.7

[a] Source: CBCP plot plan and SKC: Telephone Conversation between M. Riddle, SKC and M. Jindal ENSR on 11/9/92

TABLE 2-13

Source Parameters and TSP/PM-10 Emission Rates For Aggregate Materials Handling and Storage Operations For the CBCP As Certified[a]

Number	Description	Type	UTM Coordinates (km)		24-Hour Emission Rate (g/s)	Annual Emission Rate (g/s)
			East	North		
2	Limestone Dryers[b]	Point	441.549	3365.643	2.50e-2	5.65e-2
3	Coal Pile and Associated Activities	Area	441.558	3365.850	2.32e-2	0
4	Coal Crusher	Point	441.631	3365.798	5.04e-3	4.32e-3
5	Coal Conveying	Area	441.610	3365.627	3.23e-2	1.62e-2
6	Limestone Pile	Area	441.661	3365.725	8.36e-3	8.36e-3
7	Limestone Fabric Filters	Point	441.671	3365.688	4.79e-2	3.45e-2
8	Limestone Hopper	Point	441.674	3365.591	4.79e-2	3.45e-2
9	Fly Ash Mechanical Collector	Point	441.605	3365.646	1.71e-2	1.50e-2
10	Bed Ash Mechanical Collector	Point	441.603	3365.632	2.14e-3	1.87e-3
11	Coal Pile and Associated Activities[c]	Area	441.558	3365.850	2.32e-2	0

[a] Source: A. Carlson of Black & Veatch transmittal of ISCST2 Input File to J. Yuhas, ENSR on 10/6/92

[b] emission rate is for limestone pulverizer dust only

[c] listed twice to represent different settling velocities

TABLE 2-14

Findings for Comparison No. 2, Assessment B, Net Air Quality Effect of Case 3: CBCP as Proposed to be Modified Supplying 380 k lb/hr Steam to SKC with SKC Package Boilers at 260 k lb/hr Steam Firing Fuel Oil vs. Case 1: The Future Operation of the 3 Power Boilers and 2 Bark Boilers at 640 k lb/hr Steam for the SKC Recycling Operation

Pollutant	Averaging Period	Meteorological Year	Maximum Predicted Impacts ($\mu g/m^3$)		Case 3 Net Air Quality Effect ($\mu g/m^3$)	Case 3 Number of Receptors Improved[a]
			Case 1	Case 3		
SO_2	3 Hr	1983	667.30	421.76	81.09	991
		1984	631.97	259.34	67.95	1002
		1985	483.92	275.87	66.97	999
		1986	442.87	264.61	60.42	984
		1987	502.10	280.84	66.45	991
	24 Hr	1983	274.63	108.36	26.14	995
		1984	189.32	61.31	20.76	1004
		1985	246.96	70.01	19.14	999
		1986	175.19	68.99	20.49	990
		1987	163.15	93.54	20.91	991
	Annual	1983	5.81	3.99	1.41	1004
		1984	4.91	3.14	1.30	1003
		1985	5.81	3.88	1.34	1004
		1986	4.95	2.95	1.23	1004
		1987	9.02	3.47	1.43	1004

TABLE 2-14 (Cont'd)

Findings for Comparison No. 2, Assessment B, Net Air Quality Effect of Case 3: CBCP as Proposed to be Modified Supplying 380 k lb/hr Steam to SKC with SKC Package Boilers at 260 k lb/hr Steam Firing Fuel Oil vs. Case 1: The Future Operation of the 3 Power Boilers and 2 Bark Boilers at 640 k lb/hr Steam for the SKC Recycling Operation

Pollutant	Averaging Period	Meteorological Year	Maximum Predicted Impacts (μg/m^3)		Case 3 Net Air Quality Effect (μg/m^3)	Case 3 Number of Receptors Improved[a]
			Case 1	Case 3		
PM10	24 Hr	1983	135.81	22.68	7.41	1006
		1984	146.14	23.09	7.24	1004
		1985	141.20	22.96	7.00	1007
		1986	151.09	29.61	6.90	1005
		1987	118.66	21.36	7.24	1007
	Annual	1983	22.61	3.60	0.67	994
		1984	23.36	4.23	0.65	981
		1985	24.32	3.98	0.68	1000
		1986	29.02	4.26	0.63	979
		1987	21.79	3.56	0.66	992
CO	1 Hr	1983	986.81	330.24	205.75	1004
		1984	947.32	336.40	207.05	1004
		1985	927.57	331.98	206.68	1004
		1986	913.88	334.01	209.0	1004
		1987	1036.09	331.82	212.23	1004
	8 Hr	1983	412.55	151.28	81.52	1004
		1984	368.58	95.31	83.54	1004
		1985	432.25	135.57	78.97	1004
		1986	367.64	136.10	75.90	1004
		1987	382.87	103.21	78.97	1004

TABLE 2-14 (Cont'd)

Findings for Comparison No. 2, Assessment B, Net Air Quality Effect of Case 3: CBCP as Proposed to be Modified Supplying 380 k lb/hr Steam to SKC with SKC Package Boilers at 260 k lb/hr Steam Firing Fuel Oil vs. Case 1: The Future Operation of the 3 Power Boilers and 2 Bark Boilers at 640 k lb/hr Steam for the SKC Recycling Operation

Pollutant	Averaging Period	Meteorological Year	Maximum Predicted Impacts (μg/m³)		Case 3 Net Air Quality Effect (μg/m³)	Case 3 Number of Receptors Improved[a]
			Case 1	Case 3		
NO_2	Annual	1983	4.82	2.64	1.15	1004
		1984	5.00	2.07	1.10	1004
		1985	4.97	2.57	1.13	1004
		1986	4.27	1.94	1.06	1004
		1987	7.18	2.27	1.17	1004
Pb	24 Hr	1983	2.0e-02	4.8e-03	3.18e-03	977
		1984	1.8e-02	7.3e-03	3.0e-03	977
		1985	2.4e-02	7.1e-03	2.8e-03	995
		1986	2.1e-02	6.1e-03	2.8e-03	987
		1987	1.9e-02	5.7e-03	3.0e-03	974
	Annual	1983	1.1e-03	5.0e-04	2.3e-04	975
		1984	1.2e-03	6.6e-04	2.2e-04	979
		1985	1.1e-03	5.8e-04	2.3e-04	986
		1986	1.1e-03	6.1e-04	2.1e-04	977
		1987	1.5e-03	5.7e-04	2.4e-04	980

TABLE 2-14 (Cont'd)

Findings for Comparison No. 2, Assessment B, Net Air Quality Effect of Case 3: CBCP as Proposed to be Modified Supplying 380 k lb/hr Steam to SKC with SKC Package Boilers at 260 k lb/hr Steam Firing Fuel Oil vs. Case 1: The Future Operation of the 3 Power Boilers and 2 Bark Boilers at 640 k lb/hr Steam for the SKC Recycling Operation

Pollutant	Averaging Period	Meteorological Year	Maximum Predicted Impacts (μg/m^3)		Case 3 Net Air Quality Effect (μg/m^3)	Case 3 Number of Receptors Improved[a]
			Case 1	Case 3		
Total Air Toxics	8 Hr	1983	9.5	0.70	1.93	1004
		1984	8.4	0.53	1.87	1004
		1985	9.7	0.64	1.85	1004
		1986	9.0	0.63	1.79	1004
		1987	9.8	0.62	1.85	1004
	24 Hr	1983	5.7	0.37	1.09	1004
		1984	5.1	0.28	1.06	1004
		1985	6.6	0.28	1.00	1004
		1986	6.1	0.24	1.00	1004
		1987	5.4	0.32	1.04	1004
	Annual	1983	0.34	0.02	0.08	1003
		1984	0.35	0.03	0.08	1003
		1985	0.34	0.02	0.08	1003
		1986	0.32	0.02	0.08	1003
		1987	0.46	0.02	0.09	1003

[a] Out of a total of 1008

TABLE 2-15

Findings for Comparison No. 2, Assessment B, Net Air Quality Effect of Case 3: CBCP as Proposed to be Modified Supplying 380 k lb/hr Steam to SKC with SKC Package Boilers at 260 k lb/hr Steam Firing Natural Gas vs. Case 1: The Future Operation of the 3 Power Boilers and 2 Bark Boilers at 640 k lb/hr Steam for the SKC Recycling Operation

Pollutant	Averaging Period	Meteorological Year	Maximum Predicted Impacts (μg/m³)		Case 3 Net Air Quality Effect (μg/m³)	Case 3 Number of Receptors Improved(a)
			Case 1	Case 3		
CO	1 Hr	1983	986.81	339.81	205.13	1004
		1984	947.32	343.18	206.46	1004
		1985	927.57	340.70	206.08	1004
		1986	913.88	342.88	208.40	1004
		1987	1036.09	339.64	211.64	1004
	8 Hr	1983	412.55	154.82	81.30	1004
		1984	368.58	97.06	79.60	1004
		1985	432.25	139.31	78.75	1004
		1986	367.64	139.56	75.69	1004
		1987	382.77	106.09	78.75	1004
NO_2	Annual	1983	4.82	2.81	1.14	1004
		1984	5.00	2.21	1.09	1004
		1985	4.97	2.73	1.12	1004
		1986	4.27	2.07	1.05	1004
		1987	7.18	2.42	1.16	1004

(a) Out of a total of 1008

average net benefit to air quality over the entire model receptor grid with the CBCP. For the vast majority of receptors, out of a total of 1008, the maximum predicted impacts of Case 3 show an improvement over Case 1 for the individual criteria pollutants and total air toxics.

Table 2-15 presents the results of the same comparison with the SKC package boilers firing natural gas. The Case 3 results for the package boiler on fuel oil (Table 2-14) showed a net improvement in air quality for all pollutants. Since emissions for Case 3 are lower for all pollutants, except CO and NO_x than with the SK package boilers firing oil, it stands to reason that there is no need to model pollutants other than CO and NO_x for this comparison. Since CO and NO_x emissions increase, however, for Case 3 with the package boilers firing natural gas, results are presented in Table 2-15 for CO and NO_2 only for Case 3 with natural gas. Referring to Table 2-15, Case 3 with natural gas still represents a large improvement over Case 1 maximum impacts, Case 3 producing a positive net air quality benefit and lower maximum impacts over virtually all receptors.

The above results demonstrate that the CBCP as proposed to be modified meets the first criteria of Comparison No. 2. That is, on balance the air quality impacts of the CBCP, as proposed to be modified, and the addition of the three as-yet-to-be-proposed boilers on the SKC site necessary to provide 640,000 lb. of steam per hour for SKC's use will be less than the air quality impacts of the future SKC recycling operation without the CBCP.

The findings for Assessment A, Case 4 vs Case 2, are displayed in Tables 2-16 and 2-17, for the SKC package boilers in Case 4 on fuel oil and natural gas, respectively. These findings are presented in the same format as those for Assessment B.

Referring to Table 2-16, with the exception of the pollutants SO_2 and CO, the maximum predicted impacts of Case 4, CBCP as proposed to be modified plus the SKC package boilers, are lower than those of Case 2, CBCP as certified. For SO_2, due to downwash of the package boiler emissions, the maximum predicted impacts for Case 4 are higher for some averaging periods for some of the meteorological years modeled. However, the average net SO_2 air quality effect of Case 4 is positive for all averaging periods and meteorological years, demonstrating a net SO_2 improvement with Case 4 over Case 2. This is due to the fact that maximum SO_2 impacts are lower for Case 4 at the majority of receptors. For all other pollutants except CO and annual average PM-10, the average net air quality effect of Case 4 is also positive, and the number of receptors where lower maximum impacts are predicted for Case 4 are in the majority.

For the pollutant CO, due to higher total CO emissions and the SKC package boilers downwashing, the maximum impacts are higher for Case 4 and the calculated average net air quality effects are negative, with a minority of receptors showing improvement. However, it is

TABLE 2-16

Findings for Comparison No. 2, Assessment A, Net Air Quality Effect of Case 4: CBCP as Proposed to be Modified with SKC Package Boilers at 375 k lb/hr Steam Firing Fuel Oil vs. Case 2: Cedar Bay as Certified

Pollutant	Averaging Period	Meteorological Year	Maximum Predicted Impacts ($\mu g/m^3$)		Case 4 Net Air Quality Effect ($\mu g/m^3$)	Case 4 Number of Receptors Improved
			Case 2	Case 4		
SO_2	3 hr	1983	165.60	443.25	5.70	831
		1984	173.48	232.21	6.95	829
		1985	236.12	299.74	9.75	841
		1986	210.39	260.78	7.03	807
		1987	173.15	267.99	6.11	845
	24 hr	1983	60.99	112.54	3.12	742
		1984	89.88	68.87	4.23	766
		1985	70.75	83.26	3.71	809
		1986	81.04	65.48	3.59	768
		1987	72.54	86.38	3.37	750
	Annual	1983	9.33	3.75	0.46	467
		1984	9.92	2.84	0.50	477
		1985	9.82	3.72	0.49	483
		1986	12.39	2.64	0.51	497
		1987	10.11	3.44	0.47	460
PM-10	24 hr	1983	37.17	22.68	0.36	527
		1984	34.23	23.09	0.32	479
		1985	35.17	22.96	0.29	493
		1986	34.79	29.61	0.24	527
		1987	35.35	21.36	0.29	516
	Annual	1983	4.23	3.60	-0.05	128
		1984	5.10	4.23	-0.06	106
		1985	3.98	3.98	-0.06	113
		1986	4.62	4.26	-0.06	127
		1987	4.13	3.56	-0.05	132

TABLE 2-16 (Cont'd)

Findings for Comparison No. 2, Assessment A, Net Air Quality Effect of Case 4: CBCP as Proposed to be Modified with SKC Package Boilers at 375 k lb/hr Steam Firing Fuel Oil vs. Case 2: Cedar Bay as Certified

Pollutant	Averaging Period	Meteorological Year	Maximum Predicted Impacts (μg/m³) Case 2	Maximum Predicted Impacts (μg/m³) Case 4	Case 4 Net Air Quality Effect (μg/m³)	Case 4 Number of Receptors Improved
CO	1 hr	1983	47.38	367.49	-15.86	87
		1984	57.94	356.48	-15.41	91
		1985	60.60	366.49	-15.43	90
		1986	69.07	365.90	-15.40	95
		1987	52.69	369.81	-15.23	96
	8 hr	1983	14.17	147.28	-5.37	117
		1984	16.84	96.36	-5.27	115
		1985	16.86	131.26	-5.42	113
		1986	16.39	132.33	-5.28	114
		1987	15.58	111.25	-5.24	115
NO_2	Annual	1983	4.44	2.48	0.20	494
		1984	4.72	1.87	0.22	546
		1985	4.68	2.46	0.21	504
		1986	5.90	1.73	0.23	541
		1987	4.82	2.25	0.20	530
Pb	24 hr	1983	0.13	4.8E-03	0.05	980
		1984	0.14	0.01	0.05	980
		1985	0.17	0.01	0.05	980
		1986	0.14	0.01	0.05	980
		1987	0.15	0.01	0.05	980
	Annual	1983	0.01	5.0E-03	0.002	980
		1984	0.14	7.0E-03	0.003	980
		1985	0.17	6.0E-03	0.002	980
		1986	0.01	6.0E-03	0.002	980
		1987	0.01	6.0E-03	0.002	980

TABLE 2-16 (Cont'd)

Findings for Comparison No. 2, Assessment A, Net Air Quality Effect of Case 4: CBCP as Proposed to be Modified with SKC Package Boilers at 375 k lb/hr Steam Firing Fuel Oil vs. Case 2: Cedar Bay as Certified

Pollutant	Averaging Period	Meteorological Year	Maximum Predicted Impacts ($\mu g/m^3$)		Case 4 Net Air Quality Effect ($\mu g/m^3$)	Case 4 Number of Receptors Improved
			Case 2	Case 4		
Total Air Toxics	8 hr	1983	4.20	1.24	1.39	973
		1984	4.90	1.46	1.49	975
		1985	6.46	1.26	1.59	975
		1986	4.83	1.23	1.41	974
		1987	4.60	1.15	1.40	975
	24 hr	1983	1.78	0.36	0.60	975
		1984	1.94	0.28	0.66	976
		1985	2.25	0.28	0.68	976
		1986	1.86	0.23	0.60	976
		1987	2.07	0.28	0.61	976
	Annual	1983	0.10	0.02	0.032	977
		1984	0.11	0.03	0.035	978
		1985	0.11	0.02	0.034	978
		1986	0.14	0.02	0.034	980
		1987	0.11	0.02	0.030	979

(a)Out of a total of 1008

very important to note that the maximum CO impacts for both cases are much less than the Florida and EPA Significant Impact Levels (SILs) for 1-hour CO (2000 $\mu g/m^3$) and 8-hour CO (500 $\mu g/m^3$). The SILs are used to determine if a source has a significant impact and/or contributes to a violation of an ambient air quality standard or PSD increment. The SILs for CO are 5 percent of the AAQS. In this case, a comparison as to a benefit in air quality is not meaningful, since impacts are insignificant in both cases.

For annual average PM-10 concentrations, although the maximum concentrations are lower, the net air quality effect on a regional basis is negative. This is due to particulate emissions from the SKC package boilers, which downwash. As shown in the table, the average net effects are quite small however, and much less than the annual PM-10 SIL of 1.0 $\mu g/m^3$. Thus, the net effect is insignificant. As will be shown in Section 3, the Cedar Bay Facility as proposed to be modified will be well within the AAQS for PM-10.

Table 2-17 displays the findings for Assessment A for the SKC package boilers firing natural gas. Results are shown for CO and NO_2 only, since these are the only pollutants that increase in Case 4, due to the package boilers firing natural gas. For CO, the same conclusions can be drawn as in the oil-firing case. Impacts, although higher for Case 4, are insignificant, thus rendering a comparison meaningless. For Case 4, NO_2 maximum impacts are again lower than Case 2, and a positive average net air quality benefit is demonstrated.

The above results demonstrate that the CBCP, as proposed to be modified, meets the second criteria of Comparison No. 2. That is, on balance, the air quality impacts of the CBCP, as proposed to be modified, and the addition of any boilers on the SKC site at their permitted capacity will be less than the air quality impacts of the CBCP as certified.

The findings for Assessment C, Case 4 vs. Case 1a, are displayed in Tables 2-18 and 2-19, for the SKC package boilers in Case 4 on fuel oil and natural gas, respectively. Referring to Table 2-18, the maximum predicted concentrations for Case 4, with the SKC package boilers on oil, are much lower than the corresponding Case 1a concentrations for each pollutant and averaging period. In addition, the net air quality effect of Case 4 is positive for each pollutant and averaging period, indicating an average net benefit to air quality over the entire model receptor grid. For the vast majority of receptors, out of a total of 1008, the maximum predicted impacts of Case 4 show an improvement over Case 1a for the individual criteria pollutants and total air toxics.

Table 2-19 presents the results of the same comparison with the SKC package boilers firing natural gas. Since only CO and NO_x emissions increase from the package boilers firing natural gas, while emissions of all other pollutants decrease, results are presented in Table 2-19 for CO and NO_2 only. These results show that Case 4 with natural gas still represents a large

TABLE 2-17

Findings for Comparison No. 2, Assessment A, Net Air Quality Effect of Case 4: CBCP as Proposed to be Modified with SKC Package Boilers at 375 k lb/hr Steam Firing Natural Gas vs. Case 2: Cedar Bay as Certified

Pollutant	Averaging Period	Meteorological Year	Maximum Predicted Impacts ($\mu g/m^3$) Case 2	Maximum Predicted Impacts ($\mu g/m^3$) Case 4	Case 4 Net Air Quality Effect ($\mu g/m^3$)	Case 4 Number of Receptors Improved[a]
CO	1 hr	1983	47.38	375.86	-16.55	85
		1984	57.94	364.04	-16.10	86
		1985	60.60	374.80	-16.12	90
		1986	69.07	374.28	-16.14	93
		1987	52.69	378.34	-15.92	94
	8 hr	1983	14.17	150.53	-5.62	113
		1984	16.84	98.49	-5.52	114
		1985	16.86	135.03	-5.67	110
		1986	16.39	136.45	-5.54	112
		1987	15.58	113.46	-5.49	112
NO_2	Annual	1983	4.44	2.62	0.19	447
		1984	4.72	1.98	0.21	476
		1985	4.68	2.60	0.20	453
		1986	5.90	1.84	0.22	489
		1987	4.82	2.40	0.19	459

[a] Out of total of 1008

TABLE 2-18

Findings for Comparison No. 2, Assessment C, Net Air Quality Effect of Case 4: CBCP as Proposed to be Modified with SKC Package Boilers at 375k lb/hr Steam Firing Fuel Oil vs. Case 1a: The Future Operation of the 3 Power Boilers and 2 Bark Boilers at 745k lb/hr Steam for the SKC Recycling Operation

Pollutant	Averaging Period	Meteorological Year	Maximum Predicted Impacts ($\mu g/m^3$)		Case 4 Net Air Quality Effect ($\mu g/m^3$)	Case 4 Number of Receptors Improved[(a)]
			Case 1a	Case 4		
SO_2	3 hr	1983	678.13	443.25	85.58	989
		1984	637.91	232.21	72.84	1001
		1985	500.85	299.74	71.27	997
		1986	461.10	260.78	64.91	985
		1987	527.11	267.99	70.75	990
	24 hr	1983	281.34	112.54	27.60	997
		1984	190.00	68.87	22.28	1004
		1985	259.58	83.26	20.49	997
		1986	184.73	65.48	21.98	993
		1987	171.91	86.38	22.33	989
	Annual	1983	6.01	3.75	1.50	1004
		1984	4.95	2.84	1.39	1003
		1985	6.11	3.72	1.42	1004
		1986	5.04	2.64	1.31	1003
		1987	9.33	3.44	1.52	1004
CO	1 hr	1983	980.12	367.49	202.98	1004
		1984	943.78	356.48	204.42	1004
		1985	922.11	366.49	204.11	1004
		1986	910.40	365.90	206.37	1004
		1987	1036.23	369.81	209.57	1004
	8 hr	1983	410.77	147.28	80.63	1003
		1984	367.68	96.36	78.97	1003

TABLE 2-18 (Cont'd)

Findings for Comparison No. 2, Assessment C, Net Air Quality Effect of Case 4: CBCP as Proposed to be Modified with SKC Package Boilers at 375k lb/hr Steam Firing Fuel Oil vs. Case 1a: The Future Operation of the 3 Power Boilers and 2 Bark Boilers at 745k lb/hr Steam for the SKC Recycling Operation

Pollutant	Averaging Period	Meteorological Year	Maximum Predicted Impacts ($\mu g/m^3$)		Case 4 Net Air Quality Effect ($\mu g/m^3$)	Case 4 Number of Receptors Improved(a)
			Case 1a	Case 4		
CO	8 hr	1985	431.98	131.26	78.02	1004
		1986	365.36	132.33	75.32	1004
		1987	380.01	111.25	78.11	1004
NO_x	Annual	1983	5.23	2.48	1.26	1004
		1984	5.05	1.87	1.21	1004
		1985	5.33	2.46	1.24	1004
		1986	4.51	1.73	1.15	1004
		1987	7.56	2.25	1.29	1004
PM-10	24 hr	1983	135.81	22.68	7.14	1006
		1984	146.14	23.09	7.01	1003
		1985	141.20	22.96	6.78	1007
		1986	151.09	29.61	6.66	1001
		1987	118.57	21.36	6.99	1005
	Annual	1983	22.57	3.60	0.64	991
		1984	23.33	4.23	0.64	981
		1985	24.28	3.98	0.67	998
		1986	29.00	4.26	0.61	978
		1987	21.75	3.56	0.64	988
Pb	24 hr	1983	0.019	0.0048	0.0031	981
		1984	0.016	0.0073	0.0028	979
		1985	0.022	0.0071	0.0027	995
		1986	0.020	0.0061	0.0027	987
		1987	0.018	0.0057	0.0029	975

TABLE 2-18 (Cont'd)

Findings for Comparison No. 2, Assessment C, Net Air Quality Effect of Case 4: CBCP as Proposed to be Modified with SKC Package Boilers at 375k lb/hr Steam Firing Fuel Oil vs. Case 1a: The Future Operation of the 3 Power Boilers and 2 Bark Boilers at 745k lb/hr Steam for the SKC Recycling Operation

Pollutant	Averaging Period	Meteorological Year	Maximum Predicted Impacts (µg/m³)		Case 4 Net Air Quality Effect (µg/m³)	Case 4 Number of Receptors Improved[a]
			Case 1a	Case 4		
Pb	Annual	1983	0.0011	0.0048	0.00023	975
		1984	0.0011	0.0073	0.00022	980
		1985	0.0011	0.0071	0.00023	987
		1986	0.0010	0.0061	0.00021	978
		1987	0.0015	0.0057	0.00023	979
Total Air Toxics	8 hr	1983	9.24	1.24	1.89	1004
		1984	8.26	1.46	1.83	1004
		1985	9.62	1.26	1.81	1004
		1986	8.66	1.23	1.75	1004
		1987	9.32	1.15	1.81	1004
	24 hr	1983	5.58	0.36	1.07	1004
		1984	4.86	0.28	1.04	1004
		1985	6.31	0.28	0.98	1004
		1986	5.83	0.23	0.98	1004
		1987	5.14	0.28	1.02	1004
	Annual	1983	0.33	0.02	0.08	1004
		1984	0.34	0.03	0.08	1004
		1985	0.33	0.02	0.08	1004
		1986	0.31	0.02	0.08	1004
		1987	0.44	0.02	0.08	1004

[a] Out of a total of 1008.

TABLE 2-19

Findings for Comparison No. 2, Assessment C, Net Air Quality Effect of Case 4: CBCP as Proposed to be Modified with SKC Package Boilers at 375k lb/hr Steam Firing Natural Gas vs. Case 1a: The Future Operation of the 3 Power Boilers and 2 Bark Boilers at 745k lb/hr Steam for the SKC Recycling Operation

Pollutant	Averaging Period	Meteorological Year	Maximum Predicted Impacts ($\mu g/m^3$)		Case 4 Net. Air Quality Effect ($\mu g/m^3$)	Case 4 Number of Receptors Improved[a]
			Case 1a	Case 4		
CO	1 hr	1983	980.12	375.86	202.29	1004
		1984	943.78	364.04	203.73	1004
		1985	922.11	374.80	203.43	1004
		1986	910.40	374.28	205.63	1004
		1987	1036.23	378.34	208.88	1004
	8 hr	1983	410.77	150.53	80.37	1003
		1984	367.68	98.49	78.71	1003
		1985	431.98	135.03	77.77	1004
		1986	365.36	136.45	75.06	1004
		1987	380.01	113.46	77.85	1004
NO_x	Annual	1983	5.23	2.62	1.25	1004
		1984	5.05	1.98	1.20	1004
		1985	5.33	2.60	1.23	1004
		1986	4.51	1.84	1.14	1004
		1987	7.56	2.40	1.28	1004

[a] Out of a total of 1008.

improvement over Case 1a maximum impacts, a positive net air quality benefit and lower maximum impacts over the vast majority of receptors.

The above results demonstrate the CBCP, as proposed to be modified, meets the third criteria of Comparison No. 2. That is, on balance, the air quality impacts of the CBCP, as proposed to be modified, and the addition of the boilers or the SKC site at their maximum permitted capacity will be less than the air quality impacts of the SKC recycling operation with power and bark boilers at their maximum permitted capacity.

3.0 COMPARISON NO. 3: CEDAR BAY COMPLIANCE WITH AMBIENT AIR QUALITY STANDARDS (AAQS) AND PREVENTION OF SIGNIFICANT DETERIORATION (PSD) INCREMENTS, AND COMPARISON TO DRAFT AIR TOXICS NO THREAT LEVELS (NTLS)

3.1 Introduction

The objective of the information presented in this section is to provide data useful for assessing whether the CBCP, as proposed to be modified, would either cause or contribute to a violation of an ambient air quality standard (AAQS) or cause or contribute to a violation of the allowable PSD increments, in either the region surrounding the facility (a PSD Class II area) or the two distant PSD Class I areas. The two PSD Class I areas are the Okefenokee and Wolf Island Wilderness Areas in Georgia. In addition, information is presented to provide data useful for assessing whether the CBCP would produce air toxics concentrations above the Draft Florida No Threat Levels (NTLs). For annual average estimates of impacts the Cedar Bay CFB boilers are assumed to operate at an annual capacity of 93%.

The national and Florida AAQS are listed in Table 3-1. The PSD increments are listed in Table 3-2. Also listed are the "significant impact levels" (SIL) established by EPA for these pollutants. The Draft NTLs for air toxics being modeled are listed in Table 3-3. These were selected from the entire list of NTLs for those toxic air pollutants emitted from the CBCP sources.

The modeling for AAQS purposes considers the impacts of other major existing and permitted sources in Duval County as well as background concentrations of the AAQS pollutants.

For PSD increment consumption calculations, SO_2, NO_x and TSP increment consuming and increment expanding sources in Duval County are considered, plus increment consuming sources permitted since baseline dates, along with the Cedar Bay facility. This includes increment expansions resulting from the shutdown of the 3 power boilers and 2 bark boilers at the SKC facility.

TABLE 3-1

National and Florida Ambient Air Quality Standards (µg/m^3) For Pollutants Being Modeled

Pollutant	Averaging Period	NAAQS Standards		Florida State Standards	EPA Significant Impact Level[a]
		Primary	Secondary		
SO_2	Annual	80	--	60	1
	24-hour	365	--	260	5
	3-hour	--	1,300	1,300	25
NO_2	Annual	100	100	100	1
PM_{10}	Annual	50	50	50	1
	24-hour	150	150	150	5
CO	8-hour	10,000	--	10,000	500
	1-hour	40,000	--	40,000	2,000
Lead (Pb)	Calendar Quarter	1.5	1.5	1.5	0.03[b]

[a] 40 CFR 51.165(b)(2)

[b] Proposed by Florida DER, 11-06-92.

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TABLE 3-2

Federal and Florida PSD Increments

Pollutant	Averaging Period	PSD Area Classification		PSD Class II Significant Impact Levels
		Class I	Class II	
SO_2	3-hour	25	512	25
	24-hour	5	91	5
	Annual	2	20	1
TSP	24-hour	10	37	5
	Annual	5	19	1
NO_2	Annual	2.5	25	1

TABLE 3-3

Draft No Threat Levels (NTLs) For Air Toxics Being Modeled[(a)]

Pollutant	No Threat Levels ($\mu g/m^3$)		
	8 hr	24 hr	Annual
antimony compounds	5	1.2	3.0E-01
arsenic	2	0.48	2.3E-04
barium	5	1.2	5.0E+01
beryllium	0.02	0.0048	4.2E-04
cadmium	0.5	0.12	5.6E-04
chromium VI compounds	0.5	0.12	8.3E-05
copper	10	2.4	
fluorides (as F)	25	6	
formaldehyde	12	2.88	7.7E-02
hydrogen chloride (hydrochloric acid)	75	18	7.0E+00
indium compounds (as In)	1	0.24	
lead	0.5	0.12	9.0E-02
manganese (as Mn)	50	12	4.0E-01
mercury (as Hg) alkyl compounds	0.1	0.024	
molybdenum, soluble compounds, (as Mo)	50	12	
nickel, soluble compounds, (as Ni)	1	0.24	
phosphorus	1	0.24	
selenium	2	0.48	
sulfuric acid (H_2SO_4)	10	2.4	
tin	1	0.24	
vanadium, as(V2O5)	0.5	0.12	2.0E+01

(a)There are no Draft NTLs listed for POM or radionuclides.

The following are the applicable baseline dates:

PSD Pollutant	Minor Source Baseline Date	Major Source Baseline Date
SO_2	December 27, 1977	January 6, 1975
TSP	December 27, 1977	January 6, 1975
NO_2	March 28, 1988	February 8, 1988

3.2 Methodology

The modeling methodology employed the model being applied, the pollutants being modeled and the meteorological data are identical to that employed in addressing Comparison No. 2: Net Air Quality Impacts. However, since the maximum impacts of CBCP, by itself, occur in the near field and the facility has predicted air quality impacts below the significant impact levels beyond 4.5 km for the criteria pollutants, the receptor grid for Comparison No. 3 extended to 5 km only. The only exceptions are that receptors are added at the two PSD Class I areas for the PSD analysis and receptors not located in ambient air are deleted.

3.2.1 AAQS Analysis

The first step in the modeling of the AAQS pollutants was to examine the emissions of the CBCP alone. Pollutants for which the maximum modeled concentrations are less than the SILs for the applicable averaging periods are eliminated from further consideration. The concept here is that if these impacts are not significant, then they can neither cause nor contribute to a violation, as promulgated by EPA at 40 CFR 51.165(b)(2). For pollutants for which the CBCP is modeled to have a significant impact, multi-source modeling is performed with the existing and permitted source inventories.

Background concentrations of those pollutants are then added to modeled impacts to determine total pollutant concentrations for comparison to the AAQS.

3.2.2 PSD Analysis

PSD pollutants for which maximum modeled concentrations in the PSD Class II area around the facility, due to the CBCP alone, are less than the SILs are eliminated from further consideration. The concept here is that if these impacts are not significant, then the facility will neither cause nor contribute to a violation of a PSD Class II increment (U.S. EPA Memorandum, G. Emison, OAQPS to T. Maslany, AMD, 7/5/88). For PSD pollutants for which the CBCP is modeled to have a significant impact, multi-source modeling is performed with the PSD source inventories for the compliance evaluations. Multi-source PSD increment modeling is also performed for receptors in the PSD Class I areas.

3.2.3 NTL Comparison

The modeled maximum ground-level concentration of each draft air toxic pollutant for averaging periods consistent with the draft NTLs is identified. These concentrations are then compared to the draft NTLs. This analysis is performed for the CBCP alone, since the NTLs are intended as source-specific screening levels.

3.3 Source Data and Assumptions

The emissions and exhaust parameters used in the PSD, AAQS and NTL modeling for the CBCP as proposed to be modified are the same as those used in the net air quality impacts modeling. The PSD emissions and exhaust parameters for the SKC Power and Bark Boilers to be shut down, representative of the respective baseline years are given in Tables 3-4 through 3-8. These were supplied by KBN Engineering and Applied Sciences as the proposed representative baseline data to be submitted for review and approval by the FDER as part of SKC's air permit application for the proposed SKC Package Boilers. The SKC bark handling and storage operations were also assumed to be shut down. The inventories of Duval County sources used in the PSD and NAAQS modeling are presented in Tables 3-9 through 3-11. The SO_2 source data was provided to ENSR by KBN Engineering and Applied Sciences on 10-8-92. According to KBN, this is a proposed current update of major source inventories to be submitted for review and approval by the FDER as part of SKC's air permit application for the proposed SKC Package Boilers. The TSP/PM-10 and NO_x source data were developed by ENSR from FDER's Air Program Information System Facility Emission Reports for 1975-1991 and the Master Detail Reports for major sources. The facility emission reports were surveyed to identify major (potential to emit 100 TPY or greater) sources and source changes between the respective baseline years and 1991. The master detail reports for those sources were examined to extract source data for modeling. Allowable emissions, as listed in the FDER inventories, were employed. The tables note where a source is either a PSD increment consuming (CON) or increment expanding (EXP) source. These sources were the only sources employed in the PSD modeling. All other sources are assumed to be unaltered baseline sources and were included along with increment consuming sources in the modeling for AAQS.

TABLE 3-4

SO$_2$ and TSP PSD Baseline Stack and Operating Data for the Seminole Kraft[a] Facility in Jacksonville, Florida

Unit Description	Stack Height (m)	Stack Diameter (m)	Velocity (m/s)	Temperature (deg K)	Basis
Bark Boiler No. 1	41.45	2.46	13.01	332	Current stack data
Bark Boiler No. 2	41.45	2.46	13.01	332	Current stack data
Power Boiler No. 1	32.31	1.83	15.82	450	Current stack data and an average of 1974/1975 stack test data
Power Boiler No. 2	32.31	2.13	18.35	487	Current stack data and 1975 stack test data
Power Boiler No. 3	32.31	2.13	17.22	462	Current stack data and 1975 stack test data

Source: KBN Engineering and Applied Sciences, Inc. Memorandum from David Buff (KBN) to Al Hallquist (ENSR), October 23, 1992.

[a] Formerly St. Regis Paper Company

KBN Source: Fuel data for St. Regis Paper, 1974. Stack test data from 1974, 1975 and 1977. Current stack and operating data.

TABLE 3-5

PSD Baseline SO_2 Emission Data for the Seminole Kraft[a] Facility in Jacksonville, Florida

Unit Description	Fuel Usage	Fuel Type	% Sulfur in Fuel Oil	Hours of Operation	SO_2 Emissions			
					Annual (tons/yr)	Short Term (lb/hr)[b]	Annual (g/s)	Short Term (g/s)
Bark Boiler No. 1	1,394,774 121,520	Fuel Oil (gal) Bark (tons)	2.27	8,712	272,8	458.7[c]	7.85	57.80
Bark Boiler No. 2	1,696,627 112,480	Fuel Oil (gal) Bark (tons)	2.27	8,064	324.8	458.7[c]	9.34	57.80
Power Boiler No. 1	7,935,037	Fuel Oil (gal)	2.27	8,472	1,414.0	333.8	40.68	42.06
Power Boiler No. 2	11,610,539	Fuel Oil (gal)	2.27	8,472	2,069.0	488.4	59.52	61.54
Power Boiler No. 3	11,569,935	Fuel Oil (gal)	2.27	8,496	2,062.0	485.4	59.32	61.16

Source: KBN Engineering nd Applied Sciences, Inc. memorandum from David Buff (KBN) to Al Hallquist (ENSR), October 23, 1992

[a] Formerly St. Regis Paper Company

[b] Based on total annual hours of operation and annual emissions, unless otherwise indicated.

[c] Maximum short-term emissions for Bark Boilers 1 and 2 are based on 100-percent fuel oil usage at 1,287 gallons/hour.

KBN Source: 1976/1977 Annual Operating Report submitted to FDER.

TABLE 3-6

PSD Baseline PM Emission Data for the Seminole Kraft[a] Facility in Jacksonville, Florida

Unit Description	Basis	Hours of Operation	PM Emissions			
			Annual (TPY)	Short Term (lb/hr)[b]	Annual (g/s)	Short Term (g/s)
Bark Boiler No. 1	1977 PM stack test and operating hours	8,712	58.8	13.50	1.69	1.70
Bark Boiler No. 2	1977 PM stack test and operating hours	8,064	44.4	11.01	1.28	1.39
Power Boiler No. 1	7,935,637 gal fuel oil; 25.7 lb/1000 gal based on AP-42	8,472	102.0	24.08	2.93	3.03
Power Boiler No. 2	11,610,539 gal fuel oil; 25.7 lb/1000 gal based on AP-42	8,472	149.2	35.22	4.29	4.44
Power Boiler No. 3	11,569,935 gal fuel oil; 25.7 lb/1000 gal based on AP-42	8,496	148.7	35.00	4.28	4.41

Source: KBM Engineering and Applied Sciences, Inc. Memorandum from David Buff (KBN) to Al Hallquist (ENSR), October 23, 1992

[a] Formerly St. Regis Paper Company

[b] Based on total annual hours of operation and annual emissions.

TABLE 3-7

NO_x PSD Baseline Stack and Operating Data for the Seminole Kraft[a] Facility in Jacksonville, Florida

Unit Description	Stack Height (m)	Stack Diameter (m)	Velocity (m/s)	Temperature (K)	Basis
Bark Boiler No. 1	41.45	2.46	13.01	332	1991 stack test data
Bark Boiler No. 2	41.45	2.46	13.01	332	1991 stack test data
Power Boiler No. 1	32.31	1.83	14.02	455	1991 stack test data
Power Boiler No. 2	32.31	2.13	14.51	439	1991 stack test data
Power Boiler No. 3	32.31	2.13	14.51	439	1991 stack test data

Source: KBN Engineering and Applied Sciences, Inc. Memorandum from David Buff (KBN) to Al Hallquist (ENSR), October 23, 1992.

[a] Formerly St. Regis Paper Company

TABLE 3-8

PSD Baseline NO_x Emission Data for the Seminole Kraft[a] Facility in Jacksonville, Florida

Unit Description	Basis	1989-1990 Hours of Operation	Annual Baseline NO_x Emissions	
			tons/yr	g/s
Bark Boiler No. 1	74.1 lb/hr, 1991 stack test	8,169	302.7	8.71
Bark Boiler No. 2	45.9 lb/hr, 1991 stack test	7,877	180.8	5.20
Power Boiler No. 1	8,129,846 gal/yr, 67 lb/1000 gal	8,255	272.3	7.83
Power Boiler No. 2	8,581,041 gal/yr, 67 lb/1000 gal	8,472	287.5	8.27
Power Boiler No. 3	8,723,551 gal/yr, 67 lb/1000 gal	8,489	292.2	8.41

Source: KBN Engineering and Applied Sciences, Inc. Memorandum from David Buff (KBN) to Al Hallquist (ENSR), October 23, 1992.

[a] Formerly St. Regis Paper Company

KBN Source: 1989/1990 Annual Operating Reports submitted to FDER and stack tests.

Table 3-9

SO_2 Source Data Used in the Modeling Analysis

			Stack Data (m)		Operating Data		SO_2 Emissions			UTM (km)	
APIS Number/Facility	Source Description	APIS Source Number	Height	Diameter	Temperature (K)	Velocity (m/sec)	(g/s)	(TPY)	SO_2 PSD Source (EXP/CON)	East	North
31DVL160202 Celotex	Gypsum Crushing System	01	7.6	0.49	321.9	18.90	0.26	9	-	446.4	3362.6
	Calcinizing Kettle #1 - #3	07, 11, 12	22.9	0.91	727.4	4.88	0.83	30	-		
	Wallboard Drying Kilns	08, 13, 14	15.2	0.94	435.8	7.32	20.16	701	-		
31DVL160213 U.S. Naval Station - Mayport	Boiler #1 - #3, Bldg. 1241	01, 02, 03	12.2	0.91	544.1	14.33	16.33	544	-	460.4	3362.8
	Boiler #1 - #2, Bldg.250	04, 08	14.0	1.22	560.8	7.92	10.53	351	-		
	Carbonaceous Fuel Boiler, Hot Water Boiler	07	18.3	1.52	533.0	7.01	0.62	19	-		
31DVL160005 Anchor Hocking Glass	Glass Melt Furnace #1	01	17.4	0.91	511.3	19.51	2.05	68	-	431.5	3357.5
	Glass Melt Furnace #2	02	17.4	0.82	522.4	14.02	2.41	84	-		
	Glass Melt Furnace #3	03	33.2	1.71	429.7	11.58	10.40	361	-		
	Glass Melt Furnace #4	04	35.7	1.58	510.8	11.89	3.75	131	-		
31DVL160006 Anheuser Busch	Boiler #1 - #4	01 - 04	30.5	1.07	483.0	17.37	72.58	2120	-	437.9	3366.8
	Grain Dryer #1, 2	05	21.3	1.68	322.0	9.00	19.78	269	CON		
	Anerobic & Bio Gas Flare	31,32	6.1	2.20	1000.0	15.00	5.66	54	CON		
31DVL160039 SCM Glidco Organics	Boiler #3 (Retired)	03	12.2	1.10	658.0	10.06	8.49	295	EXP	435.6	3360.7
	Boiler #4	04	12.2	1.10	405.2	14.02	19.91	692	-		
	Boiler #5	05	15.2	1.10	535.8	12.80	20.92	728	-		
	Boiler #6	06	15.2	1.22	513.6	10.36	24.44	850	-		
	Boiler #7	11	13.7	1.22	449.7	5.49	4.01	139	CON		
31DVL160042 Duval Asphalt Products	Asphalt Batch Plant	01,02	11.6	0.98	376.3	31.09	36.54	1270	-	428.7	3361.4
31DVL160001 JEA - SJRPP	Units #1 & #2	01, 04	194.2	10.13	328.0	18.29	1175.96	40904	CON	446.9	3366.3

Table 3-9 (Cont'd)

SO_2 Source Data Used in the Modeling Analysis

APIS Number/Facility	Source Description	APIS Source Number	Stack Data (m)		Operating Data		SO_2 Emissions		SO_2 PSD Source (EXP/CON)	UTM (km)	
			Height	Diameter	Temperature (K)	Velocity (m/sec)	(g/s)	(TPY)		East	North
31DVL160045 JEA - Northside	Steam Generator #1	01	73.2	5.03	400.8	23.16	690.35	23998	-	446.9	3365.0
	Steam Generator #2	02	88.4	5.12	394.1	13.11	586.78	20398	-		
	Steam Generator #3	03	103.6	7.01	438.6	19.20	1255.59	43647	-		
	Combustion Turbines #3 - #6	06 - 09	10.1	6.55	779.7	18.29	231.60	8050	-		
	Auxiliary Boiler A	14	73.2	5.03	671.9	1.22	28.60	20	CON		
	Auxiliary Boiler B	13	76.2	5.03	588.6	0.30	8.47	294	CON		
31DVL160046 JEA - Southside	Steam Generator #1 & #2	01, 02	40.8	2.44	433.0	11.58	105.34	3,664	-	437.6	3353.8
	Steam Generator #3	03	40.8	3.05	406.9	10.36	79.76	2,773	-		
	Steam Generator #4	04	43.9	3.35	421.9	11.89	110.25	3,833	-		
	Steam Generator #5	05	44.2	3.05	416.9	13.72	207.90	7,227	-		
	Auxiliary Boiler	10	6.7	0.49	493.6	17.68	1.31	46	-		
31DVL160047 JEA - Kennedy	Combustion Turbine #3 - #6	03 - 06	13.7	2.80	651.9	8.84	191.14	6,646	-	440.0	3359.1
	Steam Generator #8	07	45.7	3.20	394.1	7.92	74.98	2,607	EXP		
	Steam Generator #9	08	45.7	3.20	398.0	7.92	74.98	2,607	-		
	Steam Generator #10	09	41.5	2.74	410.8	15.54	198.95	6,918	-		
	Auxiliary Boiler	13	10.1	0.49	493.6	17.68	1.22	42	CON		
31JAX450003 Container Corporation of Amer.	Power Boiler #7	15	103.6	4.42	489.0	13.52	154.40	5,367	CON	455.1	3386.7
	Power Boiler #5	06	78.3	3.35	454.0	15.35	190.40	6,619	CON		
	Recovery Boiler #4	07	75.9	3.76	513.0	16.55	35.10	1,220	CON		
	Recovery Boiler #5	11	87.8	2.74	496.0	14.36	31.20	1,084	CON		
	Lime Kiln #4	21	31.1	1.45	436.0	21.07	3.38	117	CON		

Table 3-9 (Cont'd)

SO_2 Source Data Used in the Modeling Analysis

APIS Number/Facility	Source Description	APIS Source Number	Stack Data (m)		Operating Data		SO_2 Emissions		SO_2 PSD Source (EXP/CON)	UTM (km)	
			Height	Diameter	Temperature (K)	Velocity (m/sec)	(g/s)	(TPY)		East	North
31JAX450003 Container Corporation of Amer. (cont'd)	Smelt Dissolving Tank #4	14	75.9	1.22	340.0	16.77	0.70	25	CON		
	Smelt Dissolving Tank #5	14	87.8	1.45	436.0	21.07	0.70	25	CON		
	Power Boiler #3 & #4	05	69.2	2.44	483.0	16.86	144.70	5,030	EXP		
	Power Boiler #5	06	69.2	3.35	480.0	16.25	170.0	5,910	EXP		
	Recovery Boiler #4	07	75.9	3.51	493.0	18.78	35.10	1,220	EXP		
	Recovery Boiler #3	??	40.8	2.74	390.0	13.26	10.50	365	EXP		
	Lime Kiln #2	??	13.4	1.07	361.0	12.25	1.30	45	EXP		
	Lime Kiln #3	??	13.4	1.37	360.0	17.59	1.30	45	EXP		
	Smelt Dissolving Tank #3	??	69.5	1.83	350.0	5.21	0.60	21	EXP		
	Smelt Dissolving Tank #4	??	33.2	0.61	360.0	5.82	0.20	7	EXP		
31DVL160003 Jefferson Smurfit	Power Boiler #10	11	61.0	3.05	341.5	9.70	36.48	1,265	CON	439.9	3359.3
	Recovery Boiler #9	05	53.3	3.20	409.8	22.86	5.52	834	CON		
	Smelt Dissolving Tank #9	04	53.3	1.65	362.0	4.32	0.48	17			
	Lime Kiln #1, 2	06	15.8	1.45	347.0	6.7	0.68	34	EXP		
	Lime Kiln #3	23	60.7	1.37	340.4	12.22	1.31	37	CON		
	Power Boilers	??	76.2	3.75	455.4	8.04	36.48	1,268	EXP		
	Recovery Boiler #9	05	53.3	3.20	389.8	11.56	16.81	834	EXP		
31DVL160069 Georgia Pacific	Boiler	01	11.6	0.61	477.4	9.14	2.58	90	-	440.1	3368.3
	Boiler	02	4.9	0.61	505.2	6.40	3.36	117	-		
31DVL160072 U.S. Gypsum	Wallboard Kiln #2	33	13.7	1.07	421.9	28.96	12.60	416	-	438.9	3361.2
	Calcining Kettles #1 - #7	36	28.3	1.07	505.2	0.91	18.38	607	-		
	Dowtherm Heater	41	20.7	0.91	733.0	6.40	1.22	40	-		

Table 3-9 (Cont'd)

SO_2 Source Data Used in the Modeling Analysis

APIS Number/Facility	Source Description	APIS Source Number	Stack Data (m)		Operating Data		SO_2 Emissions		SO_2 PSD Source (EXP/CON)	UTM (km)	
			Height	Diameter	Temperature (K)	Velocity (m/sec)	(g/s)	(TPY)		East	North
31DVL160072 U.S Gypsum (cont'd)	Rotary Kiln	48	26.8	0.49	339.1	59.13	4.08	137	-		
31DVL160148 Occidental Chemical	Bulk Ship Loading Conveyor, Phosphate Railcar Unloading	01	3.7	0.91	298.0	52.12	4.38	76	-	439.3	3359.8
	Hot Water Boiler #1 & #2	03, 04	6.1	0.30	355.2	11.89	4.23	148	-		
	Steam Boilers	05	18.3	0.91	427.4	10.06	3.86	134	-		
31DVL160146 J. W. Swisher	Boilers #1 - #3	01	18.3	1.22	505.2	0.61	4.26	148	-	437.9	3357.9
	Boiler #4 - 6	02	9.1	0.30	477.4	7.01	4.21	36	-		
31DVL160010 Baptist Medical Center	Turbines, Reciprocative Engine	03	15.2	1.07	435.8	24.69	13.89	128	-	435.4	3352.0
31DVL160004 Maxwell House	Boiler #1	03	45.7	0.98	606.9	0.61	3.96	138	-	439.7	3350.0
	Boiler #2	04	45.7	0.43	396.9	67.97	7.52	261	-		
	Boiler #2 (Retired)	13	15.2	0.91	402.4	20.73	2.44	85	EXP		
31DVL160155 Gulf Life Insurance	Boilers #1 & #2	01	18.3	0.91	421.9	2.74	7.82	91	-	436.2	3354.1
	Duel Fuel Engine	02	18.3	0.30	852.4	56.08	0.97	12	-		
31DVL160043 Duval Asphalt Products	Asphalt Batch Plant	01	11.6	0.98	376.3	31.09	11.06	384	-	443.2	3344.0
31DVL450004 ITT Rayonier	Power Boilers #1 - #3	01 - 03	55.0	3.05	329.0	9.75	173.88	5,532	CON	454.7	3392.2
	Recovery Boiler	06	76.2	2.29	324.7	17.37	40.6	1,352	-		
	Power Boilers #1 - #3	01 - 03	37.2	3.05	329.0	9.75	173.88	1,383	EXP		
31DVL160071 Union Camp	Waste Product Incinerator	01	16.2	1.07	699.7	9.45	9.69	337	-	427.6	3357.3
	Boilers, Myrcene Units	14	20.1	1.22	585.8	11.58	8.03	237	-		
31DVL160198 E S Metals		02	25.6	0.91	324.7	15.24	18.77	651	EXP	431.8	3358.3
		03	24.4	1.22	355.2	3.96	5.38	187	EXP		

Table 3-9 (Cont'd)

SO_2 Source Data Used in the Modeling Analysis

APIS Number/Facility	Source Description	APIS Source Number	Stack Data (m)		Operating Data		SO_2 Emissions		SO_2 PSD Source (EXP/CON)	UTM (km)	
			Height	Diameter	Temperature (K)	Velocity (m/sec)	(g/s)	(TPY)		East	North
GA Gilman Paper Company**	Power Boiler No. 3		83.8	4.30	450.0	2.82	87.29	3034	CON	448.2	3401.3
	Coal Fired Boiler		45.7	3.05	326.0	7.76	88.75	3085	CON		
	Recovery Boiler No. 2, 3		54.9	2.13	425.0	16.76	15.2	264	CON		
	Recovery Boiler No. 4		76.2	2.59	411.0	12.19	15.80	549	CON		
	Lime Kiln		30.5	1.52	350.0	11.64	2.13	74	CON		
	Power Boilers No. 1 - 3		83.8	4.30	449.7	7.30	281.00	9768	EXP		
	Power Boiler No. 4		36.6	1.80	699.7	20.00	59.90	2082	EXP		
	Recovery Boiler No. 2		47.2	2.30	425.8	13.10	7.60	264	EXP		
	Recovery Boiler No. 3		53.3	1.60	394.1	25.20	7.60	264	EXP		
	Recovery Boiler No. 4		76.2	2.60	427.4	22.10	15.80	549	EXP		

TABLE 3-10

TSP/PM-10 Source Data Used in the Modeling Analysis

APIS Number/Facility	Source Description	APIS Source Number	Stack Data (m)		Operating Data		PM Emissions		PM PSD Source (EXP/CON)	UTM (km)	
			Height	Diameter	Temperature (K)	Velocity (m/sec)	(g/s)	(TPY)		East	North
31DVL160202 Celotex	Gypsum Crushing System	01	7.6	0.49	321.9	18.90	0.63	21	-	446.4	3362.6
	Calcinizing Kettle #1 - #3	07, 11, 12	22.9	0.91	727.4	4.88	0.42	14	-		
	Wallboard Drying Kilns	08, 13, 14	15.2	0.94	435.8	7.32	0.32	11	-		
	Calcining Kettle	03	27.4	1.00	344.2	24.69	4.96	172			
	Material Equipment Storage	04	11.3	0.21	294.2	132.0	0.63	22			
	Wallboard End Trim System	05	18.3	0.49	294.2	26.8	0.63	21			
31DVL160005 Anchor Hocking Glass	Glass Melt Furnace #1	01	17.4	0.91	511.3	19.51	1.28	45	-	431.5	3357.5
	Glass Melt Furnace #2	02	17.4	0.82	522.4	14.02	1.32	46	-		
	Glass Melt Furnace #3	03	33.2	1.71	429.7	11.58	2.04	71	-		
	Glass Melt Furnace #4	04	35.7	1.58	510.8	11.89	1.83	64	-		
31DVL160039 SCM Glidco Organics	Boiler #3 (Retired)	03	12.2	1.10	658.0	10.06	0.31	18	EXP	435.6	3360.7
	Boiler #4	04	12.2	1.10	405.2	14.02	1.22	42	-		
	Boiler #5	05	15.2	1.10	535.8	12.80	1.27	44	-		
	Boiler #6	06	15.2	1.22	513.6	10.36	1.50	52	-		
	Boiler #7	11	13.7	1.22	449.7	5.49	0.78	10	CON		
	Dryer	07	12.5	1.22	310.9	2.74	0.12	1			
	Sodium Acetate Dryer #1	08	12.2	1.22	314.2	6.70	0.12	11			
	Sodium Acetate Dryer #2	09	12.5	1.22	310.9	2.44	0.12	11			
31DVL160001 JEA - SJRPP	Units #1 & #2	01, 04	194.2	10.13	328.0	18.29	46.44	1615	CON	446.9	3366.3
31DVL160045 JEA - Northside	Steam Generator #1	01	73.2	5.03	400.8	23.16	34.86	1061	-	446.9	3365.0
	Steam Generator #2	02	88.4	5.12	394.1	13.11	29.64	901	-		
	Steam Generator #3	03	103.6	7.01	438.6	19.20	190.24	827	-		
	Combustion Turbines #3 - #6	06 - 09	10.1	6.55	779.7	18.29	9.02	572	-		

TABLE 3-10 (Cont'd)

TSP/PM-10 Source Data Used in the Modeling Analysis (cont'd)

APIS Number/Facility	Source Description	APIS Source Number	Stack Data (m)		Operating Data		PM Emissions		PM PSD Source (EXP/CON)	UTM (km)	
			Height	Diameter	Temperature (K)	Velocity (m/sec)	(g/s)	(TPY)		East	North
	Auxiliary Boiler A	14	73.2	5.03	671.9	1.22	1.46	1	CON		
	Auxiliary Boiler B	13	76.2	5.03	588.6	0.30	0.44	15	CON		
31DVL160046 JEA - Southside	Steam Generator #1 & #2	01, 02	40.8	2.44	433.0	11.58	9.58	414	-	437.6	3353.8
	Steam Generator #3	03	40.8	3.05	406.9	10.36	7.26	315	-		
	Steam Generator #4	04	43.9	3.35	421.9	11.89	10.03	305	-		
	Steam Generator #5	05	44.2	3.05	416.9	13.72	18.90	821	-		
	Auxiliary Boiler	10	6.7	0.49	493.6	17.68	0.04	1	-		
31DVL160047 JEA - Kennedy	Combustion Turbine #4	04	13.7	2.80	651.9	8.84	9.37	326*	-	440.0	3359.1
	Steam Generator #8	07	45.7	3.20	394.1	7.92	6.82	296	EXP		
	Steam Generator #9	08	45.7	3.20	398.0	7.92	6.82	296	-		
	Steam Generator #10	09	41.5	2.74	410.8	15.54	16.82	731	-		
	Auxiliary Boiler	13	10.1	0.49	493.6	17.68	0.04	1	CON		
31DVL160003 Jefferson Smurfit	Power Boiler #10	11	61.0	3.05	341.5	9.70	5.56	152	CON	439.9	3359.3
	Recovery Boiler #9	05	53.3	3.20	409.8	22.86	15.12	526			
	Smelt Dissolving Tank #9	04	53.3	1.65	362.0	4.32	4.59	160			
	Lime Kiln #1	06	15.8	1.52	334.7	2.93	2.65	92	EXP		
	Lime Kiln #2	07	15.8	1.37	341.3	6.58	2.65	93	EXP		
	Lime Kiln #3	23	60.7	1.37	340.4	12.22	2.65	92	CON		
	Coal Bark Boiler #1	12	53.3	1.65	366.5	3.96	4.59	160			
	Coal Bark Boiler #2	13	61.0	3.05	334.8	10.67	5.56	152			
	Coal Handling Silo #1, #2	21, 22, 20	32.9	0.30	298.11	7.01	0.14	4			
	Line Storage Silo	24	27.4	0.52	338.7	2.13	0.02	0.66			
31DVL160072 U.S. Gypsum	Wallboard Kiln #2	33	13.7	1.07	421.9	28.96	0.77	25	-	438.9	3361.2

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TABLE 3-10 (Cont'd)

TSP/PM-10 Source Data Used in the Modeling Analysis (cont'd)

APIS Number/Facility	Source Description	APIS Source Number	Stack Data (m)		Operating Data		PM Emissions		PM PSD Source (EXP/CON)	UTM (km)	
			Height	Diameter	Temperature (K)	Velocity (m/sec)	(g/s)	(TPY)		East	North
	Calcining Kettles #1 - #7	36	28.3	1.07	505.2	0.91	1.47	46	-		
	Dowtherm Heater	41	20.7	0.91	733.0	6.40	0.23	8	-		
	Rotary Kiln	48	26.8	0.49	339.1	59.13	0.20	6	-		
	Combustion Turbine #1 - #2	68.69	36.6	1.01	346.9	24.99	0.15	6	-		
	Steam Boiler	86					3.2	14			
	Ambient Vents #1	5, 36, 40, 73, 78	3.0	1.06	298.1	11.89	0.34	10			
	Ambient Vents #2	34, 35, 42, 70, 71, 72	6.1	0.70	294.2	8.84	1.40	29			
	Ambient Vents #3	37, 44, 54, 62, 63, 64, 65, 66	0.9	0.61	316.5	8.23	1.17	39			
	Stucco Bin No. 3 & No. 4	6, 7	18.3	0.46	344.2	8.53	0.08	6			
	Stucco & Feed Bin	8, 9	21.9	0.30	344.2	19.20	0.07	4			
	Kettles	39, 46, 47, 55	22.9	1.22	363.7	3.05	1.18	40			
	Storage Bins	43, 58	26.5	0.61	310.4	7.92	0.37	12			
	Tube Mill Discharge	45	20.7	0.24	298.7	72.20	0.03**	1.0			
	#5 Raymond Mill	60	26.8	0.15	331.5	49.68	0.05	2			
	Additive Feed System	61	28.9	0.46	344.22	4.27	0.05	2			
	Calcium Carbonate Storage	67	10.1	0.15	305.40	15.24	7.56×10^{-3}	0.2			
31DVL160004 Maxwell House	Agglom Process	1, 10, 30, 31	14.6	1.0	374.8	15.55	1.14	40		439.7	3350.0
	Scrap Paper Cyclone	26, 27, 28, 29	21.3	0.03	298	0.61	0.22	8			
	Thermalo Afterburner	60, 61	27.4	0.49	793	18.98	0.14	5			
	Powder Airveyor	21, 22, 18, 20, 52	27.4	0.61	298.1	0.91	0.13	4			
	Continuous Roaster	5, D4, 12, 16	27.4	0.61	311.5	19.81	0.58	20			
	Boiler #2	4	45.7	0.43	397.0	67.97	0.72	25			

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TABLE 3-10 (Cont'd)

TSP/PM-10 Source Data Used in the Modeling Analysis (cont'd)

APIS Number/Facility	Source Description	APIS Source Number	Stack Data (m)		Operating Data		PM Emissions		PM PSD Source (EXP/CON)	UTM (km)	
			Height	Diameter	Temperature (K)	Velocity (m/sec)	(g/s)	(TPY)		East	North
	Green Coffee Silo	F0, F1, F2, F3, F4, F5, 53, 55, 56, 57, 58, 59, 23, 24, 25, 54	27.4	0.31	306.5	14.33	0.40	14			
	Cooling Carts	32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51	30.5	0.18	310.9	18.29	1.84	64			
	Thermalo Roaster #1	7	45.7	0.79	844.2	9.75	0.75	26			
	Roaster Afterburner	D3	27.4	2.29	811.5	3.66	0.31	11			
	Soluble Coffee Spray Dryer	6, 8, 9	47.2	1.07	383.7	18.59	2.20	76			
	Dryer	D5, D6, D7, D8, E0, E1, D2, 14, 15, 17	23.2	1.49	327.6	7.93	0.64	22			
	Boiler #1	D1, 98, 2, 3	45.7	0.98	607.0	0.61	0 42	14			
	Probat Afterburners	E2, E3, E4, E5, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86	27.4	1.0	737 6	7 93	1.24	43			
	Thermalo Stoner Cyclone	64, 65, 62, 63, 66, 87, 89, 90, 88, Z9, E6, E7, E8, E9, 97, B1, B2, B3, B4-B9, C1-C9, 67-76, 91-96, D9, F6, A1, A2, A3, A4, A5, A7, A8, A9	27.4	0.61	308.1	7.93	4.46	156			

• Calculated based on allowable lb/hr of particulates permitted.

•• Annual TPY allowable were given, calculated lb/hr.

TABLE 3-11

NO$_x$ Source Data Used in the Modeling Analysis

APIS Number/Facility	Source Description	APIS Source Number	Stack Data (m)		Operating Data		NO$_x$ Emissions		NO$_x$ PSD Source (EXP/CON)	UTM (km)	
			Height	Diameter	Temperature (K)	Velocity (m/sec)	(g/s)	(TPY)		East	North
31DVL160213 U.S. Naval Station - Mayport	Boiler #1 - #3, Bldg. 1241	01, 02, 03	12.2	0.91	544.1	14.33	9.67	336	-	460.4	3362.8
	Boiler #1 - #2, Bldg.250	04, 08	14.0	1.22	560.8	7.92	5.58	194	-		
	Hot Water Boiler B-1	11	15.5	0.24	477.4	7.32	9.69 x 10^{-3}	.337			
31DVL160005 Anchor Hocking Glass	Glass Melt Furnace #2	02	17.4	0.82	522.4	14.02	5.00	174	-		
	Glass Melt Furnace #3	03	33.2	1.71	429.7	11.58	8.91	310	-		
	Glass Melt Furnace #4	04	35.7	1.58	510.8	11.89	6.84	238	-		
31DVL160006 Anheuser Busch	Boiler #1 - #4	01 - 04	30.5	1.07	483.0	17.37	9.78	340	-	437.9	3366.8
	Grain Dryer #1	05	21.3	1.68	322.0	9.60	1.29	45	-		
	Grain Dryer #2	06	21.3	2.07	327.6	9.00	2.31	80	-		
	Wastewater Boiler	30	12.19	0.52	477.6	5.49	0.14	5			
	Anerobic & Bio Gas Flare	31,32	6.1	2.20	1000.0	15.00	0.06	2	-		
31DVL160039 SCM Glidco Organics	Boiler #4	04	12.2	1.10	405.2	14.02	1.64	57 (P)	-		
	Boiler #7	11	13.7	1.22	449.7	5.49	0.92	32	-		
31DVL160045 JEA - Northside	Steam Generator #1	01	73.2	5.03	400.8	23.16	187.10	6504 (P)	-	446.9	3365.0
	Steam Generator #2	02	88.4	5.12	394.1	13.11	130.86	4549 (P)	-		
	Steam Generator #3	03	103.6	7.01	438.6	19.20	190.23	6613	-		
	Combustion Turbines #3 - #6	06 - 09	10.1	6.55	779.7	18.29	72.17	2509 (Δ)	-		
	Auxiliary Boiler A	14	73.2	5.03	671.9	1.22	8.26	287 (P)	-		
	Auxiliary Boiler B	13	76.2	5.03	588.6	0.30	0.58	20 (P)	-		
31DVL16001 JEA - SJRPP	Units #1 & #2	01, 04	194.2	10.13	328.0	18.29	487.69	16953			
31DVL160046 JEA - Southside	Auxiliary Boiler	10	6.7	0.49	493.6	17.68	0.09	3	-		
31DVL160047 JEA - Kennedy	Combustion Turbine #4 & #5	03 - 06	13.7	2.80	651.9	8.84	5.61	195 (Δ)	-	440.0	3359.1
	Steam Generator #9	08	45.7	3.20	398.0	7.92	115.56	4017 (Δ)	-		

TABLE 3-11 (Cont'd)

NO_x Source Data Used in the Modeling Analysis

APIS Number/Facility	Source Description	APIS Source Number	Stack Data (m)		Operating Data		NO_x Emissions		NO_x PSD Source (EXP/CON)	UTM (km)	
			Height	Diameter	Temperature (K)	Velocity (m/sec)	(g/s)	(TPY)		East	North
	Auxiliary Boiler	13	10.1	0.49	493.6	17.68	0.34	12 (P)	-		
31DVL160003 Jefferson Smurfit	Power Boiler #10	11	61.0	3.05	341.5	9.70	38.89	1352	-	439.9	3359.3
	Recovery Boiler #9	05	53.3	3.20	409.8	22.86	4.32	150			
	Bark/Coal Boiler	13	60.96	3.05	334.8	10.67	38.89	1352			
31DVL160072 U.S Gypsum	Wallboard Kiln #2	33	13.7	1.07	421.9	28.96	0.98	34 (P)	-	438.9	3361.2
	Calcining Kettles #1 - #7	36	28.3	1.07	505.2	0.91	0.53	154	-		
	Dowtherm Heater	41	20.7	0.91	733.0	6.40	0.29	10 (P)	-		
	Rotary Kiln	48	26.8	0.49	339.1	59.13	0.98	34	-		
	Wall Board Kiln #3	59	29.0	2.04	369.1	1.52	2.70	94	-		
	Combustion Turbine #1 - #2	68.69	36.6	1.01	346.9	24.99	3.05	106	-		
31DVL160215 Naval Air Station - Mayport	Bldg. #104 Boiler	01	13.72	1.40	505.35	11.58	4.11	143		434.02	3342.08
	Power Plant #2 Boilers	02	39.62	2.13	505.35	3.66	0.75	26 (P)			
	Power Plant #3 Boilers	05	13.72	1.37	505.35	8.23	0.35	12 (P)			
	Engine Test Cells 7, 8, 9	07	3.66	3.81	310.91	6.10	0.17	6 (P)			
	Engine Test Cells 11 & 12	10	7.62	4.82	505.35	17.07	5.23	182			

(P) Denotes potential emissions used when allowable were not available.
(Δ) Denotes calculated tons per year from lb/hr data.

3.4 Background SO_2, PM_{10}, NO_2, and Lead Concentrations

For comparison of total ambient concentrations to the AAQS, background concentrations are estimated to account for sources which are not explicitly included in the atmospheric dispersion modeling analysis.

In order to estimate reasonable background SO_2 concentrations, a review of recent, available SO_2 monitoring data in Duval County was performed. Table 3-12 lists all of the continuous SO_2 monitors currently in operation in Duval County and their respective location relative to Cedar Bay. Annual average, 24-hour maximums, and 3-hour maximums for SO_2 for each monitor are shown in the table. The Ft. Caroline STP monitor ceased operation in March, 1990, so the station's 1990 averages are biased. All of the other five monitor's data recoveries exceeded 95 percent for that year. All stations except Kooker Park reported the lowest annual average SO_2 concentrations in 1990.

Highest short-term and annual average concentrations measured at these stations could have significant contributions from major SO_2 point sources. Use of the highest short-term and annual average SO_2 concentrations from any of these stations could over-estimate the actual background SO_2 concentrations, since all major sources of SO_2 (>100 tpy) are explicitly included in the dispersion modeling analysis, and their impacts could be double counted.

Therefore, it is reasonable to select the lowest of the second-highest short-term and annual average concentrations reported at any of the monitoring stations as the SO_2 background concentrations to be used in the compliance analysis. Referring to Table 3-12, these concentrations are 68 $\mu g/m^3$, 3-hour; 28 $\mu g/m^3$, 24-hour; and 5 $\mu g/m^3$, annual average. These were all measured at the Minerva Street monitoring station.

Available data for PM_{10} and NO_2 are shown in Table 3-13 and 3-14, respectively. The same reasoning applies to this data in terms of major source influences and potential double counting of source impacts being modeled. Therefore, the lowest of the second-highest short-term and annual average concentrations are selected for use in the compliance analyses.

Lead concentrations were also measured at two sites in Jacksonville, Kooker Park and Roselle & Copeland. All quarterly lead concentrations at these two sites for the three year period 1989-1991 were reported as 0.0 $\mu g/m^3$. Therefore, lead background concentrations were not included in the impact evaluation.

Table 3-15 summarizes all of the background concentrations selected. These are added to the modeled impacts of major sources and the totals compared to the applicable AAQS.

TABLE 3-12

Summary of Continuous SO_2 Air Quality Data in Duval County, 1989 - 1991

						SO_2 Concentration (µg/m³)		
SAROAD Site No. (Distance Away)	Location	Monitoring Method	Period	No. of Obs.	Percent Data Recovery	3-Hour[a]	24-Hour[a]	Annual Average
1960-081-HO2 (1.4 km)	Cedar Bay STP	Continuous	1989	8410	96.0	122	38	8
			1990	8517	97.2	140	42	7
			1991	8315	94.9	187	41	7
1960-094-HO2 (3.5 km)	9501 August Rd.	Continuous	1989	8186	93.4	211	58	8
			1990	8388	95.8	198	54	7
			1991	8060	92.0	169	55	7
1960-079-HO2 (5.6 km)	Ft. Caroline STP	Continuous	1989	8071	92.1	167	71	8
			1990b	1689	19.3	86	34	6
			1991					
1960-094-HO2 (7.3 km)	5060 Cedar Pt. Rd.	Continuous	1989	6776	77.4	225	70	10
			1990	8547	97.6	137	38	6
			1991	8181	93.4	206	45	5
1960-032-HO2 (7.9 km)	Kooker Park	Continuous	1989	7586	86.6	129	33	6
			1990	8401	95.9	107	35	8
			1991	8172	93.3	108	32	7
1960-080-HO2 (13.4 km)	1605 Minerva St.	Continuous	1989	7536	86.0	107	35	7
			1990	8439	96.3	68	28	5
			1991	8372	95.6	83	30	6

Note:
km = kilometers.
No. of Obs. = number of observations.
SO_2 = sulfur dioxide
µg/m³ = micrograms per cubic meter.

[a] Second-highest concentrations for calendar year are shown.
[b] Ceased operations 3/90

Source: *Florida DER, 1989, 1990, 1991.*

TABLE 3-13

Summary of PM-10 Air Quality Data in Duval County, 1989-1991

					PM10 Concentration (µg/m³)	
SAROAD Site	**Location**	**Monitoring Method**	**Period**	**No. of Obs.**	**24-Hr[a]**	**Annual**
1960-004	1070 E. Adams St	64	1989	32	57	38
			1990	60	56	34
			1991	60	53	28
1960-053	Sewage Treatment Plant 2221 Buckmans	64	1989	3	32	32
			1990	61	61	32
			1991	60	50	31
1960-084	Roselle & Copeland	64	1989	59	58	35
			1990	61	60	32
			1991	60	59	32

(a)Second-highest for calendar year.

TABLE 3-14

Summary of NO_2 Air Quality Data

SAROAD Site No.	Location	Monitoring Method	Period	No. of Obs.	Percent Data Recovery	NO_2 Concentration ($\mu g/m^3$) Annual
1960-032	Kooker Park	Continuous	1989	7815	89.2	29
			1990	8169	93.3	28
			1991	8055	91.9	25

TABLE 3-15

Background Concentrations Used in the AAQS Compliance Evaluation

Site	Location	Pollutant	Period	Concentration ($\mu g/m^3$)
1960-080	1605 Minerva St.	SO_2	3H 24H Annual	68 28 5
1960-032	Kooker Park	NO_2	Annual	25
1960-053 1960-004	Sewage Treatment Plant 1070 E. Adams St.	PM_{10}	24H Annual	32 28

3.5 Findings for the AAQS Compliance Evaluation

The results of the modeling for the CBCP alone, as proposed to be modified, are presented in Tables 3-16 through 3-20 for the pollutants CO, NO_2, PM-10, Pb and SO_2. Each table lists the maximum predicted impact of the CBCP and the location of the model receptor at which the impact is predicted for each applicable AAQS averaging period and each year of meteorological data modeled. The significant impact (SIL) level is also listed for the applicable pollutant and averaging period. Although, no SIL for Pb has yet been promulgated by EPA, the Florida proposed SIL is available for comparison.

The results for CO and NO_2 are all well below the SILs. For this reason, these pollutants were eliminated from further consideration since they can neither cause nor contribute to an AAQS violation. The maximum predicted 24-hour concentrations of Pb shown in Table 3-19 are on the order of 0.3% of the 3-month AAQS. The 24-hour average impact is used as a very conservative measure of the expected 3-month average impact. Given this very low, yet conservative predicted impact and the fact that state monitoring has not detected measurable ambient Pb concentrations, it is concluded that Pb impacts are insignificant and therefore could neither cause nor contribute to a violation of the AAQS. The maximum predicted values are, however, well below the proposed State SIL of 0.03 $\mu g/m^3$.

The modeling results for SO_2 are presented in Table 3-20. The CBCP is predicted to have maximum impacts above the SILs. These maximum impacts are predicted to occur at short distances. Table 3-20 also lists the distance beyond which the Cedar Bay impacts are below the SILs. The maximum of these distances defines the facility's significant impact area (SIA) for SO_2 concentrations. The SIA extends 4.5 kilometers from the CFB boilers' stack.

Since significant SO_2 concentrations were predicted for the CBCP, a multi-source modeling analysis was performed for the areas of significant impact. All of the existing and permitted SO_2 sources in the inventory presented in Table 3-9 were modeled along with the CBCP. The background SO_2 concentrations from Table 3-15 were added to the modeled concentrations to represent total ambient SO_2 concentrations for comparison to the AAQS. Consistent with EPA's rules for the 3 and 24-hour averages, the highest second-high (H2H) predicted total concentrations over the year were then scanned to identify the maximum predicted total ambient SO_2 concentrations to which the CBCP contributes an impact above the SILs for comparison to the standards. If these total concentrations do not exceed the AAQS, then it can be concluded that the CBCP will neither cause nor contribute to a violation. The results of this analysis are summarized in Table 3-21. This table contains, for each averaging period and for each meteorological year modeled, the maximum predicted total ambient SO_2 concentration for

TABLE 3-16

Findings For The AAQS Compliance Evaluation Maximum Predicted CO Impacts Due To The CBCP As Proposed to be Modified

Averaging Period	Meteorological Year	Concentration (µg/m³)	Location[(a)] Distance (km)	Location[(a)] Azimuth (deg)	SIL (µg/m³)
1-Hour	1983	54.9	1.25	70	2000
	1984	54.6	1.0	80	
	1985	65.6	1.0	70	
	1986	64.5	1.0	240	
	1987	55.0	1.25	50	
8-Hour	1983	9.1	3.0	70	500
	1984	11.1	1.0	260	
	1985	13.4	1.25	50	
	1986	11.2	2.5	80	
	1987	12.8	1.25	50	

[(a)] Relative to the CFB Boilers Stack

TABLE 3-17

Findings For The AAQS Compliance Evaluation Maximum Predicted Annual Average NO_2 Impacts Due To The CBCP As Proposed to be Modified

Meteorological Year	Concentration ($\mu g/m^3$)	Location[(a)]	
		Distance (km)	Azimuth (deg)
1983	0.56	0.2	90
1984	0.56	0.2	90
1985	0.53	0.4	10
1986	0.54	0.4	30
1987	0.07	0.2	80
SIL = 1.0 $\mu g/m^3$			

(a) Relative to the CFB Boilers Stack

TABLE 3-18

Findings For The AAQS Compliance Evaluation Maximum Predicted PM-10 Impacts Due To The CBCP As Proposed to be Modified

Averaging Period	Meteorological Year	Concentration ($\mu g/m^3$)	Location[a] Distance (km)	Location[a] Azimuth (deg)	SIL ($\mu g/m^3$)	Significant Impact Distance[b] (km)
24-Hour	1983	20.7	0.3	340	5.0	1.00
	1984	23.6	0.349	350		1.25
	1985	23.7	0.372	356		1.00
	1986	29.5	0.370	351		1.00
	1987	19.9	0.3	340		0.90
Annual	1983	3.58	0.183	19	1.0	0.50
	1984	4.00	0.3	340		0.60
	1985	3.70	0.183	19		0.60
	1986	3.67	0.183	19		0.60
	1987	3.66	0.183	19		0.50

[a] Relative to CFB Boiler Stack
[b] Furthest Distance Beyond Which Impacts Are Less Than SILs

TABLE 3-19

Findings For The AAQS Compliance Evaluation Maximum 24-Hour Predicted Pb Impacts Due To The CBCP As Proposed to be Modified

Meteorological Year	Concentration (µg/m^3)	Location[b]	
		Distance (km)	Azimuth (deg)
1983	0.0048	0.2	80
1984	0.0045	0.2	90
1985	0.0032	0.4	10
1986	0.0031	0.2	100
1987	0.0044	0.2	80

[a] AAQS = 1.5 3-month Average, Background is below detectable

[b] Relative to the CFB Boilers Stack

TABLE 3-20

Findings For The AAQS Compliance Evaluation Maximum Predicted SO_2 Impacts Due To The CBCP As Proposed to be Modified

Averaging Period	Meteorological Year	Concentration ($\mu g/m^3$)	Location[a] Distance (km)	Location[a] Azimuth (deg)	SIL ($\mu g/m^3$)	Significant Impact Distance[b] (km)
3-Hour	1983	152.3	0.3	350	25.0	1.5
	1984	131.5	0.2	80		1.75
	1985	97.1	0.2	80		2.5
	1986	103.7	0.2	80		2.5
	1987	193.5	0.2	80		2.5
24-Hour	1983	16.6	0.2	80	5.0	3.5
	1984	19.4	2.5	20		4.0
	1985	19.7	0.4	10		4.5
	1986	20.6	0.3	260		4.5
	1987	15.0	0.2	60		4.5
Annual	1983	1.18	0.2	90	1.0	0.2
	1984	1.18	0.2	90		0.2
	1985	1.11	0.4	10		0.4
	1986	1.08	0.4	30		0.4
	1987	1.40	0.2	80		0.2

[a] Relative to CFB Boiler Stack

[b] Furthest Distance Beyond Which Impacts Are Less Than SILs

TABLE 3-21

Findings For The AAQS Compliance Evaluation Predicted Total Ambient SO_2 Concentrations To Which CBCP As Proposed to be Modified Contributes An Impact Above The SILs

Averaging Period	Meteorological Year	Concentration for Compliance Evaluation ($\mu g/m^3$)	AAQS ($\mu g/m^3$)	Cedar Bay Contribution ($\mu g/m^3$)
3-Hour	1983	479.1	1300	40.1
	1984	478.3		40.6
	1985	500.5		36.0
	1986	393.0		34.2
	1987	472.6		26.2
24-Hour	1983	150.1	260	6.0
	1984	152.7		5.0
	1985	157.0		6.5
	1986	125.5		5.4
	1987	128.7		6.3
Annual	1983	36.4	60	1.05
	1984	36.3		1.18
	1985	38.0		1.11
	1986	34.7		1.04
	1987	33.3		1.05

comparison to the standard and to which the CBCP as proposed to be modified contributes a significant impact. These are compared to the applicable AAQS. Also listed is CBCP's contribution to the total concentration. None of the total concentrations exceeds the AAQS. Thus, it can be concluded that the CBCP, as proposed to be modified, would neither cause nor contribute to a violation of the SO_2 AAQS.

The modeling results for PM-10 are presented in Table 3-18. The CBCP as proposed to be modified is predicted to have maximum impacts above the SILs. The maximum impacts, due mainly to the emissions from the cooling tower and aggregate materials handling, are predicted to occur at very short distances, at or near the property boundary. The significant impact area extends no farther than 1.25 km from the CFB boilers' stack. Beyond this distance, PM-10 impacts are insignificant.

Since significant PM-10 impacts were predicted for the CBCP, a multi-source modeling analysis was performed. All of the existing and permitted PM-10 sources in the inventory presented in Table 3-10 were modeled along with the CBCP. The background PM-10 concentrations from Table 3-15 were added to the modeled concentrations to represent total PM-10 concentrations for comparison to the AAQS. Table 3-22 presents the results of this analysis. For each averaging period and meteorological year modeled, the predicted total ambient PM-10 concentration for comparison to the standard and to which the CBCP contributes a significant impact is presented. These are compared to the AAQS. Also listed is Cedar Bay's contribution to the total concentration. None of the total concentrations exceeds the AAQS. Thus, it can be concluded that the CBCP, as proposed to be modified, would neither cause nor contribute to a violation of the PM-10 AAQS.

The CBCP also produces emission of volatile organic compounds (VOC), which can be precursors to ozone formation. However, no single source modeling can sufficiently characterize that source's impact on the photochemical process and ozone concentrations. However, since the VOC emissions of the CBCP will be more than offset by shutdown of the SKC Power and Bark Boilers, no significant impact on ozone concentrations is expected.

Based on all of the foregoing results, it can be concluded that the CBCP, as proposed to be modified, would neither cause nor contribute to a violation of an ambient air quality standard.

TABLE 3-22

Findings For The AAQS Compliance Evaluation Predicted Total Ambient PM-10 Concentrations To Which CBCP As Proposed to be Modified Contributes An Impact Above The SILs

Averaging Period	Meteorological Year	Concentration for Compliance Evaluation (μg/m^3)	AAQS (μg/m^3)	Cedar Bay Contribution (μg/m^3)
24-Hour	1983	61.9	150	14.2
	1984	65.0		15.0
	1985	62.9		16.5
	1986	59.2		27.0
	1987	61.7		17.1
Annual	1983	34.0	50	3.58
	1984	34.8		4.00
	1985	34.6		3.70
	1986	34.4		3.67
	1987	34.0		3.66

3.6 Findings for the PSD Increment Compliance Evaluations

The SILs are the same for AAQS and PSD Class II increments. The CBCP as proposed to be modified was shown in the previous section not to have a significant impact for the pollutant NO_2. Thus, in addition to not causing or contributing to an AAQS violation, it would neither cause nor contribute to a violation of the PSD Class II increments. Since SO_2 impacts are above the Class II SILs, a PSD Class II increment compliance evaluation was performed. Since PM-10 impacts are above the Class II SILs. A PSD Class II increment compliance evaluation was performed for TSP. A PSD Class I increment compliance evaluation was performed for SO_2, TSP and NO_2.

3.6.1 SO_2 PSD Increment Compliance Evaluation

The first step in the SO_2 PSD increment compliance evaluation was to determine the maximum predicted Class II and Class I SO_2 increment consumed by the CBCP itself. These results are summarized in Table 3-23. For each averaging period and meteorological year, the maximum SO_2 impact of the CBCP is presented for the Class II and Class I areas. The respective allowable increments are also listed. As shown in the table, the maximum SO_2 impacts of the CBCP by itself exceed neither the Class II nor Class I allowable increments. Next, an analysis was performed to identify the maximum total Class II increment consumption by all PSD increment consuming and expanding sources to which Cedar Bay would contribute an impact above the Class II SILs. The results of this analysis are summarized in Table 3-24. Consistent with EPA's rules, for each averaging period and meteorological year the predicted total Class II increment consumption (highest annual, H2H 3- and 24-hour impacts) to which Cedar Bay contributes an impact above the SILs is listed, along with the Cedar Bay contribution. As shown in this table, none of the total concentrations exceed the Class II PSD increments. Thus it can be concluded that the CBCP, as proposed to be modified, would neither cause nor contribute to a violation of the PSD Class II SO_2 increments.

For the Class I areas, the total SO_2 increment consumption due to all increment consuming and expanding sources was identified for each averaging period and meteorological year. These results are summarized in Table 3-25. For the 3- and 24-hour averaging periods, the highest second-high concentrations are listed for each of the Class I areas. For the annual average period, the highest concentration is listed. Also listed are the contribution of the CBCP to these impacts. As shown in the table, none of the concentrations exceeds allowable increments. In fact, the results for the Wolf Island Wilderness Area indicate that the annual average SO_2 Class I increment is being expanded. The negative concentrations result from the impacts of increment expanding sources exceeding those of increment consuming sources. Based on these results,

TABLE 3-23

Findings For The PSD Increment Compliance Evaluation Maximum Predicted PSD SO_2 Increment Consumed By The CBCP As Proposed to be Modified

		PSD Class II Area		PSD Class I Areas		
				Concentration (µg/m³)		Allowable Increment (µg/m³)
Averaging Period	Meteorological Year	Concentration (µg/m³)	Allowable Increment	Okefenokee	Wolf Island	
3-Hour	1983	152.3	512	2.97	1.50	25
	1984	131.5		3.39	1.82	
	1985	97.1		3.11	2.97	
	1986	103.7		2.95	1.50	
	1987	193.5		4.10	1.55	
24-Hour	1983	16.6	91	0.98	0.300	5
	1984	19.4		0.85	0.463	
	1985	19.7		1.12	0.603	
	1986	20.6		1.12	0.250	
	1987	15.0		1.01	0.411	
Annual	1983	1.18	20	0.033	0.016	2
	1984	1.18		0.042	0.019	
	1985	1.11		0.041	0.024	
	1986	1.08		0.040	0.017	
	1987	1.40		0.039	0.016	

TABLE 3-24

Findings For The PSD Increment Compliance Evaluation Maximum Predicted Total PSD Class II SO2 Increment Consumption To Which CBCP As Proposed to be Modified Contributes An Impact Above The SILs

Averaging Period	Meteorological Year	Concentration for Compliance Evaluation µg/m^3	Class II Increment	Cedar Bay Contribution (µg/m^3)
3-Hour	1983	113.9	512	113.9
	1984	116.9		116.9
	1985	96.5		96.5
	1986	106.7		71.8
	1987	129.6		129.6
24-Hour	1983	24.6	91	6.1
	1984	23.7		15.5
	1985	28.5		5.1
	1986	69.2		5.1
	1987	24.3		14.8
Annual	1983	5.01	20	1.18
	1984	4.37		1.18
	1985	5.04		1.11
	1986	4.24		1.08
	1987	4.59		1.30

TABLE 3-25

Findings For The PSD Increment Compliance Evaluation Total PSD Class I SO_2 Increment Consumption In The Okefenokee and Wolf Island Wilderness Areas

Averaging Period	Meteorological Year	Allowable Increment ($\mu g/m^3$)	Okefenokee Concentrations ($\mu g/m^3$) for Compliance Evaluation		Wolf Island Concentrations ($\mu g/m^3$) for Compliance Evaluation	
			Total Concentration	Cedar Bay Contribution	Total Concentration	Cedar Bay Contribution
3-Hour	1983	25	13.5	1.1	10.7	0.29
	1984		16.3	0.9	9.4	0.95
	1985		17.4	0.7	12.6	0.95
	1986		17.4	1.6	7.9	0.63
	1987		14.8	0.2	10.3	0.26
24-Hour	1983	5	3.5	0.3	1.8	0.04
	1984		3.3	0.3	1.8	0.06
	1985		3.8	0.3	2.1	0.17
	1986		3.6	0.3	1.5	0.13
	1987		2.9	0.4	2.3	0.06
Annual	1983	2	0.02	0.03	-0.04	0.02
	1984		0.04	0.04	-0.09	0.02
	1985		0.04	0.04	-0.09	0.02
	1986		0.03	0.04	-0.04	0.02
	1987		0.05	0.04	-0.06	0.02

it can be concluded that the CBCP, as proposed to be modified, would neither cause nor contribute to a violation of the PSD Class I SO_2 increments.

3.6.2 TSP PSD Increment Compliance Evaluation

First, the maximum predicted Class II and Class I TSP increment consumed by the CBCP itself was determined. These results are summarized in Table 3-26. For each averaging period and meteorological year, the maximum TSP impact of the CBCP is presented for the Class II and Class I areas. The respective allowable increments are also listed. As shown in the table, the maximum TSP impacts of the CBCP by itself exceed neither the Class II nor Class I allowable increments, with the exception of 1986 24-hour Class II impact. Next, an analysis was performed to identify the maximum total Class II increment consumption by all PSD increment consuming and expanding sources to which CBCP would contribute an impact above the Class II SILs. The results of this analysis are summarized in Table 3-27. Consistent with EPA's rules, for each averaging period and meteorological year the predicted total Class II increment consumption (maximum annual, H2H 24-hour) to which CBCP contributes an impact above the SILs is listed, along with the CBCP contribution. As shown in this table, none of the total concentrations exceed the Class II PSD increments. Thus, it can be concluded that the CBCP, as proposed to be modified, would neither cause nor contribute to a violation of the PSD Class II TSP increments.

For the Class I areas, the maximum total TSP increment consumption due to all increment consuming and expanding sources was identified for each averaging period and meteorological year. These results are summarized in Table 3-28. For the 24-hour averaging period, the highest second-high concentrations are listed for each of the Class I areas. For the annual averaging period, the highest concentration is listed. Also listed are the contribution of Cedar Bay to these impacts. As shown in the table, none of the concentrations exceeds allowable increments. Based on these results, it can be concluded that the CBCP, as proposed to be modified, would neither cause nor contribute to a violation of the PSD Class I TSP increments.

3.6.3 Findings for the PSD Class I NO_2 Increment Compliance Evaluation

The results of the increment consumption analysis for NO_2 are summarized in Table 3-29. For each year modeled, the maximum total annual average increment consumption is listed along with the contribution of CBCP, as proposed to be modified, to that concentration. The maximum annual average Cedar Bay impact in the Class I areas is also listed. As shown in the table, there is a net increment expansion resulting from the cumulative effect of the increment expansion sources and those consuming increment. In this case, the SKC Power and Bark Boilers are the only increment expansion sources (by shutting down) and the CBCP is the only increment

TABLE 3-26

Findings For The PSD Increment Compliance Evaluation Maximum Predicted PSD TSP Increment Consumed By The CBCP As Proposed to be Modified

Averaging Period	Meteorological Year	PSD Class II Area		PSD Class I Areas		
				Concentration ($\mu g/m^3$)		Allowable Increment ($\mu g/m^3$)
		Concentration ($\mu g/m^3$)	Allowable Increment	Okefenokee	Wolf Island	
24-Hour	1983	24.0	37	0.094	0.052	10
	1984	31.6		0.098	0.052	
	1985	28.7		0.137	0.066	
	1986	37.3		0.123	0.037	
	1987	23.6		0.107	0.064	
Annual	1983	3.95	19	0.005	0.002	5
	1984	4.27		0.006	0.003	
	1985	4.06		0.005	0.003	
	1986	4.07		0.005	0.002	
	1987	4.04		0.005	0.002	

TABLE 3-27

Findings For The PSD Increment Compliance Evaluation Predicted Total PSD Class II TSP Increment Consumption To Which CBCP As Proposed to be Modified Contributes An Impact Above The SILs

Averaging Period	Meteorological Year	Concentration for Compliance Evaluation (µg/m³)	Class II Increment	Cedar Bay Contribution (µg/m³)
24-Hour	1983	20.0	37	19.3
	1984	26.6		26.8
	1985	23.7		24.5
	1986	32.2		33.4
	1987	21.8		23.5
Annual	1983	0.91	19	3.68
	1984	1.30		4.27
	1985	0.99		3.56
	1986	1.60		3.47
	1987	0.84		3.03

TABLE 3-28

Findings For The PSD Increment Compliance Evaluation
Total PSD Class I TSP Increment Consumption

Averaging Period	Meteorological Year	Allowable Increment ($\mu g/m^3$)	Okefenokee Concentrations ($\mu g/m^3$)		Wolf Island Concentrations ($\mu g/m^3$)	
			Total Concentration	To Highest Second-High	Total Concentration	Cedar Bay Contribution
24-Hour	1983	10	0.38	0.053	0.09	0.028
	1984		0.37	0.051	0.13	0.046
	1985		0.48	0.116	0.16	0.065
	1986		0.45	0.105	0.08	0.013
	1987		0.41	0.070	0.14	0.048
Annual	1983	5	0.011	0.004	0.006	0.002
	1984		0.013	0.008	0.007	0.003
	1985		0.014	0.005	0.009	0.003
	1986		0.016	0.005	0.007	0.002
	1987		0.013	0.005	0.006	0.002

TABLE 3-29

Findings For The PSD Increment Compliance Evaluation
Total PSD Class I Annual Average NO_2 Increment Consumption

Meteorological Year	Okefenokee Concentrations (μg/m^3)			Wolf Island Concentrations (μg/m^3)		
	Highest	Cedar Bay Contribution To Highest	Maximum Cedar Bay Impact	Highest	Cedar Bay Contribution To Highest	Maximum Cedar Bay Impact
1983	-0.006	0.024	0.024	-0.01	0.013	0.013
1984	-0.005	0.017	0.017	-0.02	0.016	0.016
1985	-0.009	0.018	0.018	-0.02	0.020	0.020
1986	-0.004	0.013	0.013	-0.01	0.014	0.014
1987	-0.004	0.022	0.022	-0.02	0.013	0.013

consuming source. The impacts of the CBCP by itself are well below the allowable PSD Class I NO_2 increment. Based on these results, it is demonstrated that the CBCP, as proposed to be modified, would neither cause nor contribute to a violation of the PSD Class I NO_2 increment.

3.7 Findings for the Draft Air Toxics No Threat Levels (NTL) Evaluation

The air toxics emissions from the CBCP, by itself, as proposed to be modified, were modeled to determine the maximum impact of each pollutant for each averaging period for which a draft NTL has been proposed. The results are summarized in Table 3-30. For each pollutant and averaging period the maximum predicted concentration due to the CBCP, as proposed to be modified, is presented and compared to the applicable draft NTL. A thorough review of the results for each pollutant demonstrates that in each case the impacts are below the draft No Threat Levels.

The Draft NTLs are developed with a conservative bias intentionally built in to represent levels that are not likely to endanger public health nor cause appreciable health risks. Thus, it can be concluded that emissions of air toxics from the CBCP, as proposed to be modified, would not endanger the public health nor pose unacceptable health risks.

TABLE 3-30

Maximum Cedar Bay Air Toxics Impacts (μg/m^3)

Pollutant	Averaging Period	Year	Cedar Bay	Draft No Threat Levels
Antimony Compounds	8-hour	1983	0.63E-03	5
		1984	0.77E-03	5
		1985	0.93E-03	5
		1986	0.78E-03	5
		1987	0.89E-03	5
	24-hour	1983	0.27E-03	1.2
		1984	0.30E-03	1.2
		1985	0.33E-03	1.2
		1986	0.28E-03	1.2
		1987	0.31E-03	1.2
	Annual	1983	0.27E-03	3.0E-01
		1984	0.30E-03	3.0E-01
		1985	0.33E-03	3.0E-01
		1986	0.16E-04	3.0E-01
		1987	0.31E-03	3.0E-01

TABLE 3-30 (Cont'd)

Maximum Cedar Bay Air Toxics Impacts (μg/m^3)

Pollutant	Averaging Period	Year	Cedar Bay	Draft No Threat Levels
Arsenic	8-hour	1983	0.008	2
		1984	0.009	2
		1985	0.011	2
		1986	0.009	2
		1987	0.011	2
	24-hour	1983	0.003	0.48
		1984	0.004	0.48
		1985	0.004	0.48
		1986	0.003	0.48
		1987	0.004	0.48
	Annual	1983	1.6E-04	2.3E-04
		1984	1.8E-04	2.3E-04
		1985	1.6E-04	2.3E-04
		1986	1.9E-04	2.3E-04
		1987	2.1E-04	2.3E-04

TABLE 3-30 (Cont'd)

Maximum Cedar Bay Air Toxics Impacts (µg/m^3)

Pollutant	Averaging Period	Year	Cedar Bay	Draft No Threat Levels
Barium	8-hour	1983	0.04	5
		1984	0.05	5
		1985	0.07	5
		1986	0.06	5
		1987	0.06	5
	24-hour	1983	0.02	1.2
		1984	0.02	1.2
		1985	0.02	1.2
		1986	0.02	1.2
		1987	0.02	1.2
	Annual	1983	0.96E-03	5.0E+01
		1984	0.11E-02	5.0E+01
		1985	0.97E-03	5.0E+01
		1986	0.12E-02	5.0E+01
		1987	0.13E-02	5.0E+01

TABLE 3-30 (Cont'd)

Maximum Cedar Bay Air Toxics Impacts ($\mu g/m^3$)

Pollutant	Averaging Period	Year	Cedar Bay	Draft No Threat Levels
Beryllium	8-hour	1983	0.94E-03	0.02
		1984	0.11E-02	0.02
		1985	0.96E-03	0.02
		1986	0.94E-03	0.02
		1987	0.87E-03	0.02
	24-hour	1983	0.26E-03	0.0048
		1984	0.28E-03	0.0048
		1985	0.32E-03	0.0048
		1986	0.27E-03	0.0048
		1987	0.30E-03	0.0048
	Annual	1983	0.15E-04	4.2E-04
		1984	0.19E-04	4.2E-04
		1985	0.17E-04	4.2E-04
		1986	0.18E-04	4.2E-04
		1987	0.17E-04	4.2E-04

TABLE 3-30 (Cont'd)

Maximum Cedar Bay Air Toxics Impacts ($\mu g/m^3$)

Pollutant	Averaging Period	Year	Cedar Bay	Draft No Threat Levels
Cadmium	8-hour	1983	0.40E-02	0.5
		1984	0.47E-02	0.5
		1985	0.40E-02	0.5
		1986	0.39E-02	0.5
		1987	0.38E-02	0.5
	24-hour	1983	0.12E-02	0.12
		1984	0.13E-02	0.12
		1985	0.14E-02	0.12
		1986	0.12E-02	0.12
		1987	0.14E-02	0.12
	Annual	1983	0.62E-04	5.6E-04
		1984	0.81E-04	5.6E-04
		1985	0.72E-04	5.6E-04
		1986	0.75E-04	5.6E-04
		1987	0.77E-04	5.6E-04

TABLE 3-30 (Cont'd)

Maximum Cedar Bay Air Toxics Impacts (μg/m^3)

Pollutant	Averaging Period	Year	Cedar Bay	Draft No Threat Levels
Chromium VI Compounds	8-hour	1983	0.005	0.5
		1984	0.004	0.5
		1985	0.004	0.5
		1986	0.003	0.5
		1987	0.004	0.5
	24-hour	1983	0.0012	0.12
		1984	0.0013	0.12
		1985	0.0015	0.12
		1986	0.0012	0.12
		1987	0.0014	0.12
	Annual	1983	6.0E-05	8.3E-05
		1984	6.8E-05	8.3E-05
		1985	6.0E-05	8.3E-05
		1986	7.1E-05	8.3E-05
		1987	7.7E-05	8.3E-05

TABLE 3-30 (Cont'd)

Maximum Cedar Bay Air Toxics Impacts (μg/m^3)

Pollutant	Averaging Period	Year	Cedar Bay	Draft No Threat Levels
Copper	8-hour	1983	0.11	10
		1984	0.12	10
		1985	0.11	10
		1986	0.10	10
		1987	0.10	10
	24-hour	1983	0.02	2.4
		1984	0.02	2.4
		1985	0.02	2.4
		1986	0.02	2.4
		1987	0.02	2.4
Fluorides (as F)	8-hour	1983	0.04	25
		1984	0.05	25
		1985	0.06	25
		1986	0.05	25
		1987	0.06	25
	24-hour	1983	0.02	6
		1984	0.02	6
		1985	0.02	6
		1986	0.02	6
		1987	0.02	6

TABLE 3-30 (Cont'd)

Maximum Cedar Bay Air Toxics Impacts (μg/m^3)

Pollutant	Averaging Period	Year	Cedar Bay	Draft No Threat Levels
Formaldehyde	8-hour	1983	0.15	12
		1984	0.18	12
		1985	0.16	12
		1986	0.15	12
		1987	0.14	12
	24-hour	1983	0.23	2.88
		1984	0.35	2.88
		1985	0.034	2.88
		1986	0.029	2.88
		1987	0.027	2.88
	Annual	1983	0.24E-02	7.7E-02
		1984	0.31E-02	7.7E-02
		1985	0.28E-02	7.7E-02
		1986	0.29E-02	7.7E-02
		1987	0.27E-02	7.7E-02

TABLE 3-30 (Cont'd)

Maximum Cedar Bay Air Toxics Impacts (μg/m^3)

Pollutant	Averaging Period	Year	Cedar Bay	Draft No Threat Levels
Hydrogen Chloride	8-hour	1983	0.087	75
		1984	0.11	75
		1985	0.13	75
		1986	0.11	75
		1987	0.12	75
	24-hour	1983	0.037	18
		1984	0.041	18
		1985	0.046	18
		1986	0.039	18
		1987	0.043	18
	Annual	1983	0.19E-02	7.0E+00
		1984	0.21E-02	7.0E+00
		1985	0.19E-02	7.0E+00
		1986	0.23E-02	7.0E+00
		1987	0.24E-02	7.0E+00

TABLE 3-30 (Cont'd)

Maximum Cedar Bay Air Toxics Impacts ($\mu g/m^3$)

Pollutant	Averaging Period	Year	Cedar Bay	Draft No Threat Levels
Indium Compounds	8-hour	1983	0.10E-04	1
		1984	0.12E-04	1
		1985	0.15E-04	1
		1986	0.12E-04	1
		1987	0.14E-04	1
	24-hour	1983	0.43E-05	0.24
		1984	0.48E-05	0.24
		1985	0.53E-05	0.24
		1986	0.45E-05	0.24
		1987	0.50E-05	0.24

TABLE 3-30 (Cont'd)

Maximum Cedar Bay Air Toxics Impacts (μg/m^3)

Pollutant	Averaging Period	Year	Cedar Bay	Draft No Threat Levels
Lead Compounds	8-hour	1983	0.011	0.5
		1984	0.009	0.5
		1985	0.006	0.5
		1986	0.007	0.5
		1987	0.010	0.5
	24-hour	1983	0.0048	0.12
		1984	0.0045	0.12
		1985	0.0032	0.12
		1986	0.0031	0.12
	Annual	1983	3.4E-04	9.0E-02
		1984	3.4E-04	9.0E-02
		1985	3.2E-04	9.0E-02
		1986	3.1E-04	9.0E-02
		1987	4.1E-04	9.0E-02

TABLE 3-30 (Cont'd)

Maximum Cedar Bay Air Toxics Impacts ($\mu g/m^3$)

Pollutant	Averaging Period	Year	Cedar Bay	Draft No Threat Levels
Manganese	8-hour	1983	0.01	50
		1984	0.02	50
		1985	0.02	50
		1986	0.02	50
		1987	0.02	50
	24-hour	1983	0.0057	12
		1984	0.0064	12
		1985	0.0071	12
		1986	0.0060	12
		1987	0.0067	12
	Annual	1983	0.29E-03	4.0E-01
		1984	0.33E-03	4.0E-01
		1985	0.29E-03	4.0E-01
		1986	0.35E-03	4.0E-01
		1987	0.38E-03	4.0E-01

TABLE 3-30 (Cont'd)

Maximum Cedar Bay Air Toxics Impacts (µg/m^3)

Pollutant	Averaging Period	Year	Cedar Bay	Draft No Threat Levels
Mercury Alkyl Compounds	8-hour	1983	0.28E-02	0.1
		1984	0.35E-02	0.1
		1985	0.42E-02	0.1
		1986	0.35E-02	0.1
		1987	0.40E-02	0.1
	24-hour	1983	0.12E-02	0.024
		1984	0.13E-02	0.024
		1985	0.15E-02	0.024
		1986	0.13E-02	0.024
		1987	0.14E-02	0.024
Molybdenum	8-hour	1983	0.02	50
		1984	0.02	50
		1985	0.02	50
		1986	0.02	50
		1987	0.02	50
	24-hour	1983	0.32E-02	12
		1984	0.42E-02	12
		1985	0.41E-02	12
		1986	0.34E-02	12
		1987	0.38E-02	12

TABLE 3-30 (Cont'd)

Maximum Cedar Bay Air Toxics Impacts (µg/m^3)

Pollutant	Averaging Period	Year	Cedar Bay	Draft No Threat Levels
Nickel	8-hour	1983	0.06	1
		1984	0.08	1
		1985	0.07	1
		1986	0.06	1
		1987	0.06	1
	24-hour	1983	0.01	0.24
		1984	0.01	0.24
		1985	0.01	0.24
		1986	0.01	0.24
		1987	0.01	0.24
Phosphorous	8-hour	1983	0.04	1
		1984	0.05	1
		1985	0.04	1
		1986	0.04	1
		1987	0.04	1
	24-hour	1983	0.01	0.24
		1984	0.01	0.24
		1985	0.01	0.24
		1986	0.01	0.24
		1987	0.01	0.24

TABLE 3-30 (Cont'd)

Maximum Cedar Bay Air Toxics Impacts (µg/m^3)

Pollutant	Averaging Period	Year	Cedar Bay	Draft No Threat Levels
Selenium	8-hour	1983	0.43E-02	2
		1984	0.50E-02	2
		1985	0.43E-02	2
		1986	0.42E-02	2
		1987	0.40E-02	2
	24-hour	1983	0.64E-03	0.48
		1984	0.98E-03	0.48
		1985	0.95E-03	0.48
		1986	0.81E-03	0.48
		1987	0.76E-03	0.48
Sulfuric Acid Mist (H_2SO_4)	8-hour	1983	2.181	10
		1984	2.009	10
		1985	1.451	10
		1986	1.542	10
		1987	2.279	10
	24-hour	1983	0.365	2.4
		1984	0.366	2.4
		1985	0.419	2.4
		1986	0.346	2.4
		1987	0.392	2.4

TABLE 3-30 (Cont'd)

Maximum Cedar Bay Air Toxics Impacts (μg/m^3)

Pollutant	Averaging Period	Year	Cedar Bay	Draft No Threat Levels
Tin	8-hour	1983	0.12	1
		1984	0.15	1
		1985	0.13	1
		1986	0.12	1
		1987	0.12	1
	24-hour	1983	0.02	0.24
		1984	0.03	0.24
		1985	0.03	0.24
		1986	0.02	0.24
		1987	0.02	0.24

TABLE 3-30 (Cont'd)

Maximum Cedar Bay Air Toxics Impacts (μg/m^3)

Pollutant	Averaging Period	Year	Cedar Bay	Draft No Threat Levels
Vanadium	8-hour	1983	0.43	0.5
		1984	0.39	0.5
		1985	0.28	0.5
		1986	0.30	0.5
		1987	0.45	0.5
	24-hour	1983	0.07	0.12
		1984	0.07	0.12
		1985	0.05	0.12
		1986	0.05	0.12
		1987	0.07	0.12
	Annual	1983	0.01	2.0E+01
		1984	0.01	2.0E+01
		1985	0.01	2.0E+01
		1986	0.01	2.0E+01
		1987	0.01	2.0E+01

4.0 AIR EMISSIONS CONTROL TECHNOLOGY

4.1 Introduction

4.1.1 Project Description

The Cedar Bay Cogeneration Project (CBCP) in Jacksonville FL will be capable of generating 250 net megawatts (MW) of power and 380,000 lb/hr of steam @ 620 psig from a circulating fluidized bed (CFB) boiler-based generating plant. Electrical power will be supplied to the utility grid, and process steam will be supplied to the Seminole Kraft paper mill, located adjacent to the generating plant. Principal combustion equipment for the plant consists of three CFB boilers and two distillate oil-fired limestone dryers.

The heat input of the three boilers at full load (combined) is estimated at 3,189 MMBtu/hr. The bulk of the fuel fired in the boilers will be low sulfur coal. However, the CBCP proposes a test to ascertain whether short-fiber recycle rejects from the adjacent paper mill can be burned consistent with all requirements, and with the CFB's capability. The charging rate of this fuel would not exceed 300 tons/day, or 6% of the CBCP's total heat input. The CBCP is proposing to burn the short-fiber rejects so long as it can satisfy its requirements and use of this fuel can be accomplished consistent with proper CFB operation.

Limestone used in the boilers for desulfurization and acid gas control will be ground and dried in the two limestone dryers prior to injection into the CFBs. Each limestone dryer will consist of a crusher, in which a stream of heated air both classifies (separates by size fraction) the ground limestone, and dries the material. Air will be heated using distillate oil-fired heaters with a fuel consumption estimated at 120 gallons/hr per dryer. The limestone dryers will be permitted to operate 8 hrs/day, equivalent to 2,920 hours per year. The dryers will be equipped with fabric filters which are integral to operation of the equipment.

Additional equipment will be included to receive, store, and handle coal and limestone, and to store, handle and pelletize ash generated by the boilers.

4.1.2 Purpose of Control Technology Review

Based on a control technology assessment in the Site Certification Application and a recommendation by Florida DER, an Air Permit was issued for the CBCP in March, 1991 by FDER and the Conditions of Certification were issued by the Siting Board in February 1991.

(Since for air quality, these two documents are interchangeable, this analysis will typically refer to one or the other.) The Air Permit contained emission limitations consistent with all air quality requirements applicable to the CBCP. Given concerns about other aspects of the Project, AES subsequently offered (and the Siting Board preliminarily accepted) additional reductions in certain emissions. The CBCP has undertaken to achieve those additional proposed reductions and to satisfy the Siting Board's conditions.

These lower emission rates and the inclusion of a new add-on technology (selective non-catalytic reduction) require conforming changes to the Conditions of Certification and Air Permit. To provide the State and EPA with accurate and updated information on the project for review of the proposed changes, the CBCP is providing this technical review of the air emission controls and emission rates. Although not required, the review is presented in a "top-down" format for ease of review by DER, EPA and the public.

4.1.3 Emission Estimates and Proposed Controls

The facility will be an emission source of nitrogen oxides, sulfur dioxide (SO_2), particulate matter (PM), carbon monoxide (CO), volatile organic compounds (VOC), beryllium, mercury, lead, fluorides, sulfuric acid mist, and other trace metals. Emission rates proposed for the Cedar Bay combustion sources are shown on Table 4-1. For the CFBs, the emission rates listed in the previously issued Air Permit and Conditions of Certification, as well as the proposed emission rates, are shown on this table.

For the CFB boilers, the proposed controlled emissions level for particulate matter is 0.018 lb/MMBtu, which will be achieved with fabric filters. The proposed levels for SO_2 are 0.2 lb/MMBtu (12 month rolling average) and 0.24 lb/MMBtu (3 hr average), which will be achieved with limestone injection in the CFB boilers firing low sulfur coal. For beryllium, mercury, lead, fluorides and sulfuric acid mist, the proposed emission levels are 1.25×10^{-5}, 3.04×10^{-5}, 6.38×10^{-5}, 8.5×10^{-4}, and 0.016 lb/MMBtu, respectively. Control of particulate matter through fabric filtration will simultaneously achieve control of beryllium, mercury, lead, and other trace metals, while control of SO_2 with limestone injection will also control emissions of sulfuric acid mist and fluorides (as HF). The proposed level for nitrogen oxides is 0.17 lb/MMBtu (30-day rolling average), which will be achieved by design of the boilers and selective non-catalytic reduction. For CO and VOC, the proposed emission levels are 0.175 lb/MMBtu and 0.015 lb/MMBtu, respectively. These emission levels will be achieved using advanced combustion controls.

Emissions of particulate matter from the limestone dryer will be controlled via fabric filtration, while NO_x, CO and VOC from this source will be minimized by combustion controls. Emissions of SO_2

TABLE 4-1

Cedar Bay Facility Combustion Sources Emission Rates

Pollutant	CFBs		Limestone Dryers (lb/hr)	
	As Certified (a) (lb/MMBtu)	As Proposed (b) (lb/MMBtu)	As Certified (a) (lb/hr (c)	As Proposed (b) (lb/hr) (c)
SO_2	0.31 (d)	0.20 (d)	5.0	5.0
SO_2	0.60 (e)	0.24 (e)	5.0	5.0
NO_x	0.29 (f)	0.17 (f)	2.4	2.4
CO	0.19	0.175	0.6	0.6
PM	0.020	0.018	0.25	0.25
PM-10	0.020	0.018	0.25	0.25
VOC	0.015	0.015	0.05	0.05
Lead	7×10^{-3}	6.38×10^{-5}	0.0003	1.45×10^{-3} (g)
Beryllium	1.1×10^{-4}	1.25×10^{-5}	0.03	4.26×10^{-5}
Mercury	2.6×10^{-4}	3.04×10^{-5}	N/A	5.11×10^{-5}
Fluorides	8.6×10^{-2}	8.54×10^{-4}	0.003	N/A
H_2SO_4 mist	0.024	0.016	0.26	0.11

Notes:

(a) Emission limits as contained in Final Order and Certification PA-88-24 (2/11/91) and Final Determination, AES/Cedar Bay Cogeneration Project, Duval County, FL Permit No. PSD-FL-137 (3/28/91)

(b) Emission rates from Amended Petition of Certification (July 22, 1992) (Before the State of Florida, Division of Administrative Hearings, In Re: AES/Cedar Bay Cogeneration Project, Power Plant Site Certification Application PA-88-24) plus proposed improvements by the CBCP (Bechtel 1992)

(c) lb/hr values represent emissions for each of two limestone dryers

(d) annual average

(e) 3-hour average

(f) 30-day average

(g) no change in equipment is proposed. Revision of emission estimate based on best available data (Bechtel 1992)

(h) no information available to verify or revise previous value (Bechtel 1992) and sulfuric acid mist from the limestone dryer will be controlled by firing low sulfur fuel and direct contact between the air heater exhaust and the limestone.

Materials handling emissions will be controlled using wet suppression, fabric filters and enclosures, as detailed in Section 4.2.3. PM emissions associated with materials handling were listed in the Air Permit as 7.7 tons/yr. Based on a review of these operations, PM and PM-10 emissions are now estimated at 9.9 and 9.2 tons/yr, respectively. Emission estimate calculations for material handling operations are contained in Appendix A and discussed in Section 1.2.

4.2 Controls For Particulate Matter, Beryllium, Lead, and Radionuclides

4.2.1 Circulating Fluidized Bed Boilers Stack Emissions

4.2.1.1 Introduction

For PM and PM-10, the Site Certification Application proposed the use of fabric filtration to achieve emission rates of 0.020 lb/MMBtu for both pollutants. Emissions of lead (Pb) and beryllium (Be) were recommended to be controlled by fabric filtration to levels of 0.007 lb/MMBtu and 0.00011 lb/MMBtu, respectively. In response, Florida DER staff concurred with these recommendations; and these limits were included in the Air Permit for Cedar Bay. This emission rate for particulate matter is in conformance with the applicable New Source Performance Standard (NSPS) for Electric Utility Steam Generating Units, 40 CFR 60, Subpart Da (0.03 lb/MMBtu, 99% reduction).

Given the Siting Board's concerns about other aspects of the CBCP, as permitted, AES subsequently offered (and the Siting Board preliminary accepted), among other things, to lower the emissions of several substances, but not PM. To further improve the environmental performance of Cedar Bay, the CBCP proposes to achieve emission rates of 0.018 lb/MMBtu for both TSP and PM-10, of 1.25 x 10^{-5} lb Pb/MMBtu, and 6.38 x 10^{-5} lb Be/MMBtu, using fabric filtration.

The composition and amount of particulate matter emitted from coal-fired boilers are a function of firing configuration, boiler operation, coal properties (EPA 1985) and emission controls. Particulate matter (as total suspended particulates or TSP) will be emitted from the proposed CFB boilers as a result of entrainment of uncombustible inert matter (ash) and condensible substances. Since CFB boilers attain nearly complete combustion, very little unburned carbon will be present (EPA 1985).

The quantity and characteristics of the regulated trace metal emissions (beryllium and lead) from the Cedar Bay CFB boilers depend on the fuel composition, the chemical and physical properties of the particular trace metal, and the performance of the emission controls. Operational features of the combustion process do not significantly affect metal emissions.

Due to the high temperature and turbulence in the CFB, metals are released in both particulate and vapor phases, often as metal oxides, chlorides and sulfates. Depending on the metal compound involved and its condensation temperature, a vaporized metal begins to condense mostly on the surfaces of the fine solid particles in the flue gas (since that fraction has the greatest surface area) at normal stack temperatures (Hasselriis, 1985). Condensation occurs as the flue gases cool in the boiler and flue gas treatment equipment. Since the condensation temperatures of two of these regulated trace metals (beryllium - 2,300°F, lead - 622°F) are above the operating temperature of the fabric filter (289-300°F), the probability of removing them in the particulate control device is high.

4.2.1.2 Technically Feasible Alternatives

Fabric filters and electrostatic precipitators (ESPs) represent technically feasible options for the control of PM and trace metals from CFB boilers. Wet control techniques (scrubbers) do not represent a demonstrated control technique for CFB boilers, nor do they offer more stringent levels of control than fabric filters.

Since fabric filters and ESPs are both capable of PM and trace metal control levels in excess of 99%, performance is compared on a lb PM/MMBtu basis. Of these two options, fabric filters are capable of achieving the most stringent levels of PM control. While ESPs may rival the performance of fabric filters, they are not judged to be consistently capable of a higher degree of control of TSP, PM-10, Be, or Pb.

When specifying the emission limitation for PM in the Cedar Bay Air Permit, FDER deemed fabric filters the superior fine particulate emission control device since their performance is not as sensitive to particle size distribution as an ESP.. According to Appendix C.2 of Supplement A of AP-42 (EPA 1985), fabric filters are more efficient than ESPs at controlling fine particulate (i.e with diameters less than 6 microns). Consequently, fabric filters are also considered superior control devices for trace metals since these materials selectively condense onto smaller particles in the flue gas.

Because they are superior to ESPs for control of PM-10 and trace metals, fabric filters are considered to represent the most appropriate technology for control of TSP, PM-10, Be, and Pb from the CBCP.

4.2.1.3 Emission Levels

Based on information on control of particulate matter from the Cedar Bay boilers supplied by the equipment vendors, particulate matter control down to a level of 0.01 lb/MMBtu would be technologically feasible with fabric filters. This emission level, however, is only achievable through the use of specialty fabric filter bags (i.e. Gore-Tex laminated or Nomex), that, as detailed further in the economic analysis which follows, are significantly more expensive than conventional (woven fiberglass) bags. Based on vendor information, the lowest level achievable with woven fiberglass bags is 0.018 lb/MMBtu (Bechtel 1992), which is consistent with recent permits for coal-fired plants in Florida and EPA Region IV.

4.2.1.4 Economic Comparison

This section compares the cost of the most stringent level of control of particulate matter achievable using specialty bags (0.01 lb/MMBtu), to the level of control achievable using conventional bags (0.018 lb/MMBtu).

The three Cedar Bay boilers will have a combined total of 6,336 filter bags. The difference in cost per bag for Gore-Tex laminated bags compared to woven fiberglass bags is $210 (Bechtel 1992); thus, the total increase in capital cost to the project to achieve the more stringent level of control is $1,331,000. At a bag life of 2 years and an annual interest rate of 10%, the annualized operating cost to the project to achieve the more stringent level of control is greater than $760,000. Considering that the difference in annual emissions of the two levels of control is 95.5 tons/yr, the incremental cost effectiveness of achieving 0.01 lb/MMBtu is greater than $8,000/ton. This is not considered cost effective.

4.2.1.5 Beryllium and Lead

As described previously, for a given boiler configuration, trace metal emission rates are determined primarily based on the concentrations of the materials in the fuel. The emission rates proposed for beryllium and lead (1.25×10^{-5} and 6.38×10^{-5} lb/MMBtu, respectively) are based on analyses of the coal to be fired in the Cedar Bay boilers and the performance of the fabric filters proposed for Cedar Bay. Considering that these metals will condense selectively on the fine particles in the flue gas, the fact that a fabric filter offers superior control of fine particles compared to the alternative ESP, and that a fabric filter will be used in this case, control of beryllium and lead at these levels can be concluded to be the lowest emission rates achievable for the proposed project with woven fiberglass bags, which are consistent with permits in Florida and Region IV.

4.2.1.6 Radionuclides

Coal-fired facilities release trace amounts of radioactive elements to the atmosphere from naturally occurring radionuclides present in the fuel. For the proposed Cedar Bay boilers and fabric filter, it is estimated that approximately 2.2 x 10^{-2} curies/year of radionuclides will be emitted.

On December 15, 1989, EPA released the final rule for the National Emissions Standards for Hazardous Air Pollutants (NESHAPs) for radionuclides (54 FR 51654). In that ruling, EPA announced its decision not to further control radionuclides from coal-fired power plants since the risk that they pose is so small that it is below the assumed safe level. Accordingly, the air permit did not include a specific emission limitation for radionuclides.

4.2.1.7 CFB Stack Particulate Matter Conclusion

The Cedar Bay CFB boilers will employ fabric filters for control of particulate matter, beryllium and lead. Compared to the alternative control device (ESP), the fabric filter offers a greater degree of control of fine particles and trace metals. This alternative is thus considered appropriate for control of particulate matter, beryllium, and lead. A more stringent emission level of particulate matter is technologically feasible by utilizing specialty bags in the fabric filter. This lower level, however, is not considered to be appropriate since it would result in adverse economic impacts to the project of greater than $8,000/ton of additional PM controlled. Therefore, the emission level of 0.018 lb/MMBtu, which is comparable to the emission level of other recently permitted coal projects in Florida, is considered appropriate for control of TSP and PM-10 for the CFBs. Considering this level of PM control and based on an analysis of the coal to be fired, maximum emission rates for Pb and Be of 1.25 x 10^{-5} and 6.38 x 10^{-5} lb/MMBtu, respectively, are considered appropriate as well.

4.2.2 Limestone Dryers

After FDER staff reported that the heavy metal emissions from the limestone dryers were negligible, the Air Permit issued for the project included an emission limit of 0.25 lb/hr per dryer for both PM and PM-10. This emission limitation was not an issue in the Siting Board's Order on June 16, 1992.

The CBCP is proposing to utilize fabric filters to achieve an emission rate of 0.25 lb/hr for PM and PM-10 from each limestone dryer, with a total maximum annual emission rate of 0.73 tons/yr. In comparison, total maximum annual emissions from the Cedar Bay CFB boilers would be less than 234 tons/yr. Thus, the limestone dryers' emissions of particulate matter are negligible.

Control of PM emissions from this equipment using fabric filters is considered to represent the most stringent alternative, and since the Cedar Bay limestone dryers will be equipped with fabric filters and the operation of these filters is integral to the operation of the dryers, this alternative is concluded to be appropriate for control of particulate matter.

4.2.3 Material Handling Emissions

Emissions of particulate matter will occur as a result of delivery, storage and handling of coal and limestone, and storage and handling of ash. These emissions can be characterized as either windblown dust from outdoor storage piles, or dust released during unloading, processing, and conveying operations, and are quantified in Appendix A.

In recommending conditions for the Air Permit for the CBCP on March 11, 1991, FDER staff noted that all practical measures would be employed to control fugitive dust emissions, including the use of enclosures, water sprays, compaction, covered conveyors, and fabric filters. However, the CBCP proposes some design changes for the material handling systems and fugitive emission control systems, as described in the proposed modifications attached to the Siting Board's Order of June 16, 1992, and detailed in Appendix A along with the revised method for estimating the emissions from this equipment when they are vented through dust collectors.

The CBCP has performed an extensive review of the design of the material handling equipment and fugitive emission controls. The control systems now being proposed are described below.

4.2.3.1 Coal Delivery

Coal will be delivered to the facility by railcar; unloading will take place within a rail unloading building. Coal unloading is achieved via bottom dump hopper cars, which discharge into a subterranean surge bin. The perimeter of the surge bin is equipped with water sprays to control fugitive dust. Since the water sprays suppress additional dust that may be generated during unloading, which occurs within an enclosed unloading building, this alternative for control of fugitive dust emissions is considered appropriate.

4.2.3.2 Coal Storage

Coal will be stored at the facility in two outdoor piles. A receiving pile will be used to store coal as it is reclaimed for transfer to storage piles or to the coal hopper. The inactive coal storage pile is compacted and sealed to prevent weathering and is maintained as an emergency reserve in case of fuel supply interruption.

4.2.3.3 Coal Handling

Coal will be transferred from the unloading building receiving hoppers to the coal receiving pile using enclosed belt conveyors. Coal in this area is expected to be wet from the water sprays of the coal unloading operation. Mobile equipment (front end loaders) will be used to stack coal from the receiving pile to the inactive storage pile when necessary and to pack the coal in the storage pile to eliminate voids. Mobile equipment will also be used to remove coal from the storage pile to the coal reclaim hopper. Coal will be transported by enclosed belt conveyors from the reclaim hopper to one of the redundant coal crushers, and from the coal crusher via enclosed conveyors to the coal silos.

The conveyors, coal crushers and the coal storage silos are ventilated with a suction fan and equipped with fabric filters. The fabric filters which serve the crushers and silos will control particulate emissions to 0.003 gr/dscf which is considered appropriate for dust control from these material handling operations.

4.2.3.4 Limestone Delivery

Limestone with a particle size distribution of 3/4"x0 will be delivered to the facility in bulk dump body trucks. Limestone in this size range contains very few of the fine particles which generate fugitive dust. The limestone is pushed with portable equipment to "dozer traps" where it is reclaimed for drying, sizing, and silo storage. This altemative for control of PM is considered appropriate.

4.2.3.5 Limestone Storage

Bulk limestone (¾"x0) will be stored in an inactive outdoor storage pile to protect against interruptions in limestone supply.

4.2.3.6 Limestone Handling

From the "dozer traps" limestone will be reclaimed by enclosed continuous conveyor to the limestone dryer pulverizers, and by pneumatic conveyor from the dryer/crushers to the limestone hoppers. The limestone dryer/crushers operate in a totally enclosed system which exhausts through a fabric filter. Pneumatic conveying air is exhausted from the silos through bin vent filters. The totally enclosed nature of the dryer/crusher system and pneumatic conveying lines, and the use of fabric filters on all emission vents is considered appropriate for the control of fugitive limestone dust.

4.2.3.7 Ash Handling

Fly ash will be discharged from the bottom of the baghouse filters and air heater hoppers, conveyed to the fly ash silo, and subsequently pneumatically conveyed to the pelletizing system.

Bed ash will be discharged from the bottom of each CFB boiler, transported via drag conveyor which will transport the bed ash to a bed ash hopper. From the hopper, the bed ash will be pneumatically conveyed to the bed ash silo, and then pneumatically conveyed to the pelletizing system.

The bed ash drag conveyor will be totally enclosed up to the bed ash hopper, and equipped with a fabric filter for venting. Each of the receivers for pneumatically conveyed material (fly ash silos, bed ash hopper, bed ash silo, pelletizing operation receivers) will be equipped with fabric filters for venting and to separate transport air from entrained particulate matter.

The ash handling operations at Cedar Bay will be either pneumatically conveyed (and thus sealed), totally enclosed or equipped with fabric filters. These measures are considered appropriate for control of particulate matter from the ash handling process.

4.2.3.8 Pelletization

Ash pelletization will take place within a totally enclosed building to minimize emissions of fugitive particulate matter. In addition, particulate matter controls will be installed on the major pelletization equipment. Fabric filters will be installed on the bed and fly ash receivers, the vibratory screen, the ash recycle tank, the recycle hopper, and the pellet silo outlet conveyors. A venturi scrubber will be installed on the pelletizing hydrator, and impingement scrubbers will be installed to control emissions from the curing silo and pelletizing pan. Wet suppression will be used to control emissions from the recycle belt discharge. These measures are considered appropriate for the proposed project.

4.3 Nitrogen Oxides

4.3.1 Circulating Fluidized Bed Boilers

4.3.1.1 Introduction

For Nitrogen Oxides (NO_x) from the CFB boilers, the Site Certification Application recommended boiler design and operation to achieve an emission rate of 0.36 lb/MMBtu. This proposed emission rate for NO_x was in conformance with the applicable NSPS (40 CFR 60, Subpart Da) of 0.6 lb/MMBtu. Florida DER staff responded to the recommendations by suggesting that a 0.29 lb/MMBtu emission rate be required. FDER concurred with this 0.29 lb/MMBtu recommendation; EPA concurred in this judgement. Given the Siting Board's concerns about other aspects of the CBCP, as permitted, AES subsequently offered (and the Siting Board preliminary accepted), among other things, to lower the 0.29 lb/MMBtu emission rate to 0.17 lb/MMBtu, to go into effect 18 months after commencement of operation.

To further improve the environmental performance of the project, the CBCP proposes to achieve an emission rate of 0.17 lb NO_x/MMBtu using selective non-catalytic reduction (SNCR) without the proposed 18-month delay.

NO_x is formed in combustion sources by either the thermal oxidation of nitrogen in the combustion air or the reduction and subsequent oxidation of fuel nitrogen. Virtually all NO_x emissions originate as nitric oxide (NO) as both nitrogen and oxygen dissociate into atomic form at the high temperatures within the boiler and then recombine to form NO. A minor fraction of the NO is further oxidized in the flue gas system to form NO_2. The bulk of the NO_x formation in this facility will be through thermal oxidation of nitrogen from the combustion air, referred to as thermal NO_x.

The rate of formation of thermal NO_x is a function of the residence time, free oxygen, and peak flame temperature. Therefore, most control techniques for thermal NO_x are aimed at minimizing one or more of these variables. Other control methods, known as "add-on", "tail gas", or "back-end" techniques, remove NO_x from the exhaust gas stream.

Various coal-fired boiler configurations exhibit unique design and operational characteristics which affect the technical feasibility of certain NO_x control alternatives. Of the available alternatives, CFB technology offers the lowest potential NO_x emissions of commercially available boiler designs due to inherently lower combustion temperatures and staged combustion. The design and operation of a CFB boiler has a significant impact on both the formation and subsequent emission of NO_x, as well as the potential application of add-on NO_x controls. Moreover, an assessment of NO_x control must take into account the adverse affect on CO emissions of some NO_x control measures. As detailed further below, CO emissions are the result of incomplete combustion. Increasing combustion temperature or residence time generally enhances combustion and thereby reduces CO emissions. Such measures, however, increase formation of NO_x.

4.3.1.2 Control Alternatives

Alternative NO_x controls for the proposed CFB boilers include combustion controls, selective non-catalytic reduction (SNCR) and selective catalytic reduction (SCR). It should be noted that although both SNCR and SCR have been applied to pulverized coal (PC) and stoker fired coal units in Japan and Europe, and have recently been concluded to represent BACT for a number of these types of generating units in the US, SCR has never been applied to a CFB boiler, for reasons discussed further in subsequent sections.

4.3.1.3 Selective Catalytic Reduction

SCR has been demonstrated to achieve high levels of NO_x reduction on certain combustion sources. In the United States, SCR has been applied to natural gas-fired combustion turbines and boilers, and has recently been concluded to be appropriate for domestic pulverized coal and stoker-fired coal boilers.

The SCR process involves postcombustion removal of NO_x from the flue gas with a catalytic reactor. Ammonia (NH_3) is injected into the flue gas stream upstream of the catalyst bed, and NO_x and NH_3 combine at the catalyst surface, forming elemental nitrogen and water. The function of the catalyst is to lower the activation energy of the NO_x decomposition reaction; the catalyst allows NO_x reduction to proceed at a lower temperature than required for SNCR.

Technical and Economic Considerations

The optimum operating temperature for SCR systems has been shown to be in the range of 500-850°F. Below this temperature, the reduction reactions do not occur; above this range, the catalyst promotes oxidation of ammonia, thereby actually increasing NO_x emissions. As discussed, the bed temperature in a CFB lies within the range of 1,600 - 1,700°F, which is higher than the operating range of SCR systems. Thus, the only temperature location suitable for catalyst bed location is within the boiler sections downstream of the hot cyclone.

None of the European or Japanese installations utilizing SCR, however, are CFB boilers, nor do any of these installations utilize fabric filters for PM control (Nakabayashi, 1987; Cichanowicz, 1988). Thus, the effect of SCR system operation on baghouse performance in general, and ammonium bisulfate formation in particular, is not well known. Therefore, SCR technology from Japanese and European coal-fired sources, none of which are similar boiler technology or equipped with the type of particulate control which Cedar Bay will employ, may not be directly transferrable in this application.

Prior to the full-scale commercialization of the SCR process in both Japan and Europe, the process underwent a considerable degree of development and trials on small scale equipment. In Japan, the process was thoroughly studied in both laboratory and pilot-scale equipment for many years prior to commercialization (Kuroda 1989, Kobayashi 1987).

Kuroda noted that twenty pilot studies were conducted by Babcock-Hitachi in West Germany, Austria, Denmark and Sweden between 1984 and 1989 (Kuroda 1989); Schonbucher states that seventy pilot plants were operated within the same time frame (Schonbucher 1989). These studies were carried out prior to construction of the first commercial unit in order to determine important design and operating parameters such as optimum space velocity, effect of European fuel supplies on SCR system performance, variability of ammonia slip, process control alternatives and others. From a process development standpoint, these pilot studies were an important step in the transfer of Japanese SCR technology to European sources.

Plant energy use is a major consideration in CFB facilities where the fluidization and circulation of the bed in these boilers results in large fan power demands. Minimization of pressure drop through the boiler is thus a major design and operating consideration with a CFB. In addition, control of the air pressure in the combustor is critical to successful performance of the CFB. The additional boiler pressure drop due to an SCR catalyst bed (typically 2-3 inches of water) adds to the boiler energy requirements and air pressure control complexity.

In light of the foregoing, SCR application on CFBs is not considered demonstrated or appropriate for the Cedar Bay project.

The alternative NO_x controls both require the injection of a reducing agent to promote the reduction reactions, thus both SNCR and SCR require equipment to store, vaporize, and deliver this material to the flue gas at appropriate concentration, location, and temperature. However, the catalyst required by the SCR system is expensive and results in this alternative being more costly than SNCR.

Since SCR has never been demonstrated on a CFB boiler, there is no reliable information to suggest that this alternative offers a greater degree of control of NO_x than SNCR. Even if SNCR and SCR were able to achieve comparable levels of control, the choice of SCR over SNCR would not be economically justifiable due to the higher cost associated with SCR. Thus, in addition to being considered undemonstrated on CFB boilers, SCR is not considered economically justifiable when compared to SNCR.

4.3.1.4 Selective Non-Catalytic Reduction

SNCR has been applied to a number of different types of combustion sources, including petroleum heaters, utility and industrial boilers fired with natural gas and oil, as well as Japanese and European PC boilers.

The SNCR process is based on a gas phase homogeneous reaction, within a specified temperature range, between NO_x in the flue gas and either injected NH_3 or urea to produce gaseous nitrogen and water vapor. SNCR systems do not employ a catalyst; the NO_x reduction reactions are driven by the thermal decomposition of ammonia and the subsequent reduction of NO_x. Consequently the SNCR process operates at higher temperatures than the SCR process.

Two SNCR processes are commercially available. In the Thermal $DeNO_x$® process, developed and licensed by Exxon Research and Engineering, anhydrous or aqueous ammonia is the reduction reagent. In the NO_xOUT process, developed by EPRI and licensed by Nalco/Fuel Tech, the reduction reagent is urea.

Critical to the successful reduction of NO_x in these applications is the temperature of the flue gas at the point where the reagent is injected. For Thermal $DeNO_x$®, the necessary temperature range is 1,700 - 1,900°F; for NO_xOUT the nominal temperature range is 1,600 - 2,100°F. Also critical to effective application of these processes are gas mixing, residence time at temperature, and ammonia slip.

Theoretically, one mole of ammonia or urea will react with one mole of NO_x, forming elemental nitrogen and water. In reality, not all the injected reagent will react due to imperfect mixing, uneven temperature distribution, and insufficient residence time. These physical limitations may be compensated for by injecting a large amount of excess reagent and essentially achieving low NO_x emissions at the expense of emissions of unreacted reagent, referred to as "slip." These emissions represent an adverse environmental impact and can lead to formation of ammonium salts. Thus for a given boiler configuration, there is a limit on the degree of NO_x reduction which can be achieved with SNCR while maintaining acceptable levels of slip.

The CFB design is described as the ideal application for SNCR in the available open literature. CFB boilers are constant temperature, variable heat transfer devices. The bed temperature and downstream flue gas temperature can be set by the operator to within a few degrees. The typical temperature of CFB flue gas leaving the bed and entering the hot cyclone is at the ideal temperature for SNCR. Additionally, the reduction reagent is injected at the inlet to the hot cyclone, where all of the flue gas is swirled at 50-75 ft/second, and forced to change direction several times. This cyclonic action homogenizes the reagent flue gas NO_x concentration, thus maximizing mixing.

The CFB design offers lower NO_x formation potential than other commercial boiler types due to the lower combustion temperatures and staged air operation. However, there are site-specific technical features of the Cedar Bay CFB boilers which must be considered in determining the lowest emission level which SNCR is capable of meeting in this case.

For example, the Cedar Bay boilers are similar in physical size to the two boilers at the AES Barbers Point facility. However, due to operational differences, these two cases are not directly comparable in terms of NO_x emission rate. The two boilers at the Barbers Point facility operate at 664,444 lb/hr of main steam flow and 598,269 lb/hr of reheat steam flow per boiler with a maximum process steam flow of 30,000 lb/hr @ 65 psig on an interruptible basis. The design heat input per boiler at Barbers Point to accomplish this output is 939.5 MMBtu/hr. In contrast, the three boilers at the CBCP will operate at 745,840 lb/hr of main steam flow and 542,517 lb/hr of reheat steam flow with a maximum process steam flow of 380,000 lb/hr @ 620 psig on an uninterruptible basis requiring heat input of 1,063 MMBtu/hr per boiler (Black & Veatch, 1992).

Even though Cedar Bay and Barbers Point will both employ SNCR for control of NO_x emissions, Cedar Bay because of its higher heat input per boiler, will have a higher boiler exit NO_x emission rate than Barbers Point or any other similarly-sized boiler operating at its design condition. With this higher boiler exit NO_x emission rate, the CBCP would have to utilize more ammonia or urea in its SNCR system than other units to achieve the same emissions level. This increase in reagent would result in increased capital and operating costs (detailed further below), an increase in unreacted reagent slip (from 5 to 20 ppm, Black & Veatch, 1992), increased fouling of the air heater with ammonium salts, and contamination of the flyash with unreacted reagent, thereby causing problems with the ash pelletizing system.

Use of SNCR at Cedar Bay poses another challenge. Since the Cedar Bay boilers were not originally designed and constructed with the intent to employ SNCR, use of this alternative has required that the control equipment be retrofit. Retrofit equipment will include reagent receiving, storage, vaporization and handling equipment (tanks, pumps, piping, heaters), injection equipment to be located in the boilers (piping, injection nozzles) as well as control equipment to monitor and regulate system performance. The CBCP is proposing to retrofit SNCR systems to the Cedar Bay boilers consistent with an emission rate of 0.17 lb/MMBtu. This rate is proposed since it is thought to be the lowest achievable at Cedar Bay's CFBs, with their high heat input rate, a retrofit application of SNCR, a CO emission limitation of 0.175, and providing uninterruptible energy. Further, the CBCP has been unable to obtain vendor emission guarantees for NO_x below 0.17 lb/MMBtu. Any lower level is not considered demonstrated or appropriate for Cedar Bay. Certainly, no other project has reported data demonstrating a lower NO_x emission rate over time under these conditions.

Pushing SNCR to the apparent bounds of technology to achieve an emission rate of 0.17 lb/MMBtu would will result in increased capital and operating costs to the project. However, the CBCP is willing to incur these costs in the public interest does not consider the increased costs to achieve this rate unreasonable.

4.3.1.5 Economic Impact of NO_x Levels Below 0.17 lb/MMBtu

Should Cedar Bay be required to attempt to achieve even lower NO_x levels, however, the CBCP would have to experiment with SNCR beyond its demonstrated and commercially guaranteed limits. This process would require, at a minimum, additional equipment beyond what is required to achieve 0.17 lb/MMBtu (larger pumps and piping, more injection nozzles), additional operating costs (more reagent, more power for pumping and vaporization), and likely require derating Cedar Bay's CFBs or raising their CO limitations.

The cost associated with this additional equipment were estimated and are shown on Tables 4-2 and 4-3. They are presented in the cost estimating format recommended by EPA in their latest guidance document on the subject (EPA 1990). The cost-effectiveness figures in these tables are based on a comparison to the 0.11 lb/MMBtu limit set for the CFB boilers at Barbers Point, HI.

Table 4-3 shows the increase in retrofit costs to the three CFB boilers (total) for the additional equipment to attempt to lower the NO_x emission rate from 0.17 to 0.11 lb/MMBtu. Total installed costs, including equipment costs, commercialization costs, and installation costs, are estimated at $1,000,000. On an annualized basis, this increased costs translates to $162,000/yr (based on 10 year equipment life and an average interest rate of 10%).

Table 4-4 shows the increase in operating costs for the three CFB boilers (combined) to attempt to achieve the lower emission rate. No additional operating labor would be required; additional power charges represent costs to pump and vaporize the additional reagent prior to injection, as well as increased fuel cost to overcome the decrease in plant heat rate. Additional ammonia costs are based on 190 lb/hr of additional ammonia at a cost of $4.94/100 lb.

As described previously, attempting to achieve this lower level would result in increased levels of reagent slip, which will in turn create ammonium salts (ammonium sulfate and ammonium bisulfate) in the flue gas within the boilers. These salts will condense in the cooler portions of the boilers, resulting in increased fouling of the air heaters and blinding of the fabric filters, necessitating increased maintenance and decreased availability associated with cleaning and maintaining this equipment. Additional maintenance costs are estimated based on two additional outages per boiler per year to clean the air heater and replace fouled bags. These outages will result in decreased availability of 2% and lost power production, estimated at a value of $1,000,000 per percent on an annual basis.

TABLE 4-2

Increased Capital Costs to Achieve 0.11 lb NO_x/MMBtu

(1) Purchased Equipment	
(a) Basic Equipment	444,000
(b) Auxiliaries	included
(c) Instrumentation and Controls	included
(d) Structural Support	44,000
(e) Freight & Taxes	39,000
(2) Direct Installation	158,000
Total Direct Costs (TDC)	**$685,000**
(3) Indirect Installation	
(a) Engineering & Supervision	69,000
(b) Construction & Field Expense	69,000
(c) Construction Fee	34,000
(d) Contingencies	137,000
(e) Startup & Performance Test	7,000
Total Indirect Costs (TIC)	**$316,000**
Total Capital Cost (TCC)	**$1,000,000**
Annualized Capital Recovery (b)	**$162,000**

Notes:
Combined costs for three CFB boilers
Cost information from U.S.Generating Company
(a) Cost Factors: 1990 EPA OAQPS Control Cost Manual
(a) amortized over 10 years straight line @ 10% interest rate

TABLE 4-3

Increased Annualized Operating Costs to Achieve 0.11 lb NO_x/MMBtu

Direct Operating Costs	
Increased Operating Labor (OL)	$0
Increase Maintenance (a)	90,000
Replacement Fabric Filter Bags (b)	150,000
Utilities - Electricity and Fuel (c)	30,000
Raw Materials - Ammonia (d)	70,000
Lost Power During Downtime (e)	2,009,000
Indirect Operating Costs	
Overhead @ 30% OL & 12% Maintenance	11,000
Taxes @ 1% TCC	10,000
Insurance @ 1% TCC	10,000
Administration @ 2% TCC	20,000
Annual Operating Costs	**$2,400,000**
Annual Capital and Operating Costs	**$2,562,000**
Annual Tons Removed (f)	717
Cost Effectiveness ($/ton)	$3,573

Notes:
Combined costs for three CFB boilers
Source of operating cost information: U.G. Generating Company
(a) Two additional air heater washes per year required due to ammonium salt contamination
(b) Increased bag replacement due to ammonium salt contamination
(c) Increase in auxiliary load of 140 kw (ammonia injection, vaporization and pumping) plus 0.06% negative effect on plant heat rate, resulting in increased fuel use
(d) 190 lb/hr additionnal aqueous ammonia comsumption
(e) Decrease availability due to additional air heater cleaning, lost power and steam sales during downtime
(f) Compared to 0.17 lb/MMBtu

Considering indirect costs such as administration, overhead, and taxes, total annualized operating costs to attempt to reduce NO_x emissions from 0.17 to 0.11 lb/MMBtu are estimated at $2,400,000/yr, with total annualized operating and capital costs at over $2,500,000/yr.

This lower emission rate would result in a decrease in annual NO_x emissions of 717 tons/yr, based on a heat input of 3,189 MMBtu/hr and an annual capacity factor of 85%, which is considered a reasonable estimate of an actual operating schedule. This results in a cost effectiveness of this emission reduction of over $3,570/ton controlled. The costs of derating Cedar Bay to augment the effort attempting to reduce NO_x emissions would dwarf this estimate of cost effectiveness. In addition, the adverse environmental impacts of increased CO emissions, unreacted reagent, increased fouling of the air heater, and contamination of the flyash and of the ash pelletizing system would have to be accounted for. Furthermore, it is unclear how much, if at all, this effort would actually reduce NO_x emissions since there are no data for the hypothetical cases of NO_x emission reduction that were considered in the cost effectiveness computation. Accordingly, SNCR associated with an emission rate below 0.17 in Cedar Bay's circumstances is considered uneconomical and inappropriate for the proposed project, as well as unproven technologically.

4.3.1.6 CFB NO_x Conclusion

As described, the NO_x emission rate for the CFB boilers in the Air Permit is 0.29 lb/MMBtu (30-day average) using combustion controls and boiler operation to minimize formation of NO_x, whereas the CBCP is proposing a lower emission rate of 0.17 lb/MMBtu (30-day average) using SNCR. Selective non-catalytic reduction is preferred over SCR for fluidized bed boilers since it has been demonstrated, is operating on existing units, and has lower capital costs. SNCR has been utilized on CFB boilers at emissions levels as low as 0.11 lb/MMBtu. However attempting to achieve this level on Cedar Bay would require technological experimentation and adverse economic impacts.

Therefore, the emission rate of 0.17 lb/MMBtu is considered appropriate and the best achievable for Cedar Bay. This rate is in conformance with the most recently issued air permits for coal-fired plants in Florida and EPA Region IV, and the applicable NSPS.

4.3.2 Limestone Dryers

The Air Permit issued for the project lists an emission limit of 2.4 lb/hr per dryer for NO_x. This emission limitation was not an issue in the Siting Board's Order on June 16, 1992.

The CBCP is proposing to utilize combustion controls to achieve an emission rate of 2.4 lb/hr for NO_x from each limestone dryer, with a total annual emission rate from both dryers of 7.0 tons/yr. In comparison, total annual NO_x emissions from the Cedar Bay CFB boilers would be less than 2,208 tons/yr. Thus, the limestone dryers' emissions of NO_x are negligible.

As described, the limestone dryers will incorporate a heated stream of air to classify and dry the ground limestone. Air will be heated by direct contact with exhaust from distillate oil-fired burners. The use of burners designed for minimal NO_x formation are considered to represent the top technology for control of NO_x from these sources. Add-on controls such as SNCR and SCR are not considered feasible due to the physical design of the dryers. The air heaters are physically too small to provide adequate residence time at the temperature for SNCR to be feasible, and there are no locations in the equipment where an SCR catalyst could be situated which provide for the correct temperature. Consequently, there are no available alternatives which offer a greater degree of NO_x control than the burners proposed; and this alternative is thus concluded to be appropriate for control of NO_x from the limestone dryers.

4.4 Carbon Monoxide

4.4.1 *Introduction*

For CO, the Site Certification Application recommended the use of boiler design and combustion controls to achieve an emission rate of 0.19 lb/MMBtu. In response, Florida DER staff concurred with this recommendation and wrote this limit into the air permit for Cedar Bay. To satisfy the Siting Board's concerns over Cedar Bay, as permitted, which did not address the adequacy of Cedar Bay's emission limitation for CO, AES proposed, among other things, to lower the emission limitation for CO to 0.175 lb/MMBtu. The Siting Board's order of June 16, 1992 reflects a preliminary acceptance of this new emission limitation in partial satisfaction of its concerns.

The CBCP proposes to meet this emission rate of 0.175 lb CO/MMBtu using boiler design and combustion controls. Based on vendor-supplied emissions guarantees, the CBCP considers this limit to be the lowest achievable emission rate.

Emissions of CO result from the incomplete combustion of carbon and organic compounds. CO emissions are a function of oxygen availability (excess air), flame temperature, residence time at flame temperature, combustor design, and turbulence. Control of the emissions of CO may be effected two ways: (1) combustion modifications to minimize the formation of the pollutant, and (2) flue gas catalytic oxidation of any CO formed in the combustion process.

4.4.2 Circulating Fluidized Bed Boilers

Alternative controls for CO from combustion sources include combustion controls and catalytic oxidation. Combustion controls are the predominant control technology utilized for coal-fired sources.

Catalytic oxidation is the alternative used to obtain the most stringent control level for CO from gas turbine combustion units. This technology has never been applied to a coal-fired unit, however. In this alternative, a catalyst would be situated in the flue gas stream which would lower the activation energy of a series of reactions where reactant species (CO, VOC and O_2) are converted to carbon dioxide and water. The catalyst permits combination of the reactant species at lower gas temperatures than would be required for uncatalyzed oxidation.

The catalyst would have to be located at a point where the gas temperature is within an acceptable range. The effective temperature range for CO oxidation is between 600 and 1,150°F. In a CFB, this means that the catalyst grid would need to be installed at a point upstream of the baghouse filter.

Catalyst non-selectivity is a problem for sulfur containing fuels such as coal and fuel oil. Catalysts promote oxidation of SO_2 to SO_3 as well as CO to CO_2. The amount of SO_2 conversion is a function of temperature and catalyst design. Under optimum conditions, formation of SO_3 can be minimized to 20% of inlet SO_2. Compared to the proposed emissions level, this level of conversion would result in an increase in H_2SO_4 emissions of approximately 800 tons per year, which aside from the increased ambient air impacts would result in unacceptable amounts of corrosion to the air preheater and ductwork.

ENSR contacted an oxidation catalyst system vendor to determine the technical feasibility of installing this system on a coal-fired boiler. Due to the high particulate loading of the flue gas, trace element concentration and SO_2 level, the vendor stated that they could not provide a catalyst system for coal-fired applications. This vendor also noted that oxidation catalysts are generally designed for a maximum particulate loading of 50 mg/Nm^3 (Englehard, 1990). The proposed Cedar Bay CFB boilers will have a particulate loading of the baghouse filters in excess of 2,000 mg/Nm^3. Consequently, oxidation systems are considered technically infeasible for this facility.

The next most stringent level of control of CO from CFB boilers has been achieved through the design and operation of the boiler in a manner so as to limit formation of this pollutant. Such controls are commonly referred to as combustion controls. In general, a combustion control system seeks to maintain the proper conditions to ensure complete combustion through one or more of the following operation design features: low excess air, staged combustion, overfire air, sufficient residence time, and good mixing.

In the case of the Cedar Bay CFBs, the boilers themselves incorporate design features which enhance uniform fuel/air distribution and mixing, along with oxygen monitoring and adjustment of the staged air combustion to suppress CO formation. In assessing the CO emission rates that Cedar Bay can achieve, one must optimize these factors in the context of efforts to reduce NO_x emissions since those efforts tend to increase CO emissions. In light of the NO_x emission reductions discussed above, the lowest emission level that the vendor of the boiler equipment for Cedar Bay will guarantee is 0.175 lb CO/MMBtu.

Since the measures to control CO are inherent to the operation of the boilers, there are no adverse economic impacts associated with this alternative. Therefore, there is no basis for selecting an emission control alternative that is less restrictive than the level that provides the most stringent degree of control of CO; 0.175 lb/MMBtu is considered appropriate for the proposed project.

4.4.3 Limestone Dryers

The Air Permit issued for the project lists an emission limit of 0.6 lb/hr per dryer for this pollutant. This emission limitation was not an issue in the Siting Board's Order of June 16, 1992.

The CBCP is proposing to utilize combustion controls to achieve an emission rate of 0.6 lb/hr for CO from each limestone dryer, with a total annual emission rate of 7.0 tons/yr. In comparison, annual CO emissions from the Cedar Bay CFB boilers will be less than 2,090 tons/yr. Thus, the limestone dryers' emissions of CO are negligible.

The most stringent available alternative for control of this pollutant from these sources is considered to be the use of burners which maximize complete combustion, which will result in minimization of formation of CO. Such burners, which will be utilized in the proposed limestone dryers, are thus concluded to be appropriate for control of CO.

4.5 Sulfur Dioxide And Acid Gases

4.5.1 Introduction

Emissions of sulfur oxides are generated in fossil fuel-fired sources from the release of sulfur present in the fuel. Approximately 98% of sulfur in solid fuels is emitted upon combustion as gaseous sulfur oxides. Uncontrolled emissions of SO_2 are thus affected by fuel sulfur content alone, and not by the firing mechanism, boiler size, or operation. Similarly, uncontrolled emissions of fluorides (as hydrogen fluoride) are only affected by the fluoride content of the fuel. Sulfuric acid mist, however, is formed from the reaction of sulfur trioxide (SO_3) with water vapor outside of the combustion section. Since the formation of SO_3 is a function of the generation of SO_2, uncontrolled emissions of sulfuric acid mist are also a function of the sulfur content of the fuel.

Sulfur dioxide, hydrogen fluoride and sulfuric acid mist, referred to collectively as acid gases, are all controlled by the same technology, as described in further detail below.

4.5.2 Circulating Fluidized Bed Boilers

The SO_2 emission rates for the CFB boilers recommended in the Site Certification Application were 0.6 lb/MMBtu (3-hour average) and 0.31 lb/MMBtu (annual average firing coal with a sulfur content of from 1.7 - 3.3%). Proposed emission limits for the other acid gases, sulfuric acid mist and fluorides, were 0.024 and 0.086 lb/MMBtu, respectively. Cedar Bay proposed to utilize the operation of the CFB boilers, including limestone injection, to control sulfur dioxide and acid gas emissions. The NSPS emission limitation for SO_2 for the CBCP is 0.6 lb/MMBtu and 70% reduction (40 CFR 60, Subpart Da). Thus, the proposed emission rates were in conformance with the NSPS. Florida DER staff concurred with the applicant's analysis and these emission limits were included in the Conditions of Certification. Given the Siting Board's concerns about other aspects of the CBCP, as permitted, AES subsequently offered (and the Siting Board preliminarily accepted), among other things, to lower the SO_2 emission limit to 0.24 lb/MMBtu (12-month rolling average).

The CBCP proposes to further lower the emission limitations for SO_2 to 0.2 lb/MMBtu (annual average) and 0.24 lb/MMBtu (3-hour average), for sulfuric acid mist to 0.016 lb/MMBtu, and for fluorides to 8.54×10^{-4} lb/MMBtu, as detailed further below. These emission rates using low sulfur coal, limestone injection and CFB boiler operation. These are considered the lowest achievable emission rates for these pollutants for these units firing the contracted coal.

Control of SO_2 and acid gases is inherent to CFB operation. Second generation fluidized bed combustors were developed specifically to utilize domestic coal in an environmentally acceptable manner. In a circulating fluidized bed, sulfur released from the fuel is removed in the combustion zone by reaction with lime. Thus, the control of acid gases is integral to CFB operation and does not rely on downstream flue gas desulfurization.

Crushed limestone is fed to a CFB combustor, becoming the solid medium in which coal combustion takes place. When limestone is heated to 1600°F, it releases CO_2 and forms lime

(CaO) which subsequently reacts with acid gases released from the burning coal to form gypsum ($CaSO_4$). Theoretically, one mole of sulfur (or fluorine) combines with one mole of calcium; in theory 100% SO_2 removal could be achieved with a Ca/S ratio of 1.0. In practice, however, the desulfurization process yields less than ideal reactivity, and it has been found that only about 50% of the SO_2 is removed at this ratio. As the ratio is increased, greater desulfurization can be achieved, but with diminishing return.

The technical factors related to in-bed acid gas (SO_2, H_2SO_4, HF) control with limestone include calcium to sulfur (Ca/S) ratio, reactivity of limestone, particle size, fuel properties, mixing, and gas phase residence time. To a certain extent, these factors are related in that they are dependent on physical characteristics of the fuel and limestone used. For instance, a certain limestone may exhibit high reactivity, based on particle pore size and hardness, regardless of calcium content. Limestone reactivity is thought to depend on the ability of acid gases to reach the center of a particle. Soft limestones tend to abrade, exposing fresh surfaces. Thus, it has been found that reactivity for a given limestone can only be determined as a result of actual combustion testing. Some fuel types have been found to contain impurities which may blind the limestone, lowering its reactivity. Further, the fuel sulfur content will impact desulfurization efficiency and Ca/S ratio. The removal of SO_2 and acid gases in a CFB requires contact between each molecule of acid gas and each unreacted particle of lime. Since the boiler has a limited gas residence time, lime and acid gas molecules thus have a limited time to chemically combine. When flue gas acid gases are in low concentrations, it is far more difficult for the acid gas molecules to find an active lime site in the time available, and a greater percentage escape the boiler without reacting. In this case with low sulfur coal and low SO_2 concentrations, the acid gas removal percentage may be lower than at high inlet SO_2 concentrations, even though the emissions on a mass/heat input basis will always be lower for the CBCP's coal.

In order to meet the lower emission limit for SO_2 (compared to the existing Conditions of Certification), the CBCP will operate the limestone injection system at a higher calcium/sulfur ratio than originally proposed (3.5:1 vs 3.0:1). This higher ratio will result in more lime being present in the bed, thereby resulting in more complete capture of sulfur.

The proposed level of control was determined based on the minimum and maximum coal sulfur and fluorine contents expected from the coal supplier, and the corresponding maximum degree of acid gas capture. The emission levels (0.2 lb SO_2/MMBtu annual average, 0.24 lb SO_2/MMBtu 3-hr average, 8.54×10^{-4} lb HF/MMBtu, 0.016 lb H_2SO_4/MMBtu) are thus the lowest levels which can be achieved with this alternative on this facility.

4.5.3 Limestone Dryers

After FDER staff reported that the emissions of the acid gases H_2SO_4 and fluorides from the limestone dryers were negligible. The Air Permit included an emission limit of 5.00 lb/hr per dryer for SO_2. This emission limitation was not an issue in the Siting Board's Order on June 16, 1992.

The CBCP is proposing to utilize low sulfur oil in conjunction with direct contact between limestone and air heater exhaust to achieve an emission rate of 5.00 lb/hr for SO_2 from each limestone dryer, and 0.11 lb/hr per dryer for sulfuric acid mist. Total annual emission rate from the limestone dryers will be less than 14.6 tons SO_2/yr and 0.32 tons H_2SO_4/yr. No emissions of hydrogen fluorides are expected from the limestone dryers. In comparison, total annual SO_2 and H_2SO_4 emissions from the Cedar Bay CFB boilers will be less than 2,598 tons/yr and 207.8 tons/yr, respectively. Thus, the limestone dryers' emissions of SO_2, H_2SO_4 and fluorides are negligible.

In the proposed systems, SO_2 and sulfuric acid mist emissions will be controlled by a combination of firing low sulfur fuel in the air heaters and direct contact of the air heater exhaust with limestone. As in the CFB boiler, direct contact of the exhaust with limestone is expected to result in reduced emissions, when compared to non-direct contact drying. These measures will limit SO_2 and sulfuric acid mist emissions to a maximum of 5 lb/hr and 0.11 lb/hr per dryer, respectively, are considered to be the most stringent available control alternative, and are thus concluded to be appropriate for control of SO_2 and sulfuric acid mist emissions from the limestone dryers.

4.6 Mercury

4.6.1 Circulating Fluidized Bed Boilers

Trace quantities of mercury are present in coal, and most of this mercury is expected to volatilize during combustion. Approximately two-thirds of the mercury content in the flue gas exits as solid mercuric chloride ($HgCl_2$); the other third is exhausted as elemental mercury vapor (Flakt, 1990). Mercury is expected to condense upon submicron particles contained in the flue gas and exit as either condensed aerosol or solid mercuric chloride and be controlled by the fabric filter. Some of the vapor is expected to be emitted.

For mercury, the Site Certification Application proposed the use of fabric filtration for control of emissions, and an emission rate of 0.00026 lb/MMBtu. In response, DER staff concurred with this recommendation, and this limit was included in the Air Permit for Cedar Bay. Given the Siting Board's concerns about other aspects of the CBCP, as permitted, AES subsequently offered (and the Siting Board preliminarily accepted), among other things, to lower the mercury emission limit by about 88% and to test an innovative technology that might provide further reductions.

The CBCP has evaluated the anticipated control efficiency for mercury from the fabric filter and the levels of mercury in the contracted coal. Based on these evaluations, it is proposing to meet this lower emission limitation of 3.04×10^{-5} lb/MMBtu using fabric filtration. In addition, the CBCP proposes to test activated carbon injection on one of the CFB boilers and install this control alternative permanently on all three CFB boilers if the test is successful, as described further below.

4.6.1.1 Control Alternatives

Programs to assess the relative advantages and disadvantages of alternative pollution control devices on mercury collection from coal combustion have only recently begun. However, test data is available from programs to determine the best system of trace metals control from municipal waste combustors (MWCs), in conjunction with the recently promulgated new source performance standard for these sources; these data are currently more complete than any other data available in the published literature and as such are considered the best representation of mercury control from combustion sources in general. Even for this more complete data set, there are major uncertainties. As detailed further below, understanding mercury emissions from CFB's firing coal are further clouded by the differences in the concentration of mercury in the respective flue gases.

Potential control alternatives for mercury include:

- Sodium sulfide injection upstream of SO_2/PM control devices
- Activated carbon injection upstream of fabric filter
- Wet scrubbing techniques
- Spray dryer followed by a fabric filter
- Flue gas cooling

At this time, EPA is not clear on which control alternative best reduces mercury emissions from any combustion process (Porter, 1990) or which operating variables in the combustor influence alternative controls' performance. Recognizing this, the EPA stated in the preamble to the proposed NSPS for MWCs that a joint EPA/industry task force is being established to investigate mercury emissions and controls, and that the findings would be considered in development of the final standards (EPA 1989b). Under § 112 of the Clean Air Act as amended in 1990, there are a number of studies underway to further assess the control options for steam electric boilers.

As part of the effort of the joint task force, two meetings were held in Research Triangle Park by EPA in February 1990 to discuss both "precombustion" controls of mercury emissions and add-on control of mercury emissions. It is evident from the meetings' transcripts that there are not only numerous unknowns regarding mercury formation and control, but there are some valid side issues that must also be resolved before the subject can be understood and the MWC NSPS for Hg fairly promulgated.

Some of the key issues raised in the meetings were:

- the potential of NO_x controls by ammonia injection to reduce mercury control efficiencies of downstream (fabric filter) systems;
- the relationship between the amount of carbon in the flue gas and the amount of mercury control, and whether this is more influential on mercury emissions than NO_x controls;
- the conversion of mercuric chloride on the filter cake to mercury vapor over time;
- reliability of current test methods;
- the inconsistencies in test data between the U.S. and European facilities (which use different test methods)
- lack of data on mercury content of ash, effects of add-on mercury control to ash toxicity and possible outgassing;
- contradictory data and general variability of data;
- the overemphasis on mercury control from MWCs; and
- establishing which mercury control systems are "demonstrated".

The following provides more information on the controls discussed by the EPA/industry task force.

4.6.1.2 Sodium Sulfide Injection

For combustion units utilizing spray drying/absorption (SDA) for control of SO_2 emissions, sodium sulfide (Na_2S) can be sprayed into the gas stream as a 10 percent water solution, either upstream of or in the spray dryer. The mercury vapor is converted to solid mercuric sulfide according to the following reaction:

$$Na_2S + Hg + H_2O + 1/20_2 \rightarrow HgS + 2NaOH$$

The resulting solids are collected in the baghouse or ESP as particulate. (Buschmann, 1990). Since the Cedar Bay CFB boilers do not employ SDA's, this altemative is not feasible in this case.

4.6.1.3 Activated Carbon Injection

Injecting activated carbon or a modified activated carbon material into the flue gas upstream of the fabric filter may achieve mercury emissions reductions. There are, however, currently no CFB units operating which employ activated carbon injection. Activated carbon injection systems are listed as being offered commercially by A/S Niro Atomizer of Denmark and Research Cottrell for use on MSW incinerators. There are no vendors offering such systems for use on CFB boilers.

On MSW plants, carbon injection may achieve sizeable mercury reductions, as shown by two sets of test data in the Niro patent. In three pilot-test runs, injection of 80 mg/Nm^3 in flue gas at a location between the SDA and fabric filter resulted in overall mercury reductions of 89 percent (230°F run), 95 percent (230°F run), and 91 percent (284°F run). Mercury reductions with no carbon injection (fabric filter only) were still sizeable, however, at about 69 percent.

On full-size MWCs tests, 78 to 93 percent mercury reductions were achieved with carbon injection. However, data from these tests indicate mercury removals of 66 to 27 percent with the carbon injection system off, and utilizing only the fabric filter for mercury control. This implies that mercury control attributable to the carbon injection system was on the order of 75% of inlet mercury.

Comparisons between the potential effectiveness of this altemative on MSW plants vs CFB plants are necessarily inconclusive due to the difference in flue gas mercury concentrations. The CBCP proposes to limit mercury emissions to 3.04×10^{-5} lb/MMBtu which converts to approximately 15 ug/dscm, while MSW plants typically operate with mercury levels of 510 ug/dscm (EPA 1989d). Since programs to assess the effect of this difference have only recently begun, and considering the fact that this alternative has not been installed on a CFB boiler, carbon injection systems are consequently not considered to be demonstrated effective emission controls on CFB boilers.

4.6.1.4 Wet Scrubbing Techniques

There is a general opinion in the scientific community that because of the saturated operating conditions and cooler flue gas temperatures in wet scrubbing, better mercury condensation and collection should occur than in dry systems. The NJDEP tested the efficiency of mercury removal at the small scale resource recovery facility in Ft. Dix, New Jersey, which uses a baghouse upstream of a wet scrubber. Using EPA Test Method 101A, the removal efficiency ranged over three test runs between 16.6 percent and 74.9 percent (average 42.8 percent). Not only was the variability in test results similar to that observed in SDA/FF-equipped MWC facilities, less mercury was removed with wet scrubbing compared to SDA/FF. These test data do not support use of wet scrubbers for control of mercury from coal-fired facilities.

4.6.1.5 Flue Gas Cooling

Flue gas cooling has been considered essential for Hg removal because Hg typically enters the control equipment as a vapor. Test data available for MWCs both support and refute this theory. Env. Canada and Flakt reported mercury reduction of 40 percent when flue gas was cooled to 289°F (Env. Canada, 1987). Environment Canada also reported (1986) data that are more inconclusive. Over two test runs for each temperature, mercury reductions were 90.9% (230°F), 97.3% (257°F) and, 93.7% (284°F). The lowest flue gas temperature achieved the lowest percent mercury control. Tests conducted in June 1989 at Ogden Martin's Indianapolis Resource Recovery Facility, which uses a spray dryer/fabric filter control system, indicate that measured emissions of mercury were well below the expected levels. Mercury removal efficiency was measured at spray dryer outlet temperatures of 265 and 295°F. The study concluded that lowering the spray dryer outlet temperature by 25°F has no significant impact on the mercury stack emission. Ogden Martin has also conducted tests at one of its facilities and has observed no "discernible" reductions at a temperature of 285°F versus 325°F. Therefore, operating at temperatures below 325°F does not appear to be warranted.

Because it is questionable whether flue gas cooling achieves considerable, if any, mercury control, flue gas cooling to temperatures such as 285 to 325°F is not considered appropriate for the proposed project.

4.6.1.6 CFB Mercury Conclusion

There are many questions yet to be answered about mercury formation and control. However, a well-operated and maintained limestone injection/fabric filter control train (a control train providing high mercury removal efficiencies) is proposed for mercury control since no clear evidence exists that there is a more stringent control alternative available.

The CBCP has agreed to conduct a test of the activated carbon injection system on one of the Cedar Bay CFB boilers. This test will be used to determine if this process is capable of controlling mercury emissions from these boilers. If the test shows reductions of controlled emissions (after the fabric filter) of an additional 50% or greater, the CBCP will permanently install and operate the process on all three boilers..

4.6.2 Limestone Dryers

After FDER staff reported that the heavy metal emissions from the limestone dryers were negligible, the Air Permit did not include an emission limit for mercury from this source.

The mercury emissions from the limestone dryers will be negligible since the CBCP will use fabric filtration to achieve an emission rate of 5.11×10^{-5} lb/hr for mercury from each limestone dryer, with a total annual emission rate of less than 1.49×10^{-4} tons mercury/yr.

4.7 Volatile Organic Compounds

4.7.1 Introduction

As with emissions of CO, emissions of volatile organic compounds (VOCs) result from the incomplete combustion of carbon and organic compounds, and are a function of oxygen availability, temperature, residence time, and turbulence. VOCs are controlled in two ways: (1) controlling combustion parameters in order to maximize complete combustion, and (2) flue gas catalytic oxidation. And, as noted above, the control of VOCs must be optimized with the control of the boiler exit emissions of NO_x.

4.7.2 Circulating Fluidized Bed Boilers

For VOC, the Site Certification Application proposed the use of boiler design and combustion controls for minimization of VOC formation to a level 0.016 lb/MMBtu. Florida DER staff concurred with this recommendation. However, the Air Permit established the emission rate at 0.015 lb/MMBtu. Given the Siting Board's concerns about other aspects of the CBCP, as permitted, AES subsequently offered (and the Siting Board preliminary accepted), among other things, to lower the emissions of several substances, but not VOCs.

The CBCP proposes to achieve this emission rate for VOCs using boiler design and combustion controls. Based on information from the boiler vendor, the emission level of 0.015 lb/MMBtu is the lowest achievable emission rate which is technologically feasible for the Cedar Bay CFB boilers.

There are two techniques for reducing VOCs in flue gases: catalytic oxidation and combustion control. As described previously in the discussion for CO, catalytic oxidation is not technically feasible on coal-fired boilers. Thus, the only technically feasible control alternative is combustion control.

The boiler supplier for the Cedar Bay project has offered an emission guarantee of 0.015 lb VOC/MMBtu for this project. According to the vendor, this is the lowest the boilers can meet on a consistent basis. This emission rate is considered the lowest achievable for Cedar Bay since there is no technically feasible alternative which could be employed to allow Cedar Bay to meet a lower emission limit. In particular, ENSR is unaware of any data indicating that a plant with the physical and operational limitations characteristic of Cedar Bay achieve any lower emission rates.

The Cedar Bay CFB boilers will employ the same means to minimize formation of VOC as other CFB boilers that achieve lower VOC emission rates. However, there are no other boilers with which a direct comparison of emission limits can be made since there are no other boilers of the same size and type as Cedar Bay which are operating at the same heat input rate. This difference will affect both combustion temperature and residence time and in turn make the emissions of VOCs of different. Consequently, there is no clear evidence, apart from vendor guarantees, which could be utilized to define a feasible emission rate for VOC.

Since the proposed boilers will employ the same alternative controls permitted for VOCs, and the proposed level of emissions is the lowest level possible given the fuel being fired, the boiler size, the operating conditions, and the vendor guarantee, 0.015 lb/MMBtu is considered the lowest VOC emission rate that Cedar Bay can achieve.

4.7.3 Limestone Dryers

Although FDER staff reported that the VOC emissions from the limestone dryers were negligible, the Air Permit included an emission rate of 0.05 lb/hr VOC per dryer. This emission limit was not an issue in the Siting Board's Order of June 16, 1992.

The CBCP is proposing to use combustion controls to achieve an emission rate of 0.05 lb/hr for VOCs from each limestone dryer, with a total annual emission rate from both dryers of less than 0.15 tons VOC/yr. For comparison, total annual emissions of VOC from the CFB boilers are estimated at less than 195 tons/yr. Thus, the limestone dryers' emissions of VOCs are negligible.

The most stringent available alternative for control of this pollutant from these sources is considered to be the use of burners which maximize complete combustion, which will result in minimization of formation of VOC. Such burners, which will be utilized in the proposed facility, are thus concluded to be appropriate for control of VOC.

REFERENCES FOR SECTION 4:

Bechtel (1992). Personal Communication between S. Jelinek of ENSR and A. Nawar of Bechtel Power, October.

Black & Veatch (1992). Personal Communication between S. Jelinek of ENSR and M. Perry, November.

Buschmann, J. (1990). Presentation Material to the EPA's Task Force on Mercury Emissions. (Flakt).

Cichanowicz, E. (1988) "Selective Catalytic Reduction Controls NO_x in Europe", Power Engineering, August.

Englehard, (1990). Personal Communication between S.Jelinek of ENSR and R.Yarrington of Englehard Corporation, August.

Environment Canada (1986). "The National Incinerator Testing and Evaluation Program: Air Pollution Control Technology," Report EPS 3/UP/2, September.

Environment Canada (1987). "The National Incineration Testing & Evaluation Program (NITEP) Air Pollution Control Technology Volume II - Main Report," June.

EPA (1985). AP-42, "Compilation of Air Pollutant Emission Factors"

EPA (1987a). "Municipal Waste Combustion Study: Flue Gas Cleaning Technology," EPA/530-SW-87-021d.

EPA (1989a). "Estimating Air Toxics Emissions from Coal and Oil Combustion Sources," Office of Air Quality Planning and Standards, EPA-450/2-89-001, April.

EPA (1989b). "Proposed Standards of Performance for New Stationary Sources: Municipal Waste Combustors," Federal Register, December.

EPA (1989c). "National Emission Standards for Hazardous Air Pollutants: Radionuclides," Federal Register, December.

EPA (1989d). "Municipal Waste Combustors - Background Information for Proposed Standards. Post-Combustion Technology Performance, "EPA-450/3-89-027c, August.

EPA (1990). "OAQPS Control Cost Manual", EPA 450/3-90-006, January.

Flakt (1990). Notes provided to U.S. EPA for Joint Task Force on Mercury Control from MWCs, February.

Hasselriis, F. (1985). "Technical Guidance Relative to Municipal Waste Incineration," Prepared for: Task Force on Municipal Incineration. New York State Department of Environmental Conservation, August.

Kobayashi, N. et al (1987) "Operating Experience of SCR Systems for Steam Generators," Presented at the 80th Annual Meeting of the Air Pollution Control Association, New York, June.

Kuroda, H. et al (1989) "Recent Developments in the SCR System and Its Operational Experiences," Proceedings of the 1989 Joint Symposium on Stationary Source NO_x Control, San Francisco, March.

Nakabayashi, Y. and Abe, R. (1987), "Current Status of SCR in Japan", Proceedings of the 1987 Joint Symposium on Stationary NO_x Control, New Orleans, March.

Porter, F. (1990). Personal Communication between N. Suprenant of ENSR and F. Porter of EPA Standards Development Branch, August.

Schonbucher, B. (1989) "Reduction of Nitrogen Oxides From Coal-Fired Power Plants by Using the SCR Process: Experiences in the Federal Republic of Germany With Pilot and Commercial Scale $DeNO_x$ Plants," Proceedings of the 1989 Joint Symposium on Stationary Source NO_x Control, San Francisco, March.

APPENDIX A

PARTICULATE EMISSIONS FROM AGGREGATE MATERIALS HANDLING AND STORAGE AND COOLING TOWER OPERATIONS

A. PARTICULATE EMISSIONS FROM AGGREGATE MATERIALS HANDLING AND STORAGE AND COOLING TOWER OPERATIONS

A.1 Particulate Emissions from Aggregate Materials Handling and Storage Operations

This section of the appendix presents the calculations of particulate emissions associated with aggregate materials handling and storage operations at the CBCP as proposed to be modified, and the future SKC recycling operation. At the CBCP there will be several operations pertaining to coal, limestone and ash handling and storage that can generate airborne dust particles. Various control measures will be employed to reduce these emissions (see Section 4). For purposes of the annual emissions comparison presented in Section 1 and the dispersion modeling of air quality impacts presented in Sections 2 and 3, it is necessary to quantify the emission rates of TSP and PM-10 from these operations. For those sources controlled via dust collectors, the outlet grain loadings provide the means for calculating emission rates. For those sources controlled by means other than dust collection, it is necessary to calculate the uncontrolled fugitive emissions and then estimate the effect of the various control measures. EPA's Compilation of Air Pollutant Emission Factors (AP-42) provides TSP and PM-10 emission factor equations and control efficiencies for these types of fugitive dust sources. These emission factor equations were used to derive TSP and PM-10 emission rates from several coal and limestone handling activities at the Cedar Bay Power Plant, as proposed to be modified. These emission factor equations were also used to derive particulate emission rates from bark handling operations at the SKC recycling operation.

Tables A-1 through A-11 present the data and assumptions employed in calculating emission rates of TSP and PM-10 from all the aggregate material handling, and storage operations. For each fugitive dust emitting operation, the AP-42 emission factor equation used to calculate emissions is identified along with the emission factor derived from the equation. Calculated uncontrolled emissions are given, controls and efficiencies listed, followed by the calculated controlled emission rates on a maximum daily and annual average basis. For sources controlled by dust collection the outlet grain loadings and calculated emissions are presented.

A.2 Particulate Emissions From Cooling Tower Operations

The FDER, in their March 11, 1991 Technical Evaluation and Preliminary Determination for the CBCP air permit noted that "dissolved and suspended solids in the small droplet fraction (less than 50 microns diameter) of cooling tower drift would be considered fugitive dust..." The calculation of particulate emissions is based on the concentration of total solids (dissolved and suspended) and the drift loss rate. Table A-12 lists the data and assumptions used to calculate a TSP/PM-10 emission rate for the cooling towers at the CBCP for both the "as certified" and "as proposed to be modified" cases.

TABLE A-1

Fugitive Dust Emissions Assumptions Coal Handling and Storage at the CBCP as Proposed to be Modified

Annual Consumption	1,080,000 tons/year
Maximum Daily Consumption	4,392 tons/day
Maximum Daily Unloading	9,000 tons/day
Weight of Mobile Loader	30 tons
Speed of Mobile Loader	1.5 mph
No. of Wheels on Mobile Loader	4
Annual Miles Traveled	4,342 miles/year
Maximum Daily Miles Traveled	20 miles/day
Coal Silt Content	6.2%
Coal Moisture Content	7.5%
Climatological Values	
Average Wind Speed	7.8 mph
No. hours with wind velocity above wind erosion threshold[a]	18 hours/year 3 hours/day (worst-case)
No. days per year with more than 0.01 inch precipitation	115

[a] Based on a friction velocity of 1.12 m/sec, wind erosion threshold is 10.8 m/sec.

TABLE A-2

Sources, Controls and Calculated Emissions of TSP from Coal Handling at the as Proposed to be Modified

Location	Operation	TSP Emission Factor	AP-42 Equation	Use Rate	Uncontrolled TSP Emissions	Controls	Control Efficiency	Controlled TSP Emissions
Coal Unloading Bldg	Railcar to Feeder 1	6.65 E-04 lb/ton	Material Handling	1080000 tons/yr 9000 tons/day	0.359 tons/yr 0.25 lb/hr	Enclosure Wet Suppression	70% 70%	0.032 tons/yr 0.022 lb/hr
	Feeder 1 to Conveyor 1	6.65 E-04 lb/ton	Material Handling	1080000 tons/yr 9000 tons/day	0.359 tons/yr 0.25 lb/hr	Enclosure Wet Suppression	70% 70%	0.032 tons/yr 0.022 lb/hr
	Conveyor 1 to Conveyor 2	6.65 E-04 lb/ton	Material Handling	1080000 tons/yr 9000 tons/day	0.359 tons/yr 0.25 lb/hr	Enclosure Wet Suppression	70% 70%	0.032 tons/yr 0.022 lb/hr
Receiving Pile	Conv. 2 to Lowering Well	6.65 E-04 lb/ton	Material Handling	1080000 tons/yr 9000 tons/day	0.359 tons/yr 0.25 lb/hr	Enclosure	50%	0.180 tons/yr 0.125 lb/hr
	Wind Erosion[a]	0.096 lb/hr	Wind Erosion	18 hours/yr 3 hours/day	0.0009 tons/yr 0.0120 lb/hr	None	-	0.0009 tons/yr 0.0120 lb/hr
Storage Pile	Wind Erosion[a]	0.497 lb/hr	Wind Erosion	18 hours/yr 3 hours/day	0.0045 tons/yr 0.0621 lb/hr	None	-	0.0045 tons/yr 0.0120 lb/hr
Unpaved Road	Coal Reclaim by Loader	4.19E-01 lb/VMT	Unpaved Road	4342 VMT/yr 20 VMT/day	0.910 tons/yr 0.349 lb/hr	Watering	75%	0.227 tons/yr 0.087 lb/hr
Reclaim Hopper	Mobile Loader to Feeder 2	6.65E-04 lb/ton	Material Handling	1080000 tons/yr 4392 tons/day	0.359 tons/yr 0.12 lb/hr	Enclosure	70%	0.108 tons/yr 0.037 lb/hr
Conveyor Transfer	Feeder 2 to Conveyor 3	6.65E-04 lb/ton	Material Handling	1080000 tons/yr 4392 tons/day	0.359 tons/yr 0.12 lb/hr	Enclosure	70%	0.108 tons/yr 0.037 lb/hr
Coal Crusher Building	Conveyor 3 to Crusher Coal Crushing Crusher to Conveyor 4	3.00E-03 gr/cf	N/A	14336 ACFM 2808 hr/yr 8 hr/day	- -	Dust Collection Dust Collection	- -	0.518 tons/yr 0.123 lb/hr
Conveyor Transfer	Conveyor 4 to Conveyor 5	6.65E-04 lb/ton	Material Handling	108000 tons/yr 4392 tons/day	0.359 tons/yr 0.12 lb/hr	Enclosure	70%	0.108 tons/yr 0.037 lb/hr
Coal Silo Area	Conveyor 5 to Coal Silo	3.00E-03 gr/cf	N/A	23175 ACFM 2808 hr/yr 8 hr/day	- -	Dust Collection Dust Collection	- -	0.837 tons/yr 0.199 lb/hr

[a] emission factor shown is the emission rate only when wind speeds exceed the wind erosion threshold, as shown under "use rate"
N/A = not applicable

TABLE A-3

Sources, Controls and Calculated Emissions of PM-10 from Coal Handling at the CBCP as Proposed to be Modified

Location	Operation	PM-10 Emission Factor	AP-42 Equation	Use Rate	Uncontrolled PM-10 Emissions	Controls	Control Efficiency	Controlled PM-10 Emissions
Coal Unloading Bldg	Railcar to Feeder 1	3.15 E-04 lb/ton	Material Handling	1080000 tons/yr 9000 tons/day	0.170 tons/yr 0.12 lb/hr	Enclosure Wet Suppression	70% 70%	0.015 tons/yr 0.011 lb/hr
	Feeder 1 to Conveyor 1	3.15 E-04 lb/ton	Material Handling	1080000 tons/yr 9000 tons/day	0.170 tons/yr 0.12 lb/hr	Enclosure Wet Suppression	70% 70%	0.015 tons/yr 0.011 lb/hr
	Conveyor 1 to Conveyor 2	3.15 E-04 lb/ton	Material Handling	1080000 tons/yr 9000 tons/day	0.170 tons/yr 0.12 lb/hr	Enclosure Wet Suppression	70% 70%	0.015 tons/yr 0.011 lb/hr
Receiving Pile	Conv. 2 to Lowering Well	3.15 E-04 lb/ton	Material Handling	1080000 tons/yr 9000 tons/day	0.170 tons/yr 0.12 lb/hr	Enclosure	50%	0.085 tons/yr 0.059 lb/hr
	Wind Erosion[a]	0.048 lb/hr	Wind Erosion	18 hours/yr 3 hours/day	0.0004 tons/yr 0.006 lb/hr	None	-	0.0004 tons/yr 0.006 lb/hr
Storage Pile	Wind Erosion	0.249 lb/hr	Wind Erosion	18 hours/yr 3 hours/day	0.0022 tons/yr 0.0311 lb/hr	None	-	0.0022 tons/yr 0.0311 lb/hr
Unpaved Road	Coal Reclaim by Loader	1.89E-01 lb/VMT	Unpaved Road	4342 VMT/yr 20 VMT/day	0.409 tons/yr 0.158 lb/hr	Watering	75%	0.102 tons/yr 0.039 lb/hr
Reclaim Hopper	Mobile Loader to Feeder 2	3.15E-04 lb/ton	Material Handling	1080000 tons/yr 4392 tons/day	0.170 tons/yr 0.06 lb/hr	Enclosure	70%	0.051 tons/yr 0.017 lb/hr
Conveyor Transfer	Feeder 2 to Conveyor 3	3.15E-04 lb/ton	Material Handling	1080000 tons/yr 4392 tons/day	0.170 tons/yr 0.06 lb/hr	Enclosure	70%	0.051 tons/yr 0.017 lb/hr
Coal Crusher Building	Conveyor 3 to Crusher Coal Crushing Crusher to Conveyor 4	3.00E-03 gr/cf	N/A	14336 ACFM 2808 hr/yr 8 hr/day	- -	Dust Collection Dust Collection	- -	0.518 tons/yr 0.123 lb/hr
Conveyor Transfer	Conveyor 4 to Conveyor 5	3.15E-04 lb/ton	Material Handling	108000 tons/yr 4392 tons/day	0.170 tons/yr 0.06 lb/hr	Enclosure	70%	0.051 tons/yr 0.017 lb/yr
Coal Silo Area	Conveyor 5 to Coal Silo	3.00E-03 gr/cf	N/A	23175 ACFM 2808 hr/yr 8 hr/day	- -	Dust Collection Dust Collection	- -	0.837 tons/yr 0.199 lb/hr

[a] emission factor shown is the emission rate only when wind speeds exceed the wind erosion threshold, as shown under "use rate"

N/A = not applicable

TABLE A-4

Fugitive Dust Emissions Assumptions Limestone Handling at the CBCP as Proposed to be Modified

Annual Consumption	158,000 tons/year
Maximum Daily Consumption	780 tons/day
Weight of Delivery Trucks	50 tons full, 20 tons empty
No. of Lanes (paved road)	2
Surface Silt Content	12.5%
Dust Loading	1750 lb/mile
Annual Miles Traveled	619 miles/year full 619 miles/year empty
Maximum Daily Miles Traveled	3.94 miles/day full 3.94 miles/day empty
Weight of Mobile Loader	30 tons
Speed of Mobile Loader	1.5 mph
No. of Wheels on Mobile Loader	4
Annual Miles Traveled	244 miles/year
Maximum Daily Miles Traveled	1.55 miles/day
Limestone Silt Content	1.6%
Limestone Moisture Content	7%
Climatological Values	
Average Wind Speed	7.8 mph
No. hours with wind velocity above wind erosion threshold[(a)]	18 hours/yr 3 hours/day (worst-case)
No. days per year with more than 0.01 inch precipitation	115
[(a)] Based on a friction velocity of 1.12 m/sec, wind erosion threshold is 10.8 m/sec.	

TABLE A-5

Sources, Controls and Calculated Emissions of TSP from Limestone Handling at the CBCP as Proposed to be Modified

Location	Operation	TSP Emission Factor	AP-42 Equation	Use Rate	Uncontrolled TSP Emissions	Controls	Control Efficiency	Controlled TSP Emissions
Paved Road	Limestone Delivery	3.68E+00 lb/VMT	Paved Road	619 VMT/yr 3.94 VMT/day	1.139 tons/yr 0.604 lb/hr	Water Flushing	70%	0.342 tons/yr 0.181 lb/hr
Limestone Dump	Dumping from Truck	7.31E-04 lb/ton	Material Handling	158000 tons/yr 780 tons/day	0.058 tons/yr 0.024 lb/hr	None	-	0.058 tons/yr 0.024 lb/hr
Limestone Pile	Wind Erosion[a]	0.023 lb/hr	Wind Erosion	18 hours/yr 3 hours/day	0.0002 tons/yr 0.0029 lb/hr	None	-	0.0002 tons/yr 0.0029 lb/hr
Unpaved Road	Reclaim by Mobile Loader	1.08E-01 lb/VMT	Unpaved Road	244 VMT/yr 1.55 VMT/day	0.013 tons/yr 0.007 lb/hr	Watering	75%	0.0033 tons/yr 0.0017 lb/hr
Dozer Traps	Mobile Loader to Conveyor	7.31E-04 lb/ton	Material Handling	158000 tons/yr 780 tons/day	0.058 tons/yr 0.024 lb/hr	None	0%	0.058 tons/yr 0.024 lb/hr
Limestone Pulverizer	Conveyor to Pulverizer Limestone Pulverizing	3.00E-03 gr/cf	N/A	98000 ACFM 2808 hr/yr 8 hr/day	- -	Dust Collection Dust Collection	- -	3.54 tons/yr 0.84 lb/hr
Storage Bin Vent	Drop Into Storage Bins	3.00E-03 gr/cf	N/A	6400 ACFM 2808 hr/yr 8 hr/day	- -	Dust Collection Dust Collection	- -	0.23 tons/yr 0.055 lb/hr

[a] emission factor shown is the emission rate only when wind speeds exceed the wind erosion threshold, as shown under "use rate"

N/A = not applicable

TABLE A-6

Sources, Controls and Calculated Emissions of PM-10 from Limestone Handling at the CBCP as Proposed to be Modified

Location	Operation	PM-10 Emission Factor	AP-42 Equation	Use Rate	Uncontrolled PM-10 Emissions	Controls	Control Efficiency	Controlled PM-10 Emissions
Paved Road	Limestone Delivery	1.79E+00 lb/VMT	Paved Road	619 VMT/yr 3.94 VMT/day	0.554 tons/yr 0.294 lb/hr	Water Flushing	70%	0.166 tons/yr 0.088 lb/hr
Limestone Dump	Dumping from Truck	3.46E-04 lb/ton	Material Handling	158000 tons/yr 780 tons/day	0.027 tons/yr 0.011 lb/hr	None	-	0.027 tons/yr 0.011 lb/hr
Limestone Pile	Wind Erosion[a]	0.0115 lb/hr	Wind erosion	18 hours/yr 3 hours/day	0.0001 tons/yr 0.0014 lb/hr	None	-	0.0001 tons/yr 0.0014 lb/hr
Unpaved Road	Reclaim by Mobile Loader	4.86E-02 lb/VMT	Unpaved Road	244 VMT/yr 1.55 VMT/day	0.006 tons/yr 0.003 lb/hr	Watering	75%	0.0015 tons/yr 0.0008 lb/hr
Dozer Traps	Mobile Loader to Conveyor	3.46E-04 lb/ton	Material Handling	158000 tons/yr 780 tons/day	0.027 tons/yr 0.011 lb/hr	None	0%	0.027 tons/yr 0.011 lb/hr
Limestone Pulverizer	Conveyor to Pulverizer Limestone Pulverizing	3.00E-03 gr/cf	N/A	98000 ACFM 2808 hr/yr 8 hr/day	- -	Dust Collection Dust Collection	- -	3.54 tons/yr 0.84 lb/hr
Storage Bin Vent	Drop into Storage Bins	3.00E-03 gr/cf	N/A	6400 ACFM 2808 hr/yr 8 hr/day	- -	Dust Collection Dust Collection	- -	0.23 tons/yr 0.055 lb/hr

[a] emission factor shown is the emission rate only when wind speeds exceed the wind erosion threshold, as shown under "use rate"

N/A = not applicable

TABLE A-7

Sources, Controls and Calculated TSP/PM-10 Emissions from Ash Handling at the CBCP as Proposed to be Modified

Control Location	Control Method	PM-10 Emission Factor	Flow Rate	Hours of Operation	Controlled TSP & PM-10 Emissions
Bed Ash Hopper	Vent Filter	3.00E-03 gr/cf	670 ACFM	8424 hr/yr 24 hr/day	0.073 tons/yr 0.017 lb/hr
Fly Ash/Bed Ash Silo	Baghouse Filter	3.00E-03 gr/cf	3000 ACFM	8424 hr/yr 24 hr/day	0.325 tons/yr 0.077 lb/hr
Fly Ash Silo	Vent Filter	3.00E-03 gr/cf	3700 ACFM	8424 hr/yr 24 hr/day	0.401 tons/yr 0.095 lb/hr
Bed Ash Silo	Vent Filter	3.00E-03 gr/cf	1800 ACFM	8424 hr/yr 24 hr/day	0.195 tons/yr 0.046 lb/hr

TABLE A-8

Sources, Controls and Calculated Emissions of TSP/PM-10 from Ash Pelletizing at the CBCP as Proposed to be Modified

Control Location	Control Method	PM-10 Emission Factor	Flow Rate	Hours of Operation	Controlled TSP & PM-10 Emissions
Bed Ash Bin	Vent Filter	3.00E-03 gr/cf	4000 ACFM	2920 hr/yr 8 hr/day	0.15 tons/yr 0.034 lb/hr
Fly Ash Bin	Vent Filter	3.00E-03 gr/cf	3800 ACFM	2920 hr/yr 8 hr/day	0.14 tons/yr 0.033 lb/hr
Pelletizing Ash Recycle Tank	Dust Collector	3.00E-03 gr/cf	1000 ACFM	2920 hr/yr 8 hr/day	0.038 tons/yr 0.0086 lb/hr
Pelletizing Recycle Hopper	Dust Collector	3.00E-03 gr/cf	500 ACFM	2920 hr/yr 8 hr/day	0.019 tons/yr 0.0043 lb/hr
Pelletizing Pan	Impingement Scrubber	3.00E-03 gr/cf	14740 ACFM	2920 hr/yr 8 hr/day	0.553 tons/yr 0.126 lb/hr
Pellet Recycle Conveyor Discharge	Dust Collector	3.00E-03 gr/cf	1000 ACFM	2920 hr/yr 8 hr/day	0.038 tons/yr 0.0086 lb/hr
Vibratory Screen	Dust Collector	3.00E-03 gr/cf	15000 ACFM	2920 hr/yr 8 hr/day	0.56 tons/yr 0.129 lb/hr
Pellet Curing Silo Outlet Conveyor	Vent Filter	3.00E-03 gr/cf	2100 ACFM	2920 hr/yr 8 hr/day	0.079 tons/yr 0.018 lb/hr
Pellet Hydrator	Venturi Scrubber	3.00E-03 gr/cf	13500 ACFM	2920 hr/yr 8 hr/day	0.507 tons/yr 0.116 lb/hr
Pellet Curing Silo	Impingement Scrubber	3.00E-03 gr/cf	5940 ACFM	2920 hr/yr 8 hr/day	0.223 tons/yr 0.051 lb/hr
Cured Pellet Conveyor	Dust Collector	3.00E-03 gr/cf	4500 ACFM	2920 hr/yr 8 hr/day	0.17 tons/yr 0.039 lb/hr

TABLE A-9

Fugitive Dust Emissions Assumptions for Bark Handling and Storage at the SKC Recycling Operation

Annual Consumption	271936 tons/yr
Average Daily Consumption	745 tons/day
Weight of vehicle	40 tons
Speed of vehicle	5 mph
No. of wheels on vehicle	4
Miles traveled	21900 miles/yr
Bark silt content	1.5%
Bark moisture content	40%
Climatological Values	
Average Wind Speed	7.8 mph
No. hours with wind velocity above wind erosion threshold[a]	18 hours/yr 3 hours/day (worst-case)
No. days per year with more than 0.01 inch precipitation	115

[a] Based on a friction velocity of 1.12 m/sec, wind erosion threshold is 10.8 m/sec.

TABLE A-10

Sources and Calculated TSP Emissions from SKC Bark Handling and Storage Operations[a]

Location	Operation	Emission Factor	AP-42 Equation	Use Rate	TSP Emissions
Unpaved Road	Vehicle Travel	5.16E-01 lb/VMT	Unpaved Road	21900 VMT/yr 60 VMT/day	5.65 tons/yr 1.29 lb/hr
Bark Pile	Dumping from Truck	6.35E-05 lb/ton	Material Handling	271936 tons/yr 745 tons/day	0.0086 tons/yr 0.0020 lb/hr
	Wind Erosion[b]	0.594 lb/hr	Wind Erosion	18 hours/yr 3 hours/day	0.0053 tons/yr 0.0743 lb/hr
	Bark Pushing by Dozer	0.0166 lb/hr	Pushing Operation	4380 hours/year 12 hours/day	0.0362 tons/yr 0.0083 lb/hr
Wood Room	Drag Chain	6.35E-05 lb/ton	Material Handling	271936 tons/yr 745 tons/day	0.0086 tons/yr 0.0020 lb/hr
	Screening	6.35E-05 lb/ton	Material Handling	271936 tons/yr 745 tons/day	0.0086 tons/yr 0.0020 lb/hr
	Drop to Conveyor	6.35E-05 lb/ton	Material Handling	271936 tons/yr 745 tons/day	0.0086 tons/yr 0.0020 lb/hr
Bark Boiler Building	Drop into Storage Bin	6.35E-05 lb/ton	Material Handling	271936 tons/yr 745 tons/day	0.0086 tons/yr 0.0020 lb/hr

[a] Information on Bark Handling Operations provided by SKC: Telephone Conversations between Mike Riddle, SKC and (1) Mark Peterson, ENSR on 10-26-92, and (2) Malay Jindal, ENSR on 11/09/92.

[b] emission factor shown is the emission rate only when wind speeds exceed the wind erosion threshold, as shown under "use rate"

TABLE A-11

Sources and Calculated PM-10 Emissions from SKC Bark Handling and Storage Operations

Location	Operation	Emission Factor	AP-42 Equation[b]	Use Rate	PM-10 Emissions
Unpaved Road	Vehicle Travel	2.32E-01 lb/VMT	Unpaved Road	21900 VMT/yr 60 VMT/day	2.54 tons/yr 0.58 lb/hr
Bark Pile	Dumping from Truck	3.00E-05 lb/ton	Material Handling	271936 tons/yr 745 tons/day	0.0041 tons/yr 0.0009 lb/hr
	Wind Erosion[a]	0.297 lb/hr	Wind Erosion	18 hours/yr 3 hours/day	0.0027 tons/yr 0.0371 lb/hr
	Bark Pushing by Dozer	0.0104 lb/hr	Pushing Operation	4380 hours/year 12 hours/day	0.0226 tons/yr 0.0052 lb/hr
Wood Room	Drag Chain	3.00E-05 lb/ton	Material Handling	271936 tons/yr 745 tons/day	0.0041 tons/yr 0.0009 lb/hr
	Screening	3.00E-05 lb/ton	Material Handling	271936 tons/yr 745 tons/day	0.0041 tons/yr 0.0009 lb/hr
	Drop to Conveyor	3.00E-05 lb/ton	Material Handling	271936 tons/yr 745 tons/day	0.0041 tons/yr 0.0009 lb/hr
Bark Boiler Building	Drop into Storage Bin	3.000E-05 lb/ton	Material Handling	271936 tons/yr 745 tons/day	0.0041 tons/yr 0.0009 lb/hr

[a] emission factor shown is the emission rate only when wind speeds exceed the wind erosion threshold, as shown under "use rate"

TABLE A-12

Cooling Tower Particulate Emissions

Parameter	Cedar Bay as Certified	Cedar Bay as Proposed to be Modified
Total Water Flow (gpm)[a]	160,000	160,000
Drift Elimination Efficiency (%)	.002[a]	.001[b]
Drift Loss Rate (gpm)[c]	3.2	1.6
Total Dissolved Solids[d]	13,000 ppm	13,000 ppm
Total Suspended Solids[d]	50 ppm	50 ppm
% Drift <50 microns[a]	54	54
Particulate Emission Rate (lb/hr)[e]	11.29	5.64

[a] Source: Black & Veatch Memorandum from A.L. Carson to M.A. Perry, 10/14/92.
[b] Proposed improvement by Cedar Bay Cogeneration Project
[c] Calculated from total water flow and drift elimination efficiency
[d] Assumed upper limit
[e] Calculated from drift loss rate and total solids

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ENSR Consulting and Engineering

Alabama	Florence	(205) 740-8240
Alaska	Anchorage	(907) 276-4302
California	Los Angeles	
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