TAMPA ELECTRIC

RECEIVED

OCT 22 2003

BUREAU OF AIR REGULATION

October 21, 2003

Ms. Trina Vielhauer
Administrator- Title V Section
Florida Department of Environmental Protection
111 South Magnolia Drive, Suite 4
Tallahassee, FL 32301

Via FedEx
Airbill No. 7929 9419 6166

Re: Tampa Electric Company (TEC)
Polk Power Station Unit 1
Biomass Test Burn
Permit No. 1050233-012-AV
AIRS #1050233, EU ID #001

Dear Ms. Vielhauer:

The purpose of this letter is to request permission to conduct a test burn at Polk Power Station (PPS) Unit 1 under the authority of the current Title V Air Operation Permit No. 1050233-012-AV. The test burn would be conducted to test the feasibility of firing syngas produced from the gasification of a biomass based renewable resource fuel (biomass) blended with other currently permitted fuels (coal and petcoke). Biomass fuel is defined here as a renewable resource fuel consisting primarily of natural vegetative matter. As you are aware, TEC received authorization from the Florida Department of Environmental Protection (FDEP) to perform a biomass test burn on December 21, 2001. Upon receipt of the authorization, TEC immediately began procuring biomass fuel to facilitate the test burn. On December 30 and 31, 2001, TEC successfully gasified a blend of biomass, coal and pet coke, per the authorization. The blend consisted of approximately one-percent biomass by weight, which equates to approximately one ton of biomass gasified per hour.

Due to the initial success of the biomass test burn, TEC would like to continue to test other renewable fuels at Polk Unit 1. This is a process TEC is undertaking in an attempt to submit a construction permit application to FDEP in order to permanently be able to fire syngas produced from the gasification of biomass with coal and petcoke. The ability to gasify these renewable fuels and other environmentally friendly fuel sources supports TEC's green energy program and provides benefit to both the environment and our customers.

At this time, TEC is evaluating the use of Bahia grass, a native species indigenous to the area, which has been growing on the land at Polk. Approximately 50 acres of the overall plant site of 4,300 acres or 60 tons of Bahia grass have been harvested at Polk and will be used for the requested test burn. The biomass material proposed for gasification at Polk will not have been subject to painting, pressure treating, or other industrial chemical treatments that other wood derived fuels can be subject to. TEC does not anticipate the introduction of Bahia grass to be different than the biomass (Eucalyptus) used for the December 2001 test burn or have different results when used as a fuel, since Bahia grass (and almost all grasses) when compared to Eucalyptus have very similar characteristics. TEC will use existing fuel handling and feed systems in place at the plant. As such, it is expected the biomass material will be unloaded from front end unloaders to the rented conveyor and feed Charrah's blunger tank, which recycles fines/water from scrubbers to the gasifier. The biomass material will ultimately be mixed and slurried with the coal/petcoke blend from the coal silos in an effort to maintain a continuous biomass/fuel blend ratio. A process flow diagram and representative analysis of the Bahia grass has been provided with this cover letter for your review (see Attachment A and B respectively for details). As with the December 2001 test burn, TEC will not change the fuel type used during this test burn. The fuel that will be blended with the biomass for the purposes of this test burn will be consistent with the types of fuel TEC is currently permitted to gasify.

TEC requests authorization to conduct the comparison test burn for a period of up to 28-days (see Attachment C for details). This will allow TEC to evaluate the impacts of the material on the fuel handling systems and other associated process equipment as well as evaluate the effects, if any, of firing syngas produced from the gasification of a blend of biomass and other currently permitted fuels. TEC does not anticipate any emission increase, as was evident by the prior biomass test burn report submitted April 16, 2002 to FDEP that combusting syngas produced from the gasification of a fuel blend of 99% petcoke/coal with a 1% biomass does not result in a significant increase in any regulated pollutant as defined in Table 212.400-2 F.A.C. A copy of the test burn report has been provided (see Attachment D for details).

TEC will conduct a baseline test burn to establish the representative emissions from Polk Unit 1 prior to the introduction of biomass into the gasifier. Baseline testing will last up to seven days and will consist of sulfur dioxide (SO_2) and nitrogen oxides (NO_x) data collection through the use of Continuous Emissions Monitors (CEMs).

Following the baseline test, TEC will conduct a biomass blend test burn of syngas produced from the gasification of up to 5% biomass and up to 95% fuel blend. Biomass blend testing will last up to 21 days and will consist of sulfur dioxide (SO_2) and nitrogen oxides (NO_x) data collection through the use CEMs like on the December 2001 test burn. Because of the intense gas cleaning steps involved in the gasification process, the particulate matter emissions and sulfuric acid mist emissions will not be affected by the firing of the syngas produced from the gasification of the biomass blend.

The baseline and biomass blend test burns will be conducted under standard PPS operating conditions and, to the extent possible, at least 90% of the maximum permitted heat input. Data will be compiled and results reported to the FDEP within 60 days of the completion of the test burn. Any residual biomass fuel stock that is on hand after the test burn will be consumed immediately after the test burn is completed. TEC will use enough fuel on-site to supply the needs of the test burn, with perhaps a slight margin to compensate for unforeseen circumstances. TEC intends to begin the test burn upon receiving approval from FDEP, since the Bahia grass is already on-site.

PPS is interested in firing syngas produced from the gasification of biomass for several reasons. First, certain governmental initiatives may make it financially advantageous to gasify biomass at the PPS. The possible economic advantages of one particular program are currently under investigation, and this test burn is being proposed to allow for further evaluation. Second, biomass is a renewable resource, and utilizing it as a fuel source at Polk Power Station will help support the Company's commitment to the use of renewable energy sources. Given the variability of fuel pricing, biomass may be less expensive than coal and may reduce the cost of electricity to our customers. Approval of the facility Designated Representative will be provided (see Attachment E for details).

TEC appreciates the Department's cooperation and consideration in this matter. If you need any additional information or clarification on any of the issues presented above, please do not hesitate to contact Raiza Calderon or me at (813) 641- 5261.

Sincerely,

for

Laura R. Crouch
Manager- Air Programs
Environmental, Health & Safety

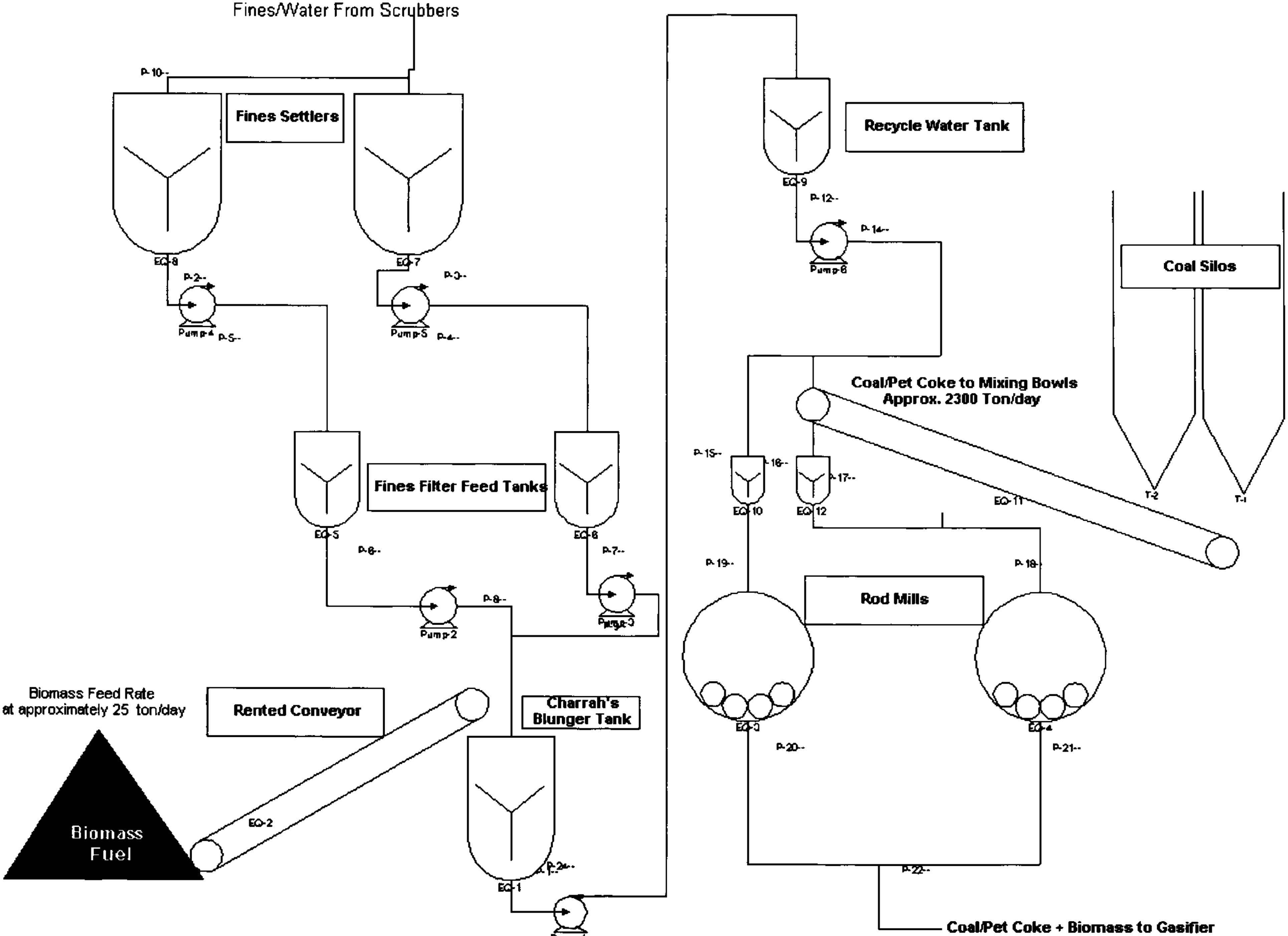
EA/bmr/RC166

c/enc: Mr. Scott Sheplak, FDEP

Enclosure

Attachment A
Polk Power Station Unit 1
Biomass Process Flow Diagram

Polk Power Station Unit 1
Bahia Grass Biomass Burn Test
Process Flow Diagram



Attachment B
Polk Power Station Unit 1
Biomass Representative Analysis

General Test Laboratory
P.O. Box 2641
Birmingham, Alabama 35291
(205) 664 - 6081

CERTIFICATE OF ANALYSIS

TO: Mr. David Bransby
Dept. of Agronomy & Soils
202 Funchess Hall Auburn Univ.
36849

Description : Auburn Univ./Agronomy & Soils

Customer Account :
Sample Date : 21-May-03

Laboratory Account BRANSBY
Received Date :

Florida Bahia

Laboratory ID Number : AH20530

Test Name	Reference	Result	
Dry Basis			
Ash, Dry	ASTM D 5142	5.61	% By Weight
Heat of Combustion, Dry	ASTM D 5865	7934	Btu/lb
Carbon Fixed, Dry	ASTM D 3172	18.67	% By Weight
Volatiles, Dry Basis	ASTM D 5142	75.72	% By Weight
Sulfur, Dry Basis	ASTM D 4239	0.14	% By Weight
As Received			
Moisture, Total	ASTM D 2013	21.24	% By Weight
Ash, As Received	ASTM D 5142	4.42	% By Weight
Heat of Combustion, As Received	ASTM D 5865	6249	Btu/lb
Carbon Fixed, As Received	ASTM D 3172	14.70	% By Weight
Volatiles, As Received	ASTM D 5142	59.64	% By Weight
Sulfur, As Received	ASTM D 4239	0.11	% By Weight
Ignited as Element			
Aluminum, Ignited Basis	ASTM D 3682	0.77	% By Weight
Calcium, Ignited Basis	ASTM D 3682	6.91	% By Weight
Barium, Ignited Basis	ASTM D 3683	42.	mg/kg
Iron, Ignited Basis	ASTM D 3682	0.22	% By Weight
Magnesium, Ignited Basis	ASTM D 3682	3.50	% By Weight
Phosphorus, Ignited Basis	ASTM D 3682	2.05	% By Weight
Potassium, Ignited Basis	ASTM D 3682	5.36	% By Weight
Silicon, Ignited Basis	ASTM D 3682	29.34	% By Weight
Sodium, Ignited Basis	ASTM D 3682	0.38	% By Weight
Sulfur, Ignited Basis	ASTM D 5016	1.30	% By Weight

This Certificate states the physical and/or chemical characteristics of the sample as submitted.

Comments:

CC:

Quality Control ______________________ Date :
7/30/2003
Supervision__________________________

smk/coal

General Test Laboratory
P.O. Box 2641
Birmingham, Alabama 35291
(205) 664 - 6081

CERTIFICATE OF ANALYSIS

TO: Mr. David Bransby
Dept. of Agronomy & Soils
202 Funchess Hall Auburn Univ.
36849

Customer Account :
Sample Date : 21-May-03
Laboratory Account BRANSBY
Received Date :

Description : Auburn Univ./Agronomy & Soils

Florida Bahia

Laboratory ID Number : AH20530

Test Name	Reference	Result	
Titanium, Ignited Basis	ASTM D 3682	0.12	% By Weight
Ignited as Oxide			
Aluminum Oxide, Ignited	ASTM D 3682	1.45	% By Weight
Calcium Oxide, Ignited	ASTM D 3682	9.67	% By Weight
Iron Oxide, Ignited	ASTM D 3682	0.31	% By Weight
Magnesium Oxide, Ignited	ASTM D 3682	5.80	% By Weight
Phosphorus Pentoxide, Ignited	ASTM D 3682	4.70	% By Weight
Potassium Oxide, Ignited	ASTM D 3682	6.46	% By Weight
Silicon Dioxide, Ignited	ASTM D 3682	62.77	% By Weight
Sodium Oxide, Ignited	ASTM D 3682	0.51	% By Weight
Sulfur Trioxide, Ignited	ASTM D 5016	3.25	% By Weight
Titanium Oxide, Ignited	ASTM D 3682	0.20	% By Weight
Barium Oxide, Ignited	ASTM D 3683	46.9	mg/kg
General			
Heat of Combustion, MAF	ASTM D 5865	8406	Btu/lb
Sulfur, lbs/mmBTU	ASTM D 3180	0.176	lbs/mmBTU
Initial Ash Fusion Temp, Red. At	ASTM D 1857	2080	Deg F
Softening Ash Fusion Temp, Red	ASTM D 1857	2268	Deg F
Hemispherical Ash Fusion,Reducin	ASTM D 1857	2310	Deg F
Fluid Ash Fusion Temp, Reducing	ASTM D 1857	2338	Deg F

This Certificate states the physical and/or chemical characteristics of the sample as submitted.

Comments:

CC:

Quality Control ____________________ Date :
7/30/2003
Supervision______________________

smk/coal

Attachment C
Polk Power Station Unit 1
Biomass Test Protocol

Tampa Electric Company (TEC) proposes to conduct a test burn at Polk Power Station Unit 1 (PPS) to compare the standard fuel blend of up to 60% petcoke and coal by weight to a blend containing up to 5% biomass and 95% of the standard blend.

The baseline test burn will evaluate SO_2 and NO_x emissions as a result of firing syngas produced from the gasification of a petcoke and coal fuel blend consisting of up to 60% petcoke. This baseline test will last for up to seven days to facilitate collection of representative data.

The biomass blend test burn will evaluate the SO_2 and NO_x emissions produced from the gasification of the above mentioned biomass fuel blend. This biomass blend test burn will last for up to 21 days to facilitate collection of representative data. Any residual biomass fuel stock that is on hand after the test burn will be consumed immediately after the test burn is completed.

The SO_2 and NO_x test burn data will be collected and analyzed using the methodologies found in Table 1. Prior to blending, fuel testing will be done on the standard fuel blend and the biomass fuel individually. Continuous emissions monitors (CEMS), located in the combustion turbine stack, will be used to collect representative data for SO_2 and NO_x, emissions during the test burn. CEMS will be quality assured pursuant to 40 CFR 75, Appendix B. The data assessment report from 40 CFR 60, Appendix F, for the most recent relative accuracy test audit (RATA) and most recent cylinder gas audit (CGA), will be submitted with the test burn report.

During these tests, when representative data is collected, PPS Unit 1 will be operated at a minimum of 90% of the maximum permitted heat input. Upon completion of all testing, TEC will compile test results in a report to be submitted to the Florida Department of Environmental Protection within 60 days of completion of the test burn.

Table 1. Summary of data collection and monitoring methodologies to be used during the PPS biomass test burn.

Test	SO_2	NO_x	Fuel Analysis
Baseline Test 7 Days	CEM Data[1]	CEM Data[1]	Weekly composite fuel analysis[2]
Biomass Test 21 Days	CEM Data[1]	CEM Data[1]	Weekly composite fuel analysis[2]

[1]Equivalent CEM data will be used in lieu of stack test data.

[2]Composite weekly fuel analysis results will be supplied during the baseline and test burn. Fuel analyses will include the following:

Fuel Analysis: Sulfur, wt. %,Volatiles, Content, wt. %, Nitrogen, wt. %, Ash, wt. %, Calorific Value, BTU/#, Carbon, wt. %, Moisture, wt. %

Attachment D
Polk Power Station Unit 1
December 2002 Biomass Test Burn Report

Tampa Electric Company

TAMPA ELECTRIC

Biomass Test Burn Report

Polk Power Station Unit 1

April 2002

1.0 Introduction

Tampa Electric Company (TEC) conducted a test burn on December 31, 2001 at the Polk Power Station (PPS) Unit 1. The purpose of this test burn was to investigate the effects of gasifying a small portion of biomass as a constituent of the feedstock that is processed to form the synthetic gas (syngas) fired in the combustion turbine (CT). TEC performed this test under the authority of the temporary permit issued by the Florida Department of Environmental Protection (the Department) dated December 21, 2001. The data from this test indicate there is no increase in monitored air emissions (NO_x and SO_2) from PPS Unit 1 as a result of the addition of a small amount of biomass as a constituent of the feedstock for PPS Unit 1. This report constitutes the required Test Burn Report for the biomass test burn. The background for this test including materials and methods used for the test are presented within. Also, the results of the test are presented and discussed.

2.0 Background

PPS Unit 1 uses an Integrated Gasification Combined Cycle Process (IGCC) to convert solid fuels into a syngas that can be fired in a CT. The IGCC process is capable of handling a variety of fuels as feedstock to the gasification process. Currently, PPS Unit 1 is typically fired on a blend of 55% petcoke and 45% coal. Thus, a similar blend was used during the test burn with biomass fuel added to allow for direct comparisons. This biomass test burn fired a fuel blend that consisted of approximately 55% petcoke, 44% coal, and 1% biomass.

The test conducted on December 31, 2001 was conducted:

- To determine if any technical impediments exist to co-firing biomass as a small portion of the feedstock to the gasifier, and
- To characterize the emissions resulting from co-firing biomass.

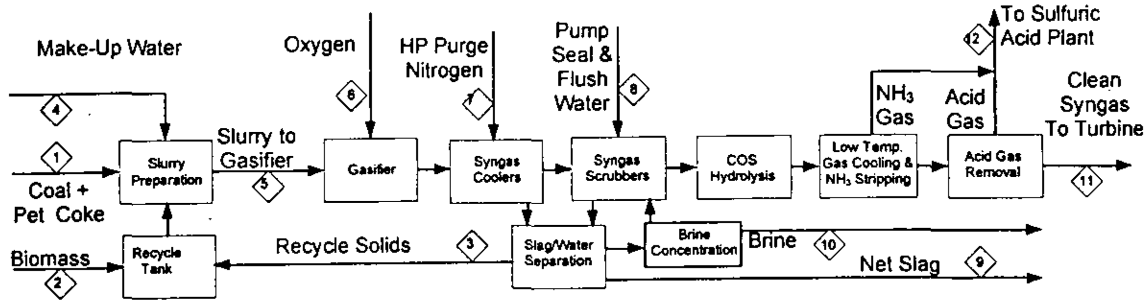
The IGCC process consists of several steps that ultimately result in the production of electrical power (Figure 1). Solid fuel is homogenized and mixed with water to produce slurry. The slurry is then passed to the gasifier that produces a high-pressure combustible gas (synthetic gas or "syngas"). After cooling the syngas, residual material from the gasification process is separated, the slag is rejected and the water and combustible fines are recycled back into the gasifier. Cooled syngas is passed through scrubbers that remove any remaining particulate matter. The syngas then is subjected to a series of steps that remove sulfur and convert the removed sulfur to H_2SO_4. This clean syngas is then fired in a CT that turns an electrical generator. Hot exhaust gasses from the CT are used to create steam that powers a steam turbine that also produces electrical power. This system is an efficient means to produce electrical power on a commercial scale.

2.1 Biomass Fuel Handling

This test used 8.8 tons of coarsely ground eucalyptus as the biomass fuel. Approximately 60 eucalyptus trees were harvested from the Common Purpose, Inc. grove located on land provided by the Tampa Airport Authority. The felled trees were sectioned into 4 foot lengths and passed through a portable hammer mill and trommel screen up to 5 times to produce material fine enough to avoid fouling the pumps and screens of PPS Unit 1's slurry feed system. The biomass fuel was transported to PPS in an enclosed trailer.

Biomass fuel was stored, handled, at processed at PPS. Biomass fuel was staged in a cleaned bin. Approximately 800 pounds of biomass fuel were loaded with a small loader into each of 22 tote sacks. The tote sacks were suspended individually over the recycled fines tank (Figure 1). The biomass fuel was introduced into the process via a stirred recycle tank and mixed with water over a period of 8 ½ hours. The mixed biomass fuel was blended with the normal coal and petcoke mixture to form slurry that was fed to the gasifier.

Figure 1. Block flow diagram of PPS Unit 1 gasifier section showing process stream designations.



2.2 Process Data Collection

Data were collected for key variables throughout IGCC process to allow for analysis of air quality impacts of this test burn. Feedstock analyses were conducted on both the standard petcoke/coal blend and the biomass fuel. Feedstock analyses include elemental, metals, and ash mineral compositions and heating value for each fuel type. Process streams were analyzed for elemental and ash composition, mass flow, and heat content at 12 points in the IGCC process corresponding to the 12 numerical labels shown in Figure 1. An overall mass balance for the gasifier was calculated during the test burn for each of the 12 process points indicated in Figure 1. Stack emissions data were collected for NO_x and SO_2 by the Continuous Emissions Monitoring System (CEMS) and reported at one-hour intervals throughout the test burn. Emissions data were reported in parts per million (ppm) for each pollutant.

2.3 Emissions data comparisons

Emissions data obtained during the test burn were compared to representative emissions data from December 29, 2001. The baseline data from December 29, 2001 were chosen as representative since those data are from the same petcoke/coal feedstock, were obtained immediately prior to the test burn, and Unit 1 was functioning normally and operating under similar conditions as those during the test burn. Larger baseline data sets were examined for possible comparison, but it was found that variability in process parameters such as heat input made statistical comparisons problematic for data that were obtained more than a few days prior to the test burn. For example, for the time period of December 26, 2001 to December 30, 2001 the sample variance for heat input in MMBtu was 12.4 times higher than the sample variance for the period December 29, 2001 to December 30, 2001 ($\sigma^2_{5\text{-day}} = 1639$ compared to $\sigma^2_{1\text{-day}} = 133$). Sample variance increased with time for heat input, power output, and for NO_x and SO_2 emissions levels.

2.4 Statistical Methods for Comparing Emissions Data

Emissions data from the test burn were analyzed and compared to the baseline data using a variety of statistical measures. Emissions data from both the test burn and the baseline periods were evaluated using the same statistical measures. Data from the CEMS were reported as the variables Heat Input (MMBtu), Power Output (MW), SO_2 (lb/MMBtu), SO_2 (ppm), NO_x (lb/MMBtu), NO_x (ppm). The statistics mean(μ), variance(σ^2), kurtosis, skewness, range, and 95% confidence interval were calculated for each variable. The mean and variance were used to compare the test burn emissions data to the baseline emissions data. Kurtosis, skewness, range, and 95% confidence interval were used to evaluate the quality of the emissions data and to make decisions about which comparative methods were appropriate to use in comparing test burn and baseline data. To compare test burn data to baseline data, each set of variables was examined using a two-sample F-test to make inferences about population variances and a two-sample t-test assuming unequal variances to make inferences about population means.

The comparative statistical methods used in this report require that certain assumptions be met before the results of these methods can be considered valid. Comparisons between the means of the test burn data and the baseline data are most useful in determining if there is a change in a process after a treatment is applied.

The statistic that is used to make comparisons between sample means is called a two-sample t-test. A t-test can be used to determine if two populations' means are equal at a given significance level. The significance level for this report is 95% ($\alpha = 0.05$) in all cases. A t-test compares the ratio of the sample means and variances to expected frequency distribution of a normal population at a specified error rate. The two-sample t-test is used to evaluate the hypothesis that two populations' means are equal against the alternative hypothesis that the two populations' means are unequal. The hypothesis of equal means is rejected when the calculated t-statistic is greater than the t-critical value at a given significance level. The validity of the t-test is based on several assumptions.

First, the two samples are independent. In practical terms, the assumption of independence means that the two samples are drawn from two different populations and that the elements of one sample are unrelated to those of the second sample. This assumption is met since the data for the test burn and the baseline emissions were taken by a discrete sampling device at different times with all variables controlled except for biomass used as a feedstock in the test burn.

Second, the two samples are drawn from a normally distributed population. Though the assumption of a normal population distribution is less critical than the assumption of independent samples it is still important to verify that the assumption is met. Since each data point collected by the CEMS is actually a discrete point sample of a continuously variable exhaust stream the potential sample population is quite large. For modest-sized samples (combined sample size ≥ 30) drawn from a large population the distribution approaches normal even with modest skewness in the two populations. The tendency of a relative frequency histogram to approach normal when samples are repeatedly drawn from a large population is called the Central Limit Theorem. Since the combined sample size of the test burn and baseline data is 28, it is prudent to verify that the Central Limit Theorem applies by calculating the skewness and kurtosis for each variable in each data set. Skewness is a measure of the central tendency of a frequency distribution that relates to the symmetry of the peak in relation to the mean, mode, and median of the distribution. Normal distributions have a skewness of 0. Kurtosis is a measure of the size of the tails of a frequency distribution. Normal distributions have a kurtosis of 0. If the sample's frequency distribution does not approximate normality, then the non-parametric Wilcoxon rank rum statistic can be used to compare population means. The Wilcoxon rank sum test is not as likely to declare a difference in population means when it exists as is a t-test since the Wilcoxon rank sum is based on relative magnitudes rather than the magnitudes of the observations.

Third, variances are assumed to be equal. Since the t-test pools sample variances when computing the test statistic, unequal variances can have an effect on the nominal significance and confidence probabilities of the statistical test, especially when sample sizes are different. However, a computationally more difficult version of the t-test that allows for the use of separate variances for each sample can be used when variances are not equal.

A statistical test for comparing two population variances is the F-test. The F-test is used to check the validity of the equal variance assumption for a two-sample t-test. The F-test compares the ratio of the sample variances to an expected population variance frequency distribution that is defined by the degrees of freedom associated with the samples. The F-test can be used to test the hypothesis that two sample variances are equal against the alternative hypothesis that two sample variances are not equal. The hypothesis of equal sample variances is rejected when the calculated F-statistic exceeds the F-critical value of the frequency distribution that is defined by the degrees of freedom for the two samples.

3.0 Results and Discussion

Biomass fuel comprised approximately 1.2% of PPS Unit 1's fuel during the 8-½ hour test burn. Biomass fuel generated approximately 860 kW of electrical power during the test burn. The addition of biomass into the feedstock tended cause a decrease in the heat content of the feedstock due to biomass' elemental composition relative to the composition of the base fuel. Emissions from Unit 1 did not increase with respect to baseline during the test burn. There were no major technical impediments to the introduction of biomass into the feedstock of Unit 1. Logs of the biomass feed rate and certified truck scale tickets of the biomass delivery were maintained, and are provided in Appendix A.

3.1 Process

Biomass was introduced to the gasifier at a rate of 1,945 lb/hr. The biomass feed rate was approximately 1.2% of the base fuel feed rate of 164,840 lb/hr. The biomass fuel accounted for approximately 860 kW of electrical power out of a total of 220.5 MW generated during the test burn based on relative heating value and feed rates of the biomass fuel and the base fuel. Process results are summarized in Table 1. Plant performance from the operators' standpoint was indistinguishable from the normal petcoke/coal feedstock. Heat input to the CT during the test burn was on average 1667 ± 9.5 MMBtu compared to the heat input during the baseline period of 1681 ± 11.5 MMBtu, which were obtained from CEM data. (Note: The actual LHV to the CT during the test was 1473 mmbtu/hr, and HHV was 1583 mmbtu/hr. The CEMS reported HHV to the CT has a large error and this is why it should not be used.) Average CT power output was steady at 167.6 ± 0.1 MW during the test burn compared to 167.5 ± 0.08 MW during the baseline period.

Table 1. General process parameters for biomass and base fuels during the biomass test burn.

Parameter	Base Fuel	Biomass Fuel	Total or Weighted Average	
Feed Rate (lb/hr)	164,840	1,945	166,786	Total
Moisture Content (Wt%)	7.82%	46.8%	8.27%	Avg
Higher Heating Value (Btu/lb)	13,322	4,424	13,218	Avg
Higher Heating Value (MMBtu/hr)	2,196	8.6	2,205	Avg
Net Power Production (kW)	219,640	860	220,500	Total

3.2 Mass Balance

The overall mass balance for the gasification process was estimated at 12 different process points. The mass balance is presented in Table 2 and the stream numbers correspond to the numerical labels in Figure 1. Process streams 1-2 and 4-8 are feed streams and have a total flow rate of 381 thousand pounds per hour (KPPH). Process streams 9-12 are output streams and have a total flow rate of 381 KPPH. Process streams 3 and 5 are key internal streams and have flow rates of 81and 264 KPPH, respectively.

Table 2. Overall mass balance for PPS Unit 1 gasifier section during biomass test burn. Units are in thousand pounds per hour (KPPH). Stream number corresponds to numerical labels in Figure 1.

Input (Feed) Streams		
Stream Number	Stream Description	Flow (KPPH)
1	Coal / Petroleum Coke Blend	164.84
2	Biomass	1.95
4	Make-Up Water To Slurry	16.5
6	Oxygen To Gasifier	166.94
7	High Pressure Purge/Sootblowing N_2	11.07
8	Pump Seal/Instrument Flush Water	19.49
TOTAL SYSTEM INPUT		380.79

Product (Output) Streams		
Stream Number	Stream Description	Flow (KPPH)
9	Slag	17.36
10	Brine	0.02
11	Clean Syngas To Combustion Turbine	337.78
12	Acid and NH_3 Gas To Sulfuric Acid Plant	25.62
TOTAL SYSTEM OUTPUT STREAMS		380.78

Key Internal Streams		
5	Slurry To Gasifier	264.4
3	Recycle Solids To Slurry Preparation	81.12

3.3 Process Stream Flows and Compositions

Each of the 12 process streams identified by numerical labels in Figure 1 was analyzed for composition and mass flows (Tables 3 and 4). Table 3 presents the stream flows and compositions for the slurry preparation area (streams 1-5). Table 3 also presents the heat content of streams 1-3 and 5. Calculated and analytically derived vales for all parameters of stream 1 (base fuel) are presented in Table 3 for comparison purposes. Calculated and laboratory analytical values agree within the sampling and analytical accuracy range of the measurements. The addition of the biomass fuel to the base fuel resulted in a net decrease in composition (as a dry weight %) for all constituents except oxygen which increased by 0.25% and ash which increased by 0.01% over the calculated base fuel composition. Table 4 presents the flows and compositions for the gasification system (streams 3 and 5-12). Table 4 presents the compositional analysis of the clean syngas (stream 11) and residual materials from the gasification process (streams 9 and 3) as requested by the Department.

Table 3. Slurry preparation area stream flows and compositions during test burn. KPPH = thousand pounds per hour, AR = as received.

	Stream Number	1	1	2		3	4	5
	Units	COKE + COAL (Lab)	COKE + COAL (Calculated)	BIOMASS	COMBINED FRESH FUELS	RECYCLE SOLIDS	MAKE-UP WATER	SLURRY TO GASIFIER
COMPOSITION								
C	Wt % Dry	82.88	82.24	49.18	82.02	66.26		80.68
H	"	4.5	4.71	5.78	4.71	0.29		4.34
N	"	1.85	1.83	0.24	1.81	0.95		1.74
S	"	2.99	3.15	0.06	3.13	2.31		3.06
O	"	3.53	3.67	39.42	3.92	0		3.58
ASH	"	4.25	4.4	5.32	4.41	30.19		6.6
TOTAL	"	100	100	100	100	100		100
SUBTOTAL FLOW	KPPH DRY	151.95	151.95	1.035	152.985	14.196		167.181
H2O	Wt % AR	7.82	7.82	46.8	8.27	82.5		36.77
H2O	KPPH	12.891	12.891	0.91	13.801	66.924	16.496	97.22
TOTAL FLOW	KPPH AR	164.841	164.841	1.945	166.786	81.12		264.401
MASS FLOW								
C	Dry Lb/Hr	125936	124962	509	125471	9406		134877
H	"	6838	7150	60	7210	41		7251
N	"	2811	2774	2	2777	135		2911
S	"	4543	4791	1	4791	328		5119
O	"	5364	5582	408	5990	0		5990
ASH	"	6458	6691	55	6746	4286		11031
Ar	"	0	0	0	0	0		0
SUBTOTAL-Dry Solids	"	151950	151950	1035	152985	14196		167181
WATER / MOISTURE	lb/hr	12891	12891	910	13801	66924	16496	97220
TOTAL	"	164841	164841	1945	166786	81120		264401
HEAT CONTENT								
Calculated HHV	BTU/Lb (Dry)	14491	14511	8419	14470	9698		14065
Measured HHV	BTU/Lb (Dry)	14435		8213		9811		13990
Balance HHV	BTU/Lb (Dry)	14452	14452	8315	14411	9701		14011
Balance HHV	BTU/Lb (AR)	13322	13322	4424	13218	1698		
Balance HHV	MMBTU/Hr	2196	2196	8.6	2205	138		2342

Table 4. Gasification system stream flows and compositions during test burn. KPPH = thousand pounds per hour.

		GASIFICATION SYSTEM INPUTS					GASIFICATION SYSTEM OUTPUTS					
STREAM NUMBER		5	6	7	8		9	3	10	11	12	
GAS STREAMS	UNITS	SLURRY TO GASIFIER	OXYGEN	HP PURGE NITROGEN	SEAL & FLUSH WATER	TOTAL SYSTEM INPUT	SLAG	RECYCLE SOLIDS	BRINE (NH_4Cl)	CLEAN SYNGAS	ACID GASES	TOTAL SYSTEM OUTPUT
CO	VOL %		0	0						44.72	2.06	
H2	VOL %		0	0						36.02	0.52	
CH4	VOL %		0	0						0.02	0.02	
CO2	VOL %		0	0						15.01	66.42	
N2	VOL %		1.08	99.99						3.33	0	
Ar	VOL %		2.01	0						0.65	0	
H2O	VOL %		0	0						0.21	5.26	
H2S	VOL %		0	0						0.01	21.02	
COS	VOL %		0	0						0.01	0.06	
NH3	VOL %		0	0						0	4.62	
O2	VOL %		96.9	0.01						0	0.01	
TOTAL	VOL %		100	100						100	100	
MOLECULA R WT	LB/MOL E		32.12	28.02						21.1	38.76	
FLOW	KSCFH		1972.6	149.9						6075.5	250.9	
SOLID AND LIQUID STREAMS												
C	WT %	80.68					42.37	66.26				
H	WT %	4.34					0.31	0.29	7.49			
N	WT %	1.74					0.44	0.95	26.22			
S	WT %	3.06					1.47	2.31				
O	WT %	3.58					0	0				
ASH	WT %	6.6					55.41	30.19	66.29			
TOTAL	WT %	100					100	100	100			
DRY FLOW	KPPH	167.181					12.149	14.196	0.021			
H2O	WT %	36.77					30	82.5				
H2O FLOW	KPPH	97.22			19.489		5.207	66.924				
TOTAL FLOW	KPPH	264.401					17.356	81.12				
ELEMENTAL FLOWS / BALANCE:												
C	LB/HR	134877	0	0		134877	5148	9406		114880	5443	134877
H	LB/HR	18130	0	0	2181	20311	620	7530	2	11709	450	20311
N	LB/HR	2911	1580	11066		15558	53	135	6	14936	428	15558
S	LB/HR	5119	0	0		5119	179	328		144	4469	5119
O	LB/HR	92331	161177	1	17308	270817	4624	59435		191926	14832	270817
ASH	LB/HR	11031	0	0		11031	6732	4286	14	0	0	11031
Ar	LB/HR	0	4184	0		4184				4184	0	4184
TOTAL	LB/HR	264401	166941	11067	19489	461898	17356	81120	21	337779	25623	461898

3.4 Feedstock Analysis

A complete feedstock laboratory analysis is presented in Table 5. Both the base fuel and the biomass fuel were analyzed for elemental composition, ash composition, metal, and heat content. Compared to the base fuel, biomass fuel has greater moisture content, ash, hydrogen, oxygen, and some metals. Compared to the base fuel, biomass fuel has lesser carbon, nitrogen, and sulfur content. The difference in elemental composition results in a much lesser heat content for biomass fuel then for the base fuel (biomass fuel heat content was 56.8% of the heat content of the base fuel) and accounts for the dilution effect observed when the fuels are blended.

Table 5. Feed stock analysis of fuels used during test burn.

	Fuel	Coal/Coke Blend	Biomass
	Units		
Total Moisture	Wt %	7.82	46.8
Ultimate Analysis			
Ash	Wt % (Dry Basis)	4.25	5.32
C	Wt % (Dry Basis)	82.88	49.18
H	Wt % (Dry Basis)	4.5	5.78
N	Wt % (Dry Basis)	1.85	0.24
S	Wt % (Dry Basis)	2.99	0.06
O	Wt % (Dry Basis)	3.53	39.42
Heating Value			
Measured HHV	BTU/Lb (Dry Basis)	14435	8213
Calculated HHV	BTU/Lb (Dry Basis)	14490	8419
Miscellaneous			
T_{250}	Deg F	2560	2188
Chlorine	Wt % (Dry Basis in Coal)	0.02	0.07
Fluorine	Wt % (Dry Basis in Coal)	<0.01	34
Chromium	PPM (Wt) In Ash	136	85.9
Vanadium	Wt % In Ash	2.286	0.63
Nickel	ug/g dry coal	166	1300
Arsenic	ug/g dry coal	2.1	35.3
Mercury	ug/g dry coal	0.03	0.02
Lead	ug/g dry coal	2.6	116
Beryllium	ug/g dry coal	1.3	9.2
Ash Minerals			
CrO	Wt % In Ash	0.02	0.01
V_2O_5	Wt % In Ash	4.08	1.12
NiO	Wt % In Ash	0.50	0.17
As_2O_3	Wt % In Ash	0.0065	0.0050
Hg	Wt % In Ash	0.000071	0.000002
PbO	Wt % In Ash	0.0066	0.0120
BeO	Wt % In Ash	0.0085	0.0030
SiO_2	Wt % In Ash	49.21	40.70
Al_2O_3	Wt % In Ash	20.52	4.98
TiO_2	Wt % In Ash	0.93	0.29
Fe_2O_3	Wt % In Ash	12.89	6.12
CaO	Wt % In Ash	3.34	22.31
MgO	Wt % In Ash	1.91	1.85
Na_2O	Wt % In Ash	0.57	1.41
K_2O	Wt % In Ash	2.04	3.64
P_2O_5	Wt % In Ash	0.16	1.44
SO_3	Wt % In Ash	3.4	3.67
Sum of Determined Minerals	Wt % In Ash	99.07	87.73
Undetermined Ash Minerals	Wt % In Ash	0.93	12.27

3.5 Emissions

A statistical analysis was performed comparing the mean NO_x and SO_2 emissions from the test burn to baseline emissions obtained immediately prior to the test burn. NO_x and SO_2 emissions were analyzed for both baseline and test burn periods on a volumetric (ppm) and mass flow (lb/hr) basis. The statistical analyses consisted of calculating descriptive statistics and making pair-wise comparisons of each pollutant's variance and mean for the baseline data and the test burn data. The results of the analyses conducted using volumetric data were consistent with the results obtained using mass data.

NO_x and SO_2 emissions during the test burn were found to be slightly lower than NQ and SO_2 emissions during the baseline period. Figures 2 and 3 show graphs of test burn emissions compared to baseline emissions for NO_x and SO_2, respectively. Tables 6 and 7 present the summary results of the statistical analyses for the test burn and baseline emissions data for NO_x and SO_2, respectively. The results presented are in volumetric units (ppm), but identical relationships and statistical conclusions are obtained using mass flow units (lb/hr). Table 8 summarizes the statistics for NO_x and SO_2 emissions for the baseline and test burn periods in both volumetric and mass- flow units, for comparison.

Figure 2. NO_x emissions (ppm) from PPS Unit 1 during baseline and test burn periods.

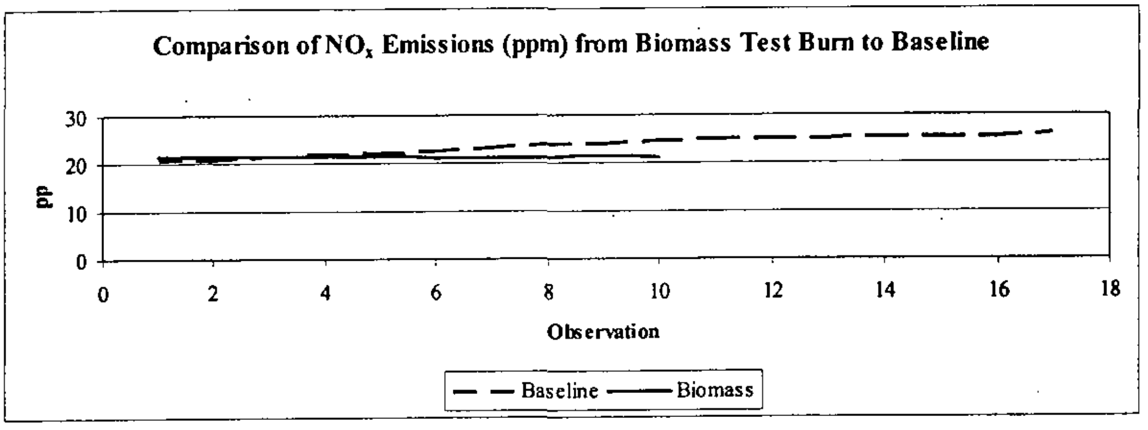
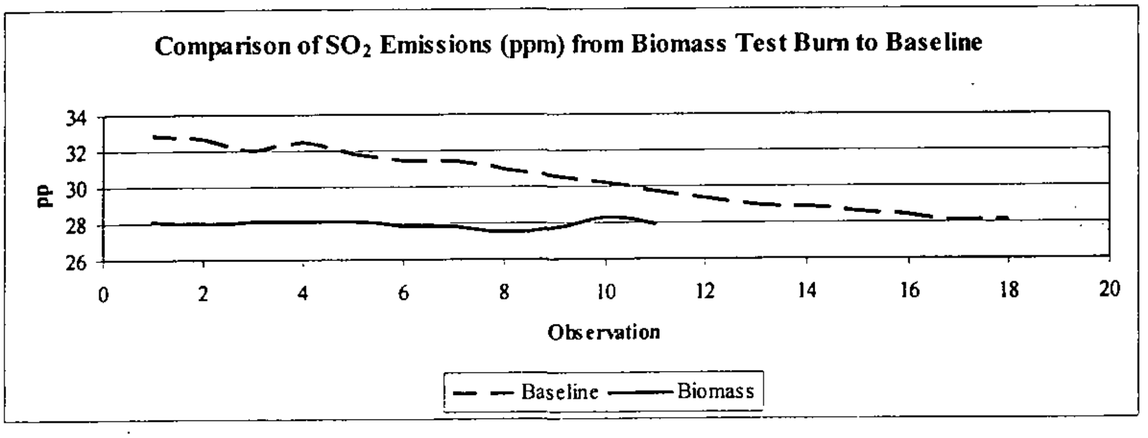


Figure 3. SO_2 emissions (ppm) from PPS Unit 1 during baseline and test burn periods.



Populations' mean and variance frequency distributions as measured by skewness and kurtosis approximated a normal distribution for both NQ and SO_2 when the sizes of the data sets were considered. Two sample t-tests, assuming unequal variances, were used to test if the mean values for NQ and SO_2 emissions were equal between the test burn and baseline emissions data. This was done because the F-tests rejected the hypothesis that the variances were equal between the test burn and the baseline emissions for both NO_x and SO_2. The two sample t-tests results indicate that the observed differences in means are not due to chance at the 95% confidence level.

Table 6. Statistical analysis comparing variances and means of baseline and test burn data for NO_x emissions (ppm).

Parameter	Baseline	Biomass
Mean (ppm)	23.44	21.25
Variance	3.89	0.06
Observations	18	11
Hypothesized Difference in Variance or Mean	0	
df F-test (t-test)	17 (18)	10
F_{calc}	66.41	
Probability that calculated F is less than or equal to F_{crit}	5.02E-08	
F_{Crit}	2.81	
t_{calc}	4.64	
Probability that calculated t_{calc} is less than or equal to t_{crit}	2.03E-04	
t_{crit}	2.10	

Conclusion: Reject hypothesis that Variances or Means are equal.

Table 7. Statistical analysis comparing variances and means of baseline and test burn data for SO_2 emissions (ppm).

Parameter	Baseline	Biomass
Mean (ppm)	30.36	27.95
Variance	2.73	0.05
Observations	18	11
Hypothesized Difference in Variance or Mean	0	
df F-test (t-test)	17 (18)	10
F_{calc}	51.99	
Probability that calculated F is less than or equal to F_{crit}	1.66E-07	
F_{Crit}	2.81	
t_{calc}	6.11	
Probability that calculated t_{calc} is less than or equal to t_{crit}	9.00E-06	
t_{crit}	2.10	

Conclusion: Reject hypothesis that Variances or Means are equal.

Table 8. Comparison of baseline and test burn emissions in volumetric and mass flow units.

	NO_x				SO_2			
	ppm		lb/hr		ppm		lb/hr	
Parameter	Baseline	Test	Baseline	Test	Baseline	Test	Baseline	Test
Mean	23.4	21.3	134.1	123.2	30.4	27.9	241.6	225.1
Number of Observations	18	11	18	11	18	11	18	11
Standard Deviation	1.97	0.24	11.35	2.2	1.7	0.2	13.1	2.5
Range	6	0.7	32.8	7.1	4.8	0.8	40.9	8.3
Minimum	19.9	20.8	114.75	119.1	28.1	27.5	221.9	221.3
Maximum	25.9	21.5	147.6	126.2	32.9	28.3	262.8	229.6
95% Confidence Interval	22.4 - 24.4	21.1 - 21.5	128.5 - 139.8	121.7 - 124.7	29.6 - 31.2	27.7 - 28.1	235.1 - 248.1	223.4 - 226.8

4.0 Conclusion

The test burn data indicates that the gasification of biomass is technically feasible and will not adversely impact emissions from PPS Unit 1. PPS requests the flexibility to gasify non- treated biomass. TEC understands that an air construction permit application is be required to accommodate the changes necessary to handle the biomass fuel. TEC appreciates the Department's attention to this process.

Appendix A
Biomass Logs

DELIVERY TICKET

№ 100451

Nutri-Source, Inc.

1212 Mt. Vernon Street
Orlando, Florida 32803-5418

Any questions regarding deliveries, contact:

MIKE LITVANY

(407) 876-1130
Telephone & Fax

(407) 257-2165
Mobile/Voice Mail

(800) 871-7773
Toll Free

DATE: 12-30-01

DRIVER: Ernest Powell

PRODUCT: SAW DUST

TRUCK NUMBER: 115

AMOUNT:_____YDS. OR
_____TONS

ENDING HUB:
BEGINNING HUB:

GROSS WT: 25.89 LBS. TN
TARE WT: 17.08 LBS. TN
NET WT: ________ LBS.

MILEAGE:

DELIVER TO: Teco Power Plant

DIRECTIONS: Mulberry 37 south

[signature]

RECEIVED BY:______

COMPANY: Wherry Truck

4:46PM 12-30-2001

LOOP ID 02
PRODUCT 02

INBOUND 25.89 TN

POLK POWER STATION

9995 SR37 SOUTH

MULBERRY FL 33860

MT WEST

5:46PM 12-30-2001

TICKET NUMBER 2

LOOP ID 02
PRODUCT 02

17.08 TN GROSS

POLK POWER STATION

9995 SR37 SOUTH

MULBERRY FL 33860

MT WEST

25.89 t
17.08 t
8.81 t

12/31/01
BIOMASS TEST
780 LB TOTES - DUMP TIMES

WOOD DUMP TIMES

	START	DONE
1	0713	0720
2	0725	0731
3	0735	0743
4	0828	0832
5	0850	0855
6	0915	0924
7	0942	0951
8	1005	1009
9	1033	1037
10	1055	1058
11	11:23	11:28
12	1145	1148
13	1210	1218
14	1235	1239
15	100	108
16	125	131
17	150	155
18	215	220
19	240	242
20	305	310
21	340	350

Appendix B
Test Burn Slag Analysis

6712 Benjamin Road • Suite 100 • Tampa, FL 33634 • Tel: 813 885 7427 • Fax: 813 885 7049 • www.stl-inc.com

SEVERN TRENT SERVICES
STL Tampa West

LOG NO: B2-10196
Received: 16 JAN 02
Reported: 31 JAN 02

Mr. Robert Dorey
Tampa Electric Company
5010 Causeway Blvd.
Tampa, FL 33619

Project: PK-MW
Sampled By: Client
Code: 105220131

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
10196-5	SPECL-PK	12-31-01/15:00

PARAMETER	10196-5
Aluminum (SPLP) (SPLP), mg/l	<0.20
Prep Date	01.21.02
Analysis Date	01.22.02
Antimony (SPLP), mg/l	0.047
Prep Date	01.21.02
Analysis Date	01.22.02
Arsenic (SPLP) (6010), mg/l	0.18
Prep Date	01.21.02
Analysis Date	01.22.02
Barium (SPLP), mg/l	0.10
Prep Date	01.21.02
Analysis Date	01.22.02
Beryllium (SPLP), mg/l	<0.040*F65
Prep Date	01.21.02
Analysis Date	01.23.01
Boron (SPLP) (6010), mg/l	0.13
Prep Date	01.28.02
Analysis Date	01.30.02
Vanadium (SPLP) (6010B), mg/l	9.1
Prep Date	01.21.02
Analysis Date	01.22.02

SEVERN TRENT SERVICES
6712 Benjamin Road • Suite 100 • Tampa, FL 33634 • Tel: 813 885 7427 • Fax: 813 885 7049 • www.stl-inc.com
STL Tampa West

LOG NO: B2-10196
Received: 16 JAN 02
Reported: 31 JAN 02

Mr. Robert Dorey
Tampa Electric Company
5010 Causeway Blvd.
Tampa, FL 33619

Project: PK-MW
Sampled By: Client
Code: 105220131

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
10196-5	SPECL-PK	12-31-01/15:00

PARAMETER	10196-5
Cadmium (SPLP), mg/l	<0.0050
Prep Date	01.21.02
Analysis Date	01.22.02
Chromium (SPLP), mg/l	<0.010
Prep Date	01.21.02
Analysis Date	01.22.02
Copper (SPLP), mg/l	<0.020
Prep Date	01.21.02
Analysis Date	01.22.02
Iron (SPLP), mg/l	<0.050
Prep Date	01.21.02
Analysis Date	01.22.02
Zinc (SPLP), mg/l	0.030
Prep Date	01.21.02
Analysis Date	01.22.02
Lead (SPLP) (6010), mg/l	<0.0050
Prep Date	01.21.02
Analysis Date	01.22.02
Magnesium (SPLP) (6010), mg/l	<0.50
Prep Date	01.21.02
Analysis Date	01.22.02

6712 Benjamin Road • Suite 100 • Tampa, FL 33634 • Tel: 813 885 7427 • Fax: 813 885 7049 • www.stl-inc.com

SEVERN TRENT SERVICES
STL Tampa West

LOG NO: B2-10196
Received: 16 JAN 02
Reported: 31 JAN 02

Mr. Robert Dorey
Tampa Electric Company
5010 Causeway Blvd.
Tampa, FL 33619

Project: PK-MW
Sampled By: Client
Code: 105220131

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
10196-5	SPECL-PK	12-31-01/15:00

PARAMETER	10196-5
Manganese (SPLP) (6010), mg/l	<0.010
Prep Date	01.21.02
Analysis Date	01.22.02
Mercury (SPLP), mg/l	<0.00020
Prep Date	01.23.02
Analysis Date	01.24.02
Molybdenum (SPLP) (6010), mg/l	0.23
Prep Date	01.21.02
Analysis Date	01.22.02
Nickel (SPLP), mg/l	<0.040
Prep Date	01.21.02
Analysis Date	01.22.02
Selenium (SPLP), mg/l	0.085
Prep Date	01.21.02
Analysis Date	01.22.02
Silver (SPLP), mg/l	<0.10*F65
Prep Date	01.21.02
Analysis Date	01.23.02
Sodium (SPLP) (6010), mg/l	0.65
Prep Date	01.21.02
Analysis Date	01.22.02

6712 Benjamin Road • Suite 100 • Tampa, FL 33634 • Tel: 813 885 7427 • Fax: 813 885 7049 • www.stl-inc.com

SEVERN TRENT SERVICES

STL Tampa West

LOG NO: B2-10196
Received: 16 JAN 02
Reported: 31 JAN 02

Mr. Robert Dorey
Tampa Electric Company
5010 Causeway Blvd.
Tampa, FL 33619

Project: PK-MW
Sampled By: Client
Code: 105220131

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
10196-5	SPECL-PK	12-31-01/15:00

PARAMETER	10196-5
Strontium (SPLP) (6010), mg/l	0.011
Prep Date	01.28.02
Analysis Date	01.30.02
Thallium (SPLP) (6010), mg/l	<0.010
Prep Date	01.21.02
Analysis Date	01.22.02

SEVERN TRENT SERVICES

6712 Benjamin Road • Suite 100 • Tampa, FL 33634 • Tel: 813 885 7427 • Fax: 813 885 7049 • www.stl-inc.com

STL Tampa West

LOG NO: B2-10196
Received: 16 JAN 02
Reported: 31 JAN 02

Mr. Robert Dorey
Tampa Electric Company
5010 Causeway Blvd.
Tampa, FL 33619

Project: PK-MW
Sampled By: Client
Code: 105220131

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
10196-6	SPECL-PK SPLP	12-31-01/15:00

PARAMETER	10196-6
Chloride (4500-Cl C), mg/l	<1.0
Analysis Date	01.23.02
Fluoride (340.2), mg/l	1.1
Analysis Date	01.22.02
Sulfate as SO4 (375.4), mg/l	12
Analysis Date	01.21.02

SEVERN TRENT SERVICES

STL Tampa West

6712 Benjamin Road • Suite 100 • Tampa, FL 33634 • Tel: 813 885 7427 • Fax: 813 885 7049 • www.stl-inc.com

LOG NO: B2-10196
Received: 16 JAN 02
Reported: 31 JAN 02

Mr. Robert Dorey
Tampa Electric Company
5010 Causeway Blvd.
Tampa, FL 33619

Project: PK-MW
Sampled By: Client
Code: 105220131

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES	DATE/ TIME SAMPLED
10196-8	Method Blank	
10196-9	Accuracy (%Rec)	
10196-10	Precision (%RPD)	
10196-11	Analyst Initials	

PARAMETER	10196-8	10196-9	10196-10	10196-11
Color (110.2)	<5	100 %	0 %	TS
Analysis Date	01.17.02	01.17.02	---	---
Polynuclear Aromatics (610)				
Naphthalene, ug/l	<10	82 %	21 %	JLB
2-Methylnaphthalene, ug/l	<10	---	---	---
1-Methylnaphthalene, ug/l	<10	---	---	---
Prep Date	01.21.02	01.21.02	---	---
Analysis Date	01.27.02	01.27.02	---	---
Purgeable Aromatics (602)				
Benzene, ug/l	<1.0	98 %	4.1 %	JFB
Chlorobenzene, ug/l	<1.0	84 %	6.0 %	JFB
1,2-Dichlorobenzene, ug/l	<1.0	---	---	JFB
1,3-Dichlorobenzene, ug/l	<1.0	---	---	JFB
1,4-Dichlorobenzene, ug/l	<1.0	---	---	JFB
Ethylbenzene, ug/l	<1.0	---	---	JFB
Toluene, ug/l	<1.0	91 %	5.5 %	JFB
Xylenes, ug/l	<1.0	---	---	JFB
Methyl Tert Butyl Ether (MTBE), ug/l	<10	---	---	JFB
Analysis Date	01.24.02	01.24.02	---	---
Biochemical Oxygen Demand carbonaceous BOD-5 (SM5210B), mg/l	<2.0	97 %	10 %	EM
Analysis Date	01.16.02	01.16.02	---	---

6712 Benjamin Road • Suite 100 • Tampa, FL 33634 • Tel: 813 885 7427 • Fax: 813 885 7049 • www.stl-inc.com

SEVERN TRENT SERVICES

STL Tampa West

LOG NO: B2-10196
Received: 16 JAN 02
Reported: 31 JAN 02

Mr. Robert Dorey
Tampa Electric Company
5010 Causeway Blvd.
Tampa, FL 33619

Project: PK-MW
Sampled By: Client
Code: 140820131

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	DATE/ TIME SAMPLED
10196-12	Method Blank	
10196-13	Accuracy (%Rec)	
10196-14	Precision (%RPD)	
10196-15	Analyst Initials	

PARAMETER	10196-12	10196-13	10196-14	10196-15
Aluminum (SPLP) (SPLP), mg/l	<0.20	114 %	0.32 %	LP
Prep Date	01.21.02	01.21.02	---	---
Analysis Date	01.22.02	01.22.02	---	---
Antimony (SPLP), mg/l	<0.0060	103 %	0.11 %	LP
Prep Date	01.21.02	01.21.02	---	---
Analysis Date	01.22.02	01.22.02	---	---
Arsenic (SPLP) (6010), mg/l	<0.010	102 %	1.0 %	LP
Prep Date	01.21.02	01.21.02	---	---
Analysis Date	01.22.02	01.22.02	---	---
Barium (SPLP), mg/l	<0.010	82 %	0.44 %	LP
Prep Date	01.21.02	01.21.02	---	---
Analysis Date	01.22.02	01.22.02	---	---
Beryllium (SPLP), mg/l	<0.0040	103 %	0.53 %	LP
Prep Date	01.21.02	01.21.02	---	---
Analysis Date	01.22.02	01.22.02	---	---
Boron (SPLP) (6010), mg/l	<0.050	124 %	2.4 %	BJB
Prep Date	01.28.02	01.28.02	---	---
Analysis Date	01.30.02	01.30.02	---	---

SEVERN TRENT SERVICES

6712 Benjamin Road • Suite 100 • Tampa, FL 33634 • Tel: 813 885 7427 • Fax: 813 885 7049 • www.stl-inc.com

STL Tampa West

LOG NO: B2-10196
Received: 16 JAN 02
Reported: 31 JAN 02

Mr. Robert Dorey
Tampa Electric Company
5010 Causeway Blvd.
Tampa, FL 33619

Project: PK-MW
Sampled By: Client
Code: 140820131

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	DATE/ TIME SAMPLED
10196-12	Method Blank	
10196-13	Accuracy (%Rec)	
10196-14	Precision (%RPD)	
10196-15	Analyst Initials	

PARAMETER	10196-12	10196-13	10196-14	10196-15
Vanadium (SPLP) (6010B), mg/l	<0.010	104 %	0.21 %	LP
Prep Date	01.21.02	01.21.02	---	---
Analysis Date	01.22.02	01.22.02	---	---
Cadmium (SPLP), mg/l	<0.0050	101 %	0.34 %	LP
Prep Date	01.21.02	01.21.02	---	---
Analysis Date	01.22.02	01.22.02	---	---
Chromium (SPLP), mg/l	<0.010	106 %	0.34 %	LP
Prep Date	01.21.02	01.21.02	---	---
Analysis Date	01.22.02	01.22.02	---	---
Copper (SPLP), mg/l	<0.020	106 %	0.76 %	LP
Prep Date	01.21.02	01.21.02	---	---
Analysis Date	01.22.02	01.22.02	---	---
Iron (SPLP), mg/l	<0.050	111 %	0.89 %	LP
Prep Date	01.21.02	01.21.02	---	---
Analysis Date	01.22.02	01.22.02	---	---
Zinc (SPLP), mg/l	<0.020	98 %	0.35 %	LP
Prep Date	01.21.02	01.21.02	---	---
Analysis Date	01.22.02	01.22.02	---	---

SEVERN TRENT SERVICES
6712 Benjamin Road • Suite 100 • Tampa, FL 33634 • Tel: 813 885 7427 • Fax: 813 885 7049 • www.stl-inc.com
STL Tampa West

LOG NO: B2-10196
Received: 16 JAN 02
Reported: 31 JAN 02

Mr. Robert Dorey
Tampa Electric Company
5010 Causeway Blvd.
Tampa, FL 33619

Project: PK-MW
Sampled By: Client
Code: 140820131

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	DATE/ TIME SAMPLED
10196-12	Method Blank	
10196-13	Accuracy (%Rec)	
10196-14	Precision (%RPD)	
10196-15	Analyst Initials	

PARAMETER	10196-12	10196-13	10196-14	10196-15
Lead (SPLP) (6010), mg/l	<0.0050	101 %	0.46 %	LP
Prep Date	01.21.02	01.21.02	---	---
Analysis Date	01.22.02	01.22.02	---	---
Magnesium (SPLP) (6010), mg/l	<0.50	103 %	1.8 %	LP
Prep Date	01.21.02	01.21.02	---	---
Analysis Date	01.22.02	01.22.02	---	---
Manganese (SPLP) (6010), mg/l	<0.010	103 %	0.10 %	LP
Prep Date	01.21.02	01.21.02	---	---
Analysis Date	01.22.02	01.22.02	---	---
Mercury (SPLP), mg/l	<0.00020	103 %	1.9 %	MEW
Prep Date	01.23.02	01.23.02	---	---
Analysis Date	01.24.02	01.24.02	---	---
Molybdenum (SPLP) (6010), mg/l	<0.010	102 %	0.060 %	LP
Prep Date	01.21.02	01.21.02	---	---
Analysis Date	01.22.02	01.22.02	---	---
Nickel (SPLP), mg/l	<0.040	105 %	0.070 %	LP
Prep Date	01.21.02	01.21.02	---	---
Analysis Date	01.22.02	01.22.02	---	---

SEVERN TRENT SERVICES
STL Tampa West
6712 Benjamin Road • Suite 100 • Tampa, FL 33634 • Tel: 813 885 7427 • Fax: 813 885 7049 • www.stl-inc.com

LOG NO: B2-10196
Received: 16 JAN 02
Reported: 31 JAN 02

Mr. Robert Dorey
Tampa Electric Company
5010 Causeway Blvd.
Tampa, FL 33619

Project: PK-MW
Sampled By: Client
Code: 140820131

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	DATE/ TIME SAMPLED
10196-12	Method Blank	
10196-13	Accuracy (%Rec)	
10196-14	Precision (%RPD)	
10196-15	Analyst Initials	

PARAMETER	10196-12	10196-13	10196-14	10196-15
Selenium (SPLP), mg/l	<0.010	101 %	0.35 %	LP
Prep Date	01.21.02	01.21.02	---	---
Analysis Date	01.22.02	01.22.02	---	---
Silver (SPLP), mg/l	<0.010	110 %	0.29 %	LP
Prep Date	01.21.02	01.21.02	---	---
Analysis Date	01.22.02	01.22.02	---	---
Sodium (SPLP) (6010), mg/l	<0.50	102 %	1.5 %	LP
Prep Date	01.21.02	01.21.02	---	---
Analysis Date	01.22.02	01.22.02	---	---
Strontium (SPLP) (6010), mg/l	<0.010	108 %	1.9 %	BJB
Prep Date	01.28.02	01.28.02	---	---
Analysis Date	01.30.02	01.30.02	---	---
Thallium (SPLP) (6010), mg/l	<0.010	103 %	1.2 %	LP
Prep Date	01.21.02	01.21.02	---	---
Analysis Date	01.22.02	01.22.02	---	---
Chloride (4500-Cl C), mg/l	<1.0	97 %	3.0 %	DN
Analysis Date	01.23.02	01.23.02	---	---
Fluoride (340.2), mg/l	<0.20	106 %	5.7 %	TS
Analysis Date	01.22.02	01.22.02	---	---

SEVERN TRENT SERVICES
STL Tampa West
6712 Benjamin Road • Suite 100 • Tampa, FL 33634 • Tel: 813 885 7427 • Fax: 813 885 7049 • www.stl-inc.com

LOG NO: B2-10196
Received: 16 JAN 02
Reported: 31 JAN 02

Mr. Robert Dorey
Tampa Electric Company
5010 Causeway Blvd.
Tampa, FL 33619

Project: PK-MW
Sampled By: Client
Code: 140820131

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	DATE/ TIME SAMPLED
10196-12	Method Blank	
10196-13	Accuracy (%Rec)	
10196-14	Precision (%RPD)	
10196-15	Analyst Initials	

PARAMETER	10196-12	10196-13	10196-14	10196-15
Sulfate as SO4 (375.4), mg/l	<5.0	97 %	2.6 %	MJC
Analysis Date	01.21.02	01.21.02	---	---

Method : SW-846, EPA 600/4-79-020, EPA 40 CFR PART 136
DOH Certification #: E84282, E87052.
These test results meet all the requirements of NELAC. All questions regarding this test report should be directed to the STL Project Manager who signed this test report.

*F65 = Elevated detection limits were reported due to sample matrix interference which required sample or extract dilution.

Michael F. Valder, Project Manager

Serial Number 005362

SEVERN TRENT SERVICES

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

STL Tampa West

2 10196

(✓) STL Tampa West
6712 Benjamin Road, Suite 100
Tampa, FL 33634

Website: www.stl-inc.com
Phone: (813) 885-7427
Fax: (813) 885-7049

( ) Alternate Laboratory Name/Location
Phone:
Fax:

PROJECT REFERENCE: PK-MW | PROJECT NO.: | PROJECT LOCATION (STATE): FL
SAMPLER'S SIGNATURE: [signature] | P.O. NUMBER: | CONTRACT NO.:
CLIENT (SITE) PM: MIKE VADER | CLIENT PHONE: 630-7378 | CLIENT FAX: 630-7360
CLIENT NAME: EPC ENVIRON. AFFAIRS | CLIENT E-MAIL:
CLIENT ADDRESS: 010 CAUSEWAY BLVD. TAMPA, FL 33619
COMPANY CONTRACTING THIS WORK (if applicable):

PAGE 1 OF 1

STANDARD REPORT DELIVERY ( ) DATE DUE
EXPEDITED REPORT DELIVERY (SURCHARGE) ( ) DATE DUE
NUMBER OF COOLERS SUBMITTED PER SHIPMENT: 2

REQUIRED ANALYSIS: 602 NAPHTHALENE (HCl); 610 METHYLNAPHTH; COLOR; CBOD; SPLP (SEE ATTACHMENT); VOLATILES; SEMI-VOLATILES; TOTAL As, Ba, Cd, Cr, Pb, Se, Ag; TOTAL CHLORIDE

PRESERVATIVE

MATRIX TYPE: COMPOSITE (C) OR GRAB (G) INDICATE; AQUEOUS (WATER); SOLID OR SEMISOLID; AIR; NONAQUEOUS LIQUID (OIL, SOLVENT, ...)

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	C/G	AQUEOUS	SOLID	AIR	NONAQ.	602 NAPHTHALENE	610 METHYLNAPHTH	COLOR	CBOD	SPLP	VOLATILES	SEMI-VOLATILES	TOTAL METALS	TOTAL CHLORIDE	REMARKS
15-02	1405	PK-2S-SA	G	✓				3	2	1	—	—	—	—	—		DUE: 2-5-02
15-02	1510	PK-2LI-Q	G	✓				3	2	1	—	—	—	—	—		DUE: 2-5-02
15-02	1435	PK-2F-Q	G	✓				3	2	1	—	—	—	—	—		DUE: 2-5-02
15-02	1155	AA63846	G	✓				—	—	—	1	—	—	—	—	→	DUE: 1-29-02
-31-01	1500	SPECL-PK	C		✓			—	—	—	—	1	—	—	—	→	SEE ATTACHMENT DUE: 2-1-02
-14-02	1015	WD02-008	C				✓	—	—	—	—	—	3	1	1	→	CAUTION: HIGH pH (11.6) DUE: 2-4-02

*ACID NOT ADDED TO VOA VIALS

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
[signature]	12-26-01	0815	[signature]	1-16-02	0925			
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**
[signature] 1-15-02			[signature]	011602	0925			

LABORATORY USE ONLY 2.0

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	STL TAMPA WEST LOG NO.	LABORATORY REMARKS
[signature]	1-16-02	1230	YES ✗ NO ( )	N/S	B210196	

Appendix C
Biomass Emissions Data

Baseline Emissions Data for Coal and Petcoke Blend

Begin Date	Gross Unit Load (MWhr)	Heat Input (mmBtu)	SO2 (ppm)	SO2 (lb/hr)	NOx (ppm)	NOx (lb/hr)
12/29/2001 12:00:00 AM	177.00	1770.6	40.1	336.1	18.3	109.7772
12/29/2001 1:00:00 AM	177.00	1761	39.3	327.6	18.1	109.182
12/29/2001 2:00:00 AM	176.00	1771.3	39.3	329.5	17.7	106.278
12/29/2001 3:00:00 AM	174.00	1743.9	37	305.5	18.1	108.1218
12/29/2001 4:00:00 AM	174.00	1712.2	36.6	296.7	18.7	109.5808
12/29/2001 5:00:00 AM	173.00	1739.3	37.8	311.2	18.3	107.8366
12/29/2001 6:00:00 AM	170.00	1698.9	34.7	279.1	18.7	108.7296
12/29/2001 7:00:00 AM	168.00	1687.5	32.9	262.8	19.9	114.75
12/29/2001 8:00:00 AM	168.00	1694.9	32.7	262.4	20.6	118.643
12/29/2001 9:00:00 AM	168.00	1660.4	32	251.5	20.7	116.228
12/29/2001 10:00:00 AM	168.00	1696.7	32.5	257.9	21.3	122.1624
12/29/2001 11:00:00 AM	168.00	1675.3	31.8	252.2	21.7	123.9722
12/29/2001 12:00:00 PM	167.00	1668.2	31.4	248	22.2	126.7832
12/29/2001 1:00:00 PM	167.00	1679.3	31.4	249.6	22.4	127.6268
12/29/2001 2:00:00 PM	167.00	1680.6	30.9	245.8	23.3	132.7674
12/29/2001 3:00:00 PM	168.00	1681.9	30.6	243.6	23.8	136.2339
12/29/2001 4:00:00 PM	168.00	1687.1	30.2	241.2	24	138.3422
12/29/2001 5:00:00 PM	168.00	1691.7	29.7	237.9	24.6	142.1028
12/29/2001 6:00:00 PM	168.00	1672.4	29.3	232	24.9	142.154
12/29/2001 7:00:00 PM	168.00	1682.3	29	231	25.1	142.9955
12/29/2001 8:00:00 PM	168.00	1691.7	28.9	231.5	25.1	143.7945
12/29/2001 9:00:00 PM	168.00	1687.3	28.6	228.5	25.4	145.1078
12/29/2001 10:00:00 PM	168.00	1689.8	28.4	227.2	25.5	147.0126
12/29/2001 11:00:00 PM	168.00	1668	28.1	221.9	25.5	145.116

Test Burn Emissions Data for Coal, Petcoke, and Biomass Blend

Begin Date	Gross Unit Load (MWhr)	Heat Input (mmBtu)	SO2 (ppm)	SO2 (lb/hr)	NOx (ppm)	NOx (lb/hr)
12/31/2001 7:00:00 AM	167.00	1661.9	28.1	226.7	21.4	124.6425
12/31/2001 8:00:00 AM	168.00	1671.9	28	227.2	21.5	125.3925
12/31/2001 9:00:00 AM	168.00	1683	28.1	229.6	21.5	126.225
12/31/2001 10:00:00 AM	168.00	1656.7	28.1	226	21.5	124.2525
12/31/2001 11:00:00 AM	168.00	1681.5	28.1	226.5	21.4	124.431
12/31/2001 12:00:00 PM	168.00	1662.5	27.8	224.3	21.2	123.025
12/31/2001 1:00:00 PM	168.00	1659.4	27.8	223.9	21.2	122.7956
12/31/2001 2:00:00 PM	168.00	1670.3	27.5	223	21.1	123.6022
12/31/2001 3:00:00 PM	168.00	1670.9	27.7	221.8	21.3	121.9757
12/31/2001 4:00:00 PM	168.00	1664.6	28.3	225.8	20.9	119.8512
12/31/2001 5:00:00 PM	168.00	1654.4	27.9	221.3	20.8	119.1168

Attachment E
Polk Power Station Unit 1
Designated Representative Signature

Responsible Official Certification

I have reviewed the letter of request for authorization to conduct a biomass test burn at Polk Power Station. I hereby certify that these documents are authentic and accurate to the best of my knowledge.

Date: 10/20/03

Signature: Mark Hornick

General Manager
Polk Power Station