TAMPA ELECTRIC



February 15, 2008

Mr. Jonathan Holtom, P.E.
Florida Department of Environmental Protection
111 South Magnolia Drive, Suite 4
Tallahassee, FL 32301

Via FedEx
Airbill. 792006754372

Re: **Request for Additional Information Regarding Change in Fuel Blend at Polk Power Station**
**File No.: 1050233-021-AC**

Dear Mr. J. Holtom:

The purpose of this letter is to respond to the Department's request for additional information (RAI) related to Tampa Electric Company's (TEC) air construction permit application purpose to increase the allowable petcoke/coal fuel blend from 60/40% and 3.5% sulfur content to 85/15% and 4.7% sulfur content for the Polk Power Station (PPS).

TEC has continued its efforts to resolve discrepancies between the previously reported stack test emission rates, and mass and heat balance process operations as understood after operating this Integrated Gasification Combine-Cycle (IGCC) plant for over 10 years. Please find below TEC's clarification to Department's identified areas as well as additional process information in order to provide reasonable assurance of emission analysis and prediction. ***Character process description and emission information contained within this letter is proprietary and should be handled as such.***

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Department Request #1

*Please provide an explanation for the unexpected trend in SAM emissions at the different fuel blends that were tested.*

TEC Response #1

There are two reasons why the sulfuric acid mist (SAM) emissions may not have correlated with sulfur content of the gasifier's solid fuel as the Department expected.

1) When the sulfur content and other quality parameters of the gasifier's solid fuel are within the capability envelope of the acid gas removal systems (COS hydrolysis and MDEA acid gas removal) as they were during the trial burn test program, operating conditions of those units are adjusted to compensate for process variations (input sulfur, ambient temperature, etc) and to ensure that CT/HRSG sulfur dioxide ($SO_2$) emissions remain below permitted levels according to the Part 75 Acid Rain CEMS. Given the extremely high level of sulfur removal that these systems provide, it is not unexpected that small gains in removal efficiency can outweigh increases in the sulfur content of the feedstock. The best information and data indicate SAM emissions are directly related to $SO_2$ emissions (SAM ~ 0.05 x $SO_2$ on a molar basis). Consequently, neither $SO_2$ nor SAM emissions will be strongly related to the sulfur content of the solid fuel to the gasifier.
2) TEC asserts that the SAM emissions previously reported, as determined via EPA Reference Method (RM) 8, are higher than the true SAM emissions due to positive and variable biases in the RM 8 measured flow and SAM concentration. TEC believes there is not enough precision within the method to accurately capture and correlate the CT/HRSG SAM conversion subtleties. An accumulation of a number of "high biases" resulted in over reporting the actual CT/HRSG stack flow and SAM concentrations.

CT/HRSG Stack Flow Rate Determination

The previously submitted stack test results based on EPA RM 8 are higher than actual SAM emissions in part because the method over-reports the CT/HRSG stack flow. This over-reporting result from

a) EPA RM 8's accuracy measuring stack flow and
b) EPA RM 8's under-reporting of the moisture content of the stack gas.

RM 8 stipulates RM 2 methodology for determining flow in the CT/HRSG stack. The stack flue gas flow is calculated using the differential pressure measured by a pitot tube at six (6) points along two (2) traverse paths across the diameter of the stack, 90 degrees apart. Stack tests conducted by TEC Air Services crew from 2001 through 2006 show 9.6% more stack flow (dkscfh) on average using a Type S pitot tube versus CEMS flow data for the exact same stack test time periods. The trial burn stack tests (Baseline, 75% PC, 85% PC, and 100% PC) conducted by Trigon Engineering show an even greater stack flow rate difference, 15.8% on average using a Type S pitot tube versus CEMS flow data for the exact same stack test time periods. See Table 1 of Attachment 1 and Chart 1 of Attachment 2. Overall, the CT/HRSG stack flow from the Type S pitot tube measurement was biased 12.1% higher than that from the CEMS flow monitor.

TEC uses a highly accurate three-dimensional (3D) probe to perform the annual RATA on the CEMS flow meter. The 3D probe measurement (using EPA Methods 2F and 2H) is a more accurate and reliable method for determining actual stack total flow than using a simple pitot tube since it accounts for yaw and pitch angles as well as wall effects. The RATA shows the CEMS flow monitor consistently reads 3 to 4% higher than the 3D probe, so even using the CEMS flow indication instead of the Type S pitot tube results in a 3 to 4% over-estimation of SAM emissions.

CT/HRSG Stack Flue Gas Moisture Content

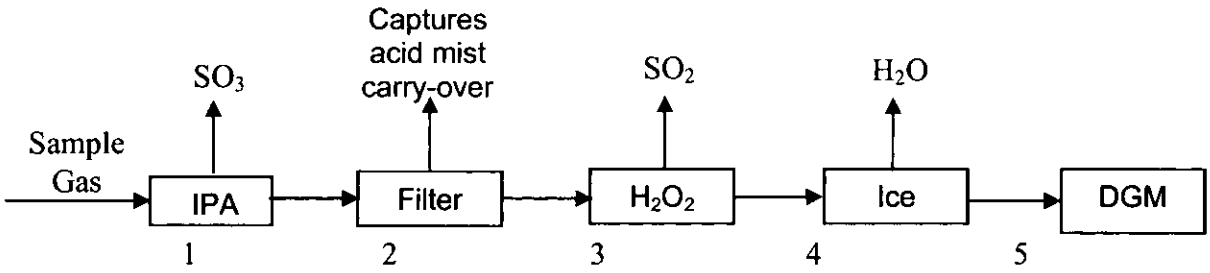
TEC believes that RM 4 used to determine the moisture content of the flue gas in the CT/HRSG by condensation and absorption is also less accurate than is ideal for this type of analysis. TEC has very thorough understanding of the water vapor content in the CT/HRSG stack flue gas from its 11½ years of operational plant data. Water vapor in the CT/HRSG stack comes almost entirely from three (3) sources:

a. Water formed by the combustion and oxidation of the $H_2$ in the syngas. This is the largest contributor to water vapor in the stack.
b. Water vapor added to the syngas in the saturator used to help control $NO_X$ emissions.
c. Humidity in the ambient air to the CT compressor.

Each of the above stream flows and their associated concentrations are continuously and often redundantly measured to support normal plant operations. Annual compliance stack test moisture determination using RM 4 has consistently under-reported the water vapor content in the CT/HRSG stack by approximately 1.5% on average. Although this is a relatively small difference, it compounds the variability in the sensitivity and acuity of EPA RM 8 to accurately evaluate SAM emissions for PSD analysis.

SAM Concentration Differences from EPA RM 8

EPA RM 8 has a title that implies broad applicability of the method; however, it was not intended nor validated on sources other than sulfuric acid plants whose flue gas contains no water vapor. A simplified process flow diagram of RM 8 is shown below. RM 8 works by differential absorption of $SO_3$ and $SO_2$. The first impinger trap (1) is filled with 80% Isopropyl Alcohol (IPA), intended to absorb $SO_3$ and SAM but resist absorption and oxidation of $SO_2$. Next is a filter (2) to capture any acid mist carry-over. The second impinger (3) contains hydrogen peroxide ($H_2O_2$) to absorb the $SO_2$. The chilled impinger (4) removes moisture prior to the dry gas meter (DGM) (5).




Simplified PFD of EPA RM 8

High biases of up to 30-60% have been documented when using RM 8 to measure the SAM concentration in a flue gas from other than an acid plant. High biases exist for a number of reasons related to the water vapor content of flue gas.

The extracted flue gas sample cools as it passes through the first (IPA) impinger and filter. As the flue gas cools, moisture condenses out of the sampled gas and mixes with the IPA in the first impinger. This affects the $SO_3$ analysis of the first impinger in two ways. First, as the condensed moisture dilutes the IPA, there will inevitably be an enhancement of the absorption of soluble species, such as $SO_2$ (*Tsaiet al.*, 2001). This allows continued conversion of $SO_2$ to $SO_3$ and $SO_3$ to SAM in the impinger fluid prior to acid concentration measurement. Second, as the IPA concentration is diluted it changes the pH of the solution. Titration (the methodology used to measure the SAM captured in the first impinger), is very sensitive to both pH and IPA concentration.

The filter after the first impinger, a high surface area material, provides a medium for further moisture condensation and absorption of $SO_2$. The absorbed $SO_2$ can be further oxidized to form sulfate (Lunsford, 1979) that causes additional over-estimation.

Best Available Data Correlation

As described above, the data indicates that the Type S pitot tube overstates the CT/HRSG stack flow rate and there are known high biases when using EPA RM 8 to determine SAM concentration in flue gases other than from an acid plant. The mechanisms for these biases can cause variability in the results. Since RM 8 overstates SAM emissions, the Department can be very confident that an emission unit is in compliance if compliance is demonstrated using RM 8. However, when evaluating SAM for PSD implications it is important to realize the method may be susceptible to variances and overstatement of emission rates. TEC believes that applying corrections for CT/HRSG stack flow rate and using statistical methods to mitigate the impact of the sample analysis bias can yield useful SAM data correlations.

Table 2 on Attachment 3 shows the last 30 individual one hour SAM determinations alongside $SO_2$ emissions during the exact same periods. When the RM 8 SAM emission rates are determined using the CEMS stack flow with plant process knowledge and process instrumentation to determine stack moisture content, and 4 outlying data points are discarded which were more than 3 standard deviations from the mean (those circled in red on the Chart 2 below), the SAM/$SO_2$ molar ratio is 0.0505 with a standard deviation of only 0.007. This is consistent with the turbine manufacturer's representations and TEC believes it to be the best correlation of SAM emissions rates, i.e., SAM emissions are approximately 5% of $SO_2$ emissions on a molar basis.

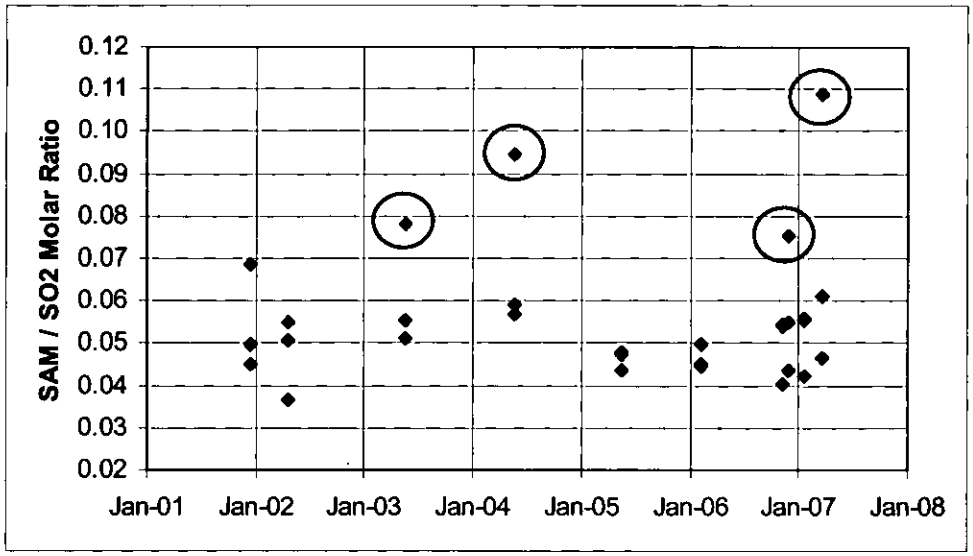



Chart 2

Department Request #2

*A) Please provide a comparison of past actual annual $SO_2$ and SAM emissions from the combustion turbine to future projected annual emissions on a Lb/MMBtu basis.*

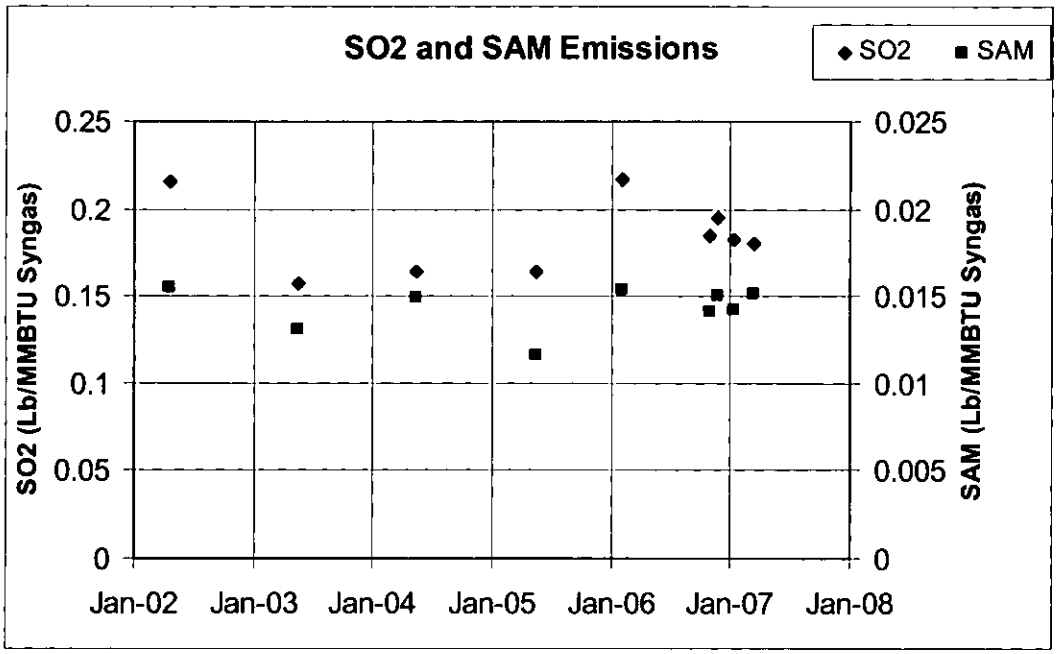
*B) For reasonable assurance purposes, in addition to the $SO_2$ continuous emissions monitor, please propose a method for regularly monitoring emissions of SAM from the combustion turbine to ensure that there are no PSD significant emissions increases from the project.*

TEC Response #2A

Because it was specifically requested by the Department, a comparison of past actual $SO_2$ and SAM emissions from the combustion turbine to future projected annual emissions is provided in Table 3 on Attachment 4.

The following graph shows $SO_2$ and SAM emissions in Lb/MMBTU (syngas Higher Heating Value (HHV)) from all CT/HRSG SAM stack tests starting in 2002 through completion of the recent trial burn test program. There are no obvious trends, and we expect no material change in

data mean or scatter in the future, whether or not we process solid fuel containing up to 4.7% sulfur.




$SO_2$ data in the preceding graph was taken directly from the CEMS, SAM data has been corrected for stack flow rate and moisture content, and the four (of 30) statistically outlying points have been discarded. Syngas HHV is that which was reported in the stack test reports. Some of the HHV data may be subject to in accuracies since some of the values may have been determined using EPA procedures related to the determination of heat input (specifically F factors) which are not accurate for syngas fuel because of its varying composition.

Although the Department may prefer reporting emission data from "typical" electric generating units on the basis of Lb/MMBTU, TEC contends this approach for evaluation of emissions from an IGCC process is inappropriate. Heat input is more complicated for the IGCC process than natural gas combined cycle (NGCC) or even pulverized coal (PC) fired boilers. Also, TEC continues to believe that expressing emissions on a Lb/Hr basis is the best indicator of environmental performance at PPS. First, it is most indicative of the facility's direct impact on the environment since it reports actual quantities of pollutants which enter the environment.

Second, it can be calculated with much greater accuracy than emissions based on a unit of fuel mass or its energy content. Stack emissions expressed as Lb/Hr are simply the stack flow times the concentration of the pollutant in the stack. When these emission rates (Lb/Hr) must be divided by fuel flow rates or heating values, more measurements are required, introducing greater uncertainty into the calculated result.

TEC Response #2B

TEC proposes two actions to provide reasonable assurance that there are no PSD significant SAM emissions increases from the project.

1) During the demonstration period TEC will conduct semi-annual CT/HRSG SAM stack tests. The primary methodology for these tests will be the current EPA RM 8 unless otherwise mutually agreed between TEC and DEP. In addition to the normal RM 8 results, TEC will also report the adjusted results based on the stack flow as determined by the CEM and plant process and instrumentation measured stack moisture content. Furthermore, instead of the nominal three determinations per test, TEC will often perform more, e.g., 6 or 8 determinations per test, to provide a better statistical basis for identifying and potentially removing outlying data points.

2) TEC will investigate potential continuous or semi-continuous SAM monitors and alternative methods to EPA RM 8 (e.g. EPA RM 8A). TEC will prepare a report on findings and recommendations to DEP within one year of issuance of the construction permit. TEC and DEP may mutually agree to try to implement some of the recommendations of the report in conjunction with the semi-annual RM 8 stack tests for comparison.

Department Request #3

*A) Please propose and provide details for the control devices or methods that will be installed to avoid any significant increases in $SO_2$ and SAM emissions from the sulfuric acid plant.*

*B) Also, for reasonable assurance purposes, please propose a method for regularly monitoring emissions of $SO_2$ and SAM from the sulfuric acid plant to ensure that there are no PSD significant emissions increases from the project.*

TEC Response #3A

During the test program, the sulfuric acid plant demonstrated its ability to accommodate feedstocks with sulfur content up to 4.7% (wt., dry) without any significant increases in $SO_2$ and SAM emissions. However, many of the controllers had to be operated at 100% output most of the time during the test program to accomplish this. Polk Power Station plans to make the following modifications to the sulfuric acid plant for improved operability on the higher sulfur fuels so the controllers can operate in their normal control range. Similar modifications to the MDEA acid gas removal system are also planned and are identified below.

Sulfuric Acid Plant Modifications

1. During the trial test burns the sulfuric acid plant compressor had to be operated very near 100% output to keep the $H_2SO_4$ plant pressure profile within design limits. Although operating the SAP compressor as such was sufficient for all trial burn scenarios, it is not a desirable long-term operating condition. Consequently re-engineering of the compressor motor, and/or gear box, and/or impellor blades will be done to provide the machine with enough incremental capacity to return the machine's controls to a normal operating range (70% or 80% output vs. the 100% output during the test burns). Please note, the re-engineering is not a design to increase the flow rate through the acid plant above its current capacity, which was adequate during the fuel trial burns, but rather it is to provide

control stability for the compressor so it can better accommodate minor process disturbances. This can most effectively be done by one of the following options:

- Changing the compressor gear box ratio
- Increasing the compressor wheel size
- Installation of a booster compressor
- Installation of a parallel compressor
- Installation of an oxygen injection quill in the decomposition furnace air inlet duct
- Change in the compressor motor size

2. Additional air supply from the plant air system was required for the sulfuric acid plant decomposition furnace during the trial burns to accommodate the increased solid fuel sulfur content. The external air source was needed during the tests because a flow restriction exists in the normal air supply to the furnace's burner. Although burner modifications were made between Trial Burns #1 and #2 and between Trial Burns #2 and #4, this problem was not completely resolved. The decomposition furnace air in intake system will be modified to decrease the pressure drop by one of the following options:

   - Modification of the existing burner
   - Replacement of the existing burner
   - Modification of the air inlet duct
   - Installation of an oxygen injection quill air inlet duct

As with the compressor modifications, the design objective for the decomposition furnace air intake modifications is not to increase the flow rate beyond that which was demonstrated during the trial burn tests. It is merely to enable the normal air supply system to provide the necessary air while keeping the inlet airflow controls in their normal range to better accommodate minor process disturbances.

3. The decomposition furnace produces $SO_2$. $O_2$ must be added upstream of the catalyst beds to permit conversion of the $SO_2$ to $SO_3$. The $O_2$ supply line and/or control valve restricted flow such that the control valve operated 100% open during most of the testing. Modifying the line and/or control valve to increase the $O_2$ supply by approximately 15%

will ensure sufficient $O_2$ will be supplied while keeping the control valve in a normal operating range to accommodate minor process upsets. Here, again, the design intent is not to provide additional $O_2$ beyond that which was used during the test, but to provide control stability. This may be accomplished by the following:

- Modification of the oxygen piping to reduce the pressure drop
- Increasing the size of the oxygen control valve

MDEA Acid Gas Removal System Modifications

1. Lowering the temperature or "chilling" the MDEA sulfur removal solvent increases its sulfur removal rate. The MDEA chiller was operated throughout the trial burns to assure adequate sulfur removal. However, the trial burns were conducted during December, January, and March when the solvent was already relatively cool. Consequently, we plan to approximately double the chilling capacity for the MDEA solvent to assure adequate sulfur removal from the syngas during warmer ambient temperature seasons. This will likely be accomplished by adding an additional chiller system.

2. During normal plant operating conditions MDEA foaming occurs to some extent. If the foaming becomes severe, it can reduce $H_2S$ removal efficiency and can also lead to dilute acid gas (lower than design $H_2S$ concentration) which has an adverse impact on the sulfuric acid plant (SAP) performance. During the trial burns with increased solid fuel sulfur content, PPS continuously injected a standard commercial foam-inhibiting additive, but shut down the ion exchange system for heat stable salt removal due to the adverse affect the additive has on the ion exchange resin. Long-term operation of the MDEA system is not possible without the ion exchange system. Equipment and provisions will be installed for a more consistent foam-inhibiting additive addition system to the circulating MDEA solvent. This will be accomplished by either adding another carbon filter bed upstream of the heat stable salt removal system or by rerouting the piping so the existing carbon filter will be positioned immediately upstream of the heat stable salt removal system. This will enable a replacement of the current batch anti-foam feeding system with a continuous very low rate anti-foam feeding system that can be better control the foaming tendencies of the MDEA solvent.

3. The first MDEA chiller system added to the plant several years ago included a heat exchanger which imposed additional pressure drop on the main MDEA flow path. As a result, one of the MDEA control valves had less available pressure drop, and consequently was undersized for the application. The control valve will be replaced with one which can perform within the normal control range with the available pressure drop.

TEC Response #3B

TEC proposes to conduct one SAP stack test at the completion of construction to confirm the results observed during the test program. Reported SAP SAM emissions are less than 5% of the total facility SAM emissions and play only a minor role in the projects SAM evaluation. Furthermore, SAP SAM emissions were below permit limits during all of the trail burn test scenarios. The SAP stack was specifically designed to have an ultra low velocity profile to address potential SAM emissions. The stacks design minimizes the area within the stack where the transport velocities are great enough to carry SAM emissions out of the stack. Please note, the proposed SAP modifications are not designed to increase flow rate through the acid plant, and correspondingly the stack, above which was done during the trial burn stack tests, thus the stack will retain its equivalent ability to knock out SAM. Additionally, TEC also has observed that the stack flow determined by EPA RM 8 for the SAP stack (which is the basis for the reported SAP SAM emissions) is consistently well above the capabilities of the equipment (compressor capacity), resulting in over-reporting of SAP stack SAM emissions. We believe these factors should provide reasonable assurance to the DEP that the SAP SAM emissions will not exceed PSD limits.

Department Request #4

*If it is determined that it will be more expedient to process this request and the pending future request to burn 6% sulfur fuel at the same time, please provide a complete application for a PSD permit, including details and descriptions for any needed control devices that satisfy best available control technology (BACT) requirements.*

TEC Response #4

The test program has shown that the AGR and SAP would not be able to accommodate an increase in sulfur loading as would be seen with a fuel containing 6% sulfur without a significant capacity increase and associated capital investment. Consequently, TEC does not intend to request an additional increase in the solid fuel sulfur content above 4.7% in the foreseeable future.

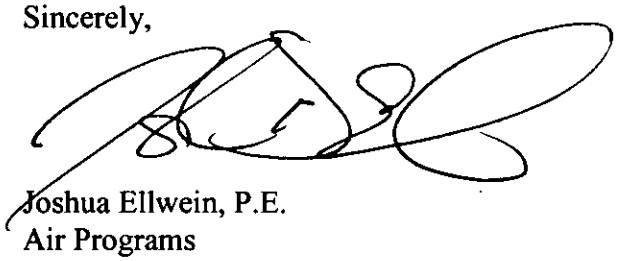
Additional Information

Dialogue with FDEP personal has cited source obligation rule 62.212.400(12)(b) stating that an evaluation of a major modification to a major source shall not include any past relaxation of any enforceable limitation to a major stationary source, but rather evaluate the modification as though construction had not yet commenced on the source. On page 3 of the BACT analysis for the original PSD permit (PSD-FL-194, 2/28/94) for PPS, a maximum solid fuel sulfur content of 3.05% is listed. The 3.05% (and the 11,035 BTU/Lb in the same sentence) refer to the fuel on an as-received basis, which translates to 3.50% sulfur on a dry basis which is consistent with all the plant design documents. On 9/12/01 PPS was issued final permit revision 1050233-008-AV incorporating the use of syngas produced from a blend of coal and petroleum coke as a permitted fuel in the gas turbines. Specific Condition E.1 of this permit cites 3.5% by weight. Instead of a relaxation of conditions relative to the initial BACT, this is merely a restatement of the design sulfur content of the plant's fuel on a different basis ("dry" instead of "as received"). The relaxation of the initial PSD permit is not on the sulfur content of the solid fuel, but the type of fuel to be gasified (e.g. 100% coal to 60% petcoke/40% coal). The hours of operation for the unit have always been 8,760, and therefore never a relaxation on plant availability.

TEC continues to look forward to resolving any questions the Department has regarding this permit application and would to continue an open dialogue between both parties to help ensure a thorough understanding is achieved.

If you have any questions, please contact me at (813) 228-4433.

Sincerely,



Joshua Ellwein, P.E.
Air Programs
Environmental, Health & Safety

Enclosures

# Attachment 1

| Date | Test Description | Stack Test Run Number | CEM KSCFH (Wet) | EPA RM KSCFH (Wet) | % Difference Wet (%) | Plant Data Moisture Content (%) | EPA RM Moisture Content (%) | CEM KSCFH (Dry) | EPA RM KSCFH (Dry) | % Difference Dry (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 12/19/01 | PC Baseline | Run 1 | 860 | 907 | 5.4 | 5.94 | 5.70 | 809 | 856 | 5.7 |
| 12/19/01 | PC Baseline | Run 2 | 857 | 902 | 5.1 | 5.94 | 5.70 | 806 | 851 | 5.4 |
| 12/19/01 | PC Baseline | Run 3 | 843 | 896 | 6.1 | 5.93 | 5.40 | 793 | 847 | 6.6 |
| 4/23/02 | 2002 Annual | Run 1 | 852 | 928 | 8.6 | 6.77 | 6.20 | 794 | 871 | 9.2 |
| 4/23/02 | 2002 Annual | Run 2 | 852 | 933 | 9.0 | 6.83 | 5.20 | 794 | 885 | 10.8 |
| 4/23/02 | 2002 Annual | Run 3 | 852 | 931 | 8.9 | 6.92 | 5.50 | 793 | 880 | 10.4 |
| 5/20/03 | 2003 Annual | Run 1 | 832 | 923 | 10.3 | 6.70 | 6.11 | 777 | 867 | 10.9 |
| 5/20/03 | 2003 Annual | Run 2 | 839 | 903 | 7.3 | 6.52 | 4.39 | 784 | 863 | 9.6 |
| 5/20/03 | 2003 Annual | Run 3 | 832 | 890 | 6.8 | 6.48 | 5.18 | 778 | 844 | 8.2 |
| 5/19/04 | 2004 Annual | Run 1 | 806 | 899 | 10.9 | 7.58 | 6.27 | 745 | 842 | 12.3 |
| 5/19/04 | 2004 Annual | Run 2 | 795 | 887 | 10.9 | 7.32 | 4.50 | 737 | 847 | 13.9 |
| 5/19/04 | 2004 Annual | Run 3 | 788 | 879 | 10.9 | 7.09 | 5.29 | 732 | 833 | 12.9 |
| 5/18/05 | 2005 Annual | Run 1 | 853 | 908 | 6.3 | 6.56 | 5.30 | 797 | 860 | 7.6 |
| 5/18/05 | 2005 Annual | Run 2 | 846 | 922 | 8.6 | 6.36 | 6.08 | 792 | 866 | 8.9 |
| 5/18/05 | 2005 Annual | Run 3 | 849 | 915 | 7.5 | 6.88 | 6.22 | 790 | 858 | 8.2 |
| 2/7/06 | 2006 Annual | Run 1 | 869 | 952 | 9.1 | 6.88 | 4.63 | 809 | 908 | 11.5 |
| 2/7/06 | 2006 Annual | Run 2 | 871 | 942 | 7.8 | 6.90 | 4.15 | 811 | 903 | 10.8 |
| 2/7/06 | 2006 Annual | Run 3 | 869 | 945 | 8.3 | 6.78 | 4.49 | 810 | 902 | 10.7 |
| | | **Average:** | 843 | 915 | 8.2 | | | 786 | 866 | 9.6 |
| 11/8/06 | Base | Run 1 | 814 | 956 | 16.1 | 6.42 | 3.81 | 762 | 920 | 18.8 |
| 11/8/06 | Base | Run 2 | 815 | 925 | 12.6 | 6.35 | 4.18 | 764 | 887 | 14.9 |
| 11/8/06 | Base | Run 3 | 812 | 942 | 14.8 | 6.20 | 5.24 | 761 | 893 | 15.9 |
| 12/1/06 | 75% PC | Run 1 | 813 | 924 | 12.9 | 7.28 | 5.83 | 753 | 871 | 14.4 |
| 12/1/06 | 75% PC | Run 2 | 817 | 948 | 14.9 | 7.09 | 5.61 | 759 | 895 | 16.4 |
| 12/1/06 | 75% PC | Run 3 | 820 | 940 | 13.7 | 6.98 | 5.22 | 763 | 891 | 15.5 |
| 1/18/07 | 85% PC | Run 1 | 818 | 942 | 14.0 | 6.92 | 4.19 | 762 | 902 | 16.9 |
| 1/18/07 | 85% PC | Run 2 | 826 | 919 | 10.7 | 6.86 | 3.90 | 769 | 883 | 13.8 |
| 1/18/07 | 85% PC | Run 3 | 822 | 933 | 12.6 | 6.89 | 3.84 | 766 | 897 | 15.8 |
| 3/23/07 | 100% PC | Run 1 | 814 | 953 | 15.8 | 6.47 | 5.48 | 761 | 901 | 16.8 |
| 3/23/07 | 100% PC | Run 2 | 819 | 921 | 11.7 | 6.28 | 5.49 | 767 | 870 | 12.6 |
| 3/23/07 | 100% PC | Run 3 | 813 | 969 | 17.5 | 6.13 | 5.88 | 763 | 912 | 17.7 |
| | | **Average:** | 817 | 939 | 13.9 | | | 763 | 893 | 15.8 |
| | | **Overall Average:** | 832 | 924 | 10.5 | 6.68 | 5.17 | 777 | 877 | 12.1 |
| | | **Standard Deviation:** | | | | 0.42 | 0.77 | | | |

Table 1

Attachment 2

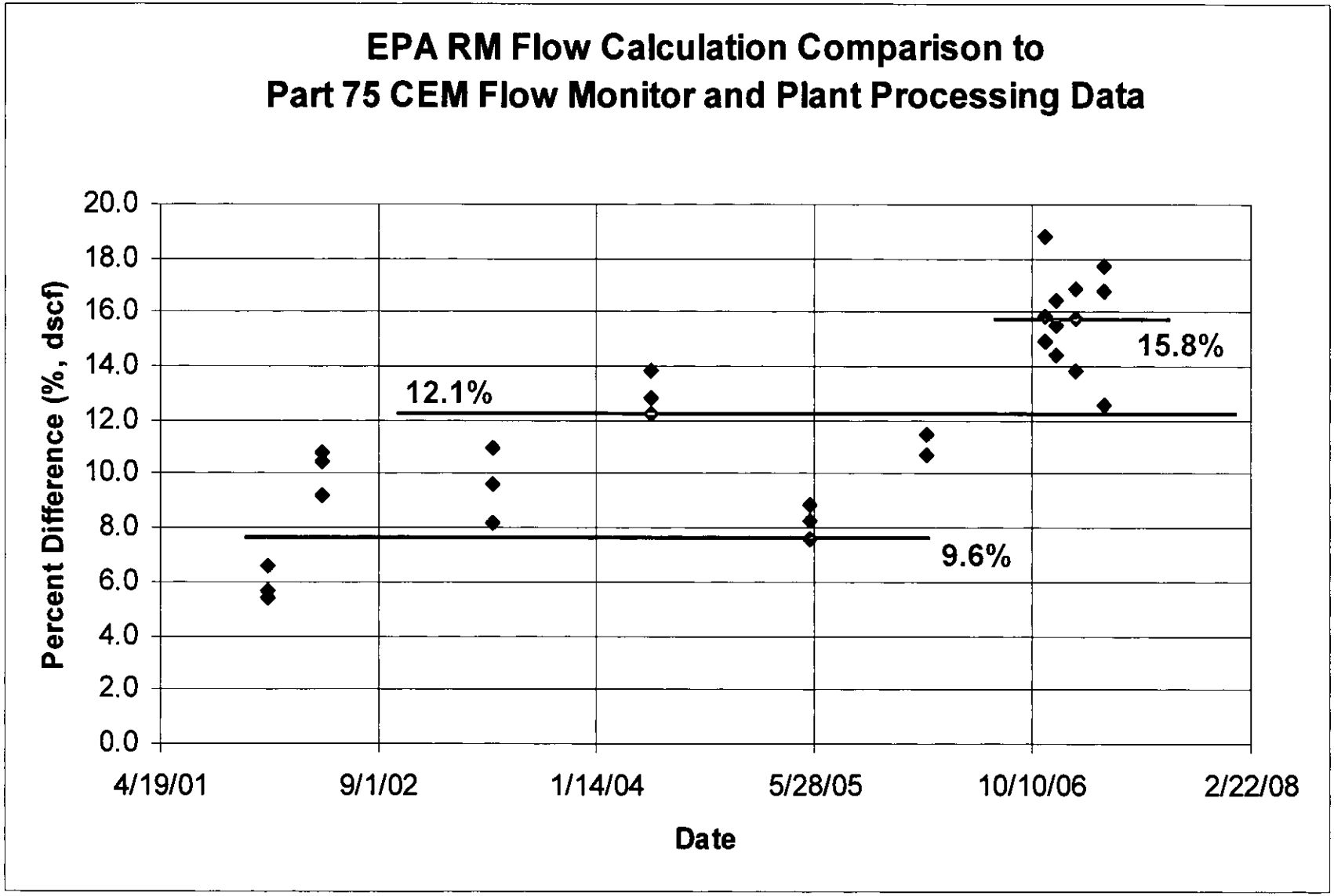



Chart 1

Attachment 3

| Test Run | Date | | | Reported $H_2SO_4$ Lb/Hr | Corrected $H_2SO_4$ Lb/Hr | CEM $SO_2$ Lb/Hr | Corrected $H_2SO_4/SO_2$ Molar Ratio | Emission Ratio $H_2SO_4/SO_2$ Lb/Hr | **Corrected $H_2SO_4/SO_2$ Molar Ratio** | **Outlier $H_2SO_4/SO_2$ Molar Ratio** | Outlier SD's From Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 12/19/01 | PC Baseline | Run 1 | 23.0 | 21.8 | 317 | 0.0449 | 0.069 | **0.0449** | | |
| 2 | 12/19/01 | PC Baseline | Run 2 | 25.9 | 24.5 | 321 | 0.0499 | 0.076 | **0.0499** | | |
| 3 | 12/19/01 | PC Baseline | Run 3 | 31.1 | 29.1 | 278 | 0.0685 | 0.105 | **0.0685** | | |
| 4 | 4/23/02 | 2002 Annual | Run 1 | 28.1 | 25.7 | 332 | 0.0505 | 0.077 | **0.0505** | | |
| 5 | 4/23/02 | 2002 Annual | Run 2 | 32.0 | 28.7 | 343 | 0.0547 | 0.084 | **0.0547** | | |
| 6 | 4/23/02 | 2002 Annual | Run 3 | 22.8 | 20.5 | 369 | 0.0363 | 0.056 | **0.0363** | | |
| 7 | 5/20/03 | 2003 Annual | Run 1 | 24.6 | 22.1 | 261 | 0.0552 | 0.085 | **0.0552** | | |
| 8 | 5/20/03 | 2003 Annual | Run 2 | 24.6 | 22.3 | 287 | 0.0509 | 0.078 | **0.0509** | | |
| 9 | 5/20/03 | 2003 Annual | Run 3 | 32.9 | 30.3 | 254 | 0.0779 | 0.119 | | 0.0779 | **3.8** |
| 10 | 5/19/04 | 2004 Annual | Run 1 | 29.9 | 26.5 | 293 | 0.0590 | 0.090 | **0.0590** | | |
| 11 | 5/19/04 | 2004 Annual | Run 2 | 26.6 | 23.2 | 265 | 0.0570 | 0.087 | **0.0570** | | |
| 12 | 5/19/04 | 2004 Annual | Run 3 | 42.7 | 37.6 | 260 | 0.0944 | 0.145 | | 0.0944 | **6.1** |
| 13 | 5/18/05 | 2005 Annual | Run 1 | 21.6 | 20.0 | 277 | 0.0472 | 0.072 | **0.0472** | | |
| 14 | 5/18/05 | 2005 Annual | Run 2 | 20.6 | 18.8 | 283 | 0.0435 | 0.067 | **0.0435** | | |
| 15 | 5/18/05 | 2005 Annual | Run 3 | 22.5 | 20.7 | 283 | 0.0477 | 0.073 | **0.0477** | | |
| 16 | 2/7/06 | 2006 Annual | Run 1 | 34.0 | 30.4 | 399 | 0.0497 | 0.076 | **0.0497** | | |
| 17 | 2/7/06 | 2006 Annual | Run 2 | 30.0 | 26.7 | 394 | 0.0443 | 0.068 | **0.0443** | | |
| 18 | 2/7/06 | 2006 Annual | Run 3 | 28.0 | 24.8 | 359 | 0.0450 | 0.069 | **0.0450** | | |
| 19 | 11/8/06 | Base | Run 1 | 21.8 | 18.1 | 294 | 0.0402 | 0.062 | **0.0402** | | |
| 20 | 11/8/06 | Base | Run 2 | 32.4 | 27.9 | 339 | 0.0538 | 0.082 | **0.0538** | | |
| 21 | 11/8/06 | Base | Run 3 | 30.6 | 26.1 | 312 | 0.0546 | 0.084 | **0.0546** | | |
| 22 | 12/1/06 | 75% PC | Run 1 | 41.4 | 35.8 | 311 | 0.0751 | 0.115 | | 0.0751 | **3.4** |
| 23 | 12/1/06 | 75% PC | Run 2 | 32.8 | 27.8 | 330 | 0.0549 | 0.084 | **0.0549** | | |
| 24 | 12/1/06 | 75% PC | Run 3 | 26.4 | 22.6 | 337 | 0.0438 | 0.067 | **0.0438** | | |
| 25 | 1/18/07 | 85% PC | Run 1 | 24.3 | 20.5 | 316 | 0.0424 | 0.065 | **0.0424** | | |
| 26 | 1/18/07 | 85% PC | Run 2 | 29.6 | 25.7 | 303 | 0.0555 | 0.085 | **0.0555** | | |
| 27 | 1/18/07 | 85% PC | Run 3 | 30.8 | 26.3 | 308 | 0.0558 | 0.085 | **0.0558** | | |
| 28 | 3/23/07 | 100% PC | Run 1 | 26.7 | 22.5 | 319 | 0.0462 | 0.071 | **0.0462** | | |
| 29 | 3/23/07 | 100% PC | Run 2 | 33.2 | 29.3 | 314 | 0.0609 | 0.093 | **0.0609** | | |
| 30 | 3/23/07 | 100% PC | Run 3 | 58.5 | 49.0 | 295 | 0.1085 | 0.166 | | 0.1085 | **8.1** |
| | | | | | | **Mean:** | 0.0556 | (including outliers) | 0.0505 | (excluding outliers) | |
| | | | | | | **Standard Deviation:** | 0.0157 | (including outliers) | 0.0072 | (excluding outliers) | |

Table 2

## SAM Past Actual Annual Comparison to Future Projected Annual Emissions

| | Max 2-yr Heat Input May 2005-April 2007 (MMBtu[1]) | Past Actual Emission Rate (lb/MMBtu[2]) | Future Projected Emission Rate (lb/MMBtu) | Past Actual Annual Emissions (Tns/yr) | Future Projected Annual Emissions (Tns/yr) | Difference (Tns/yr) |
|---|---|---|---|---|---|---|
| Data Corrected for Flow & Exclude Outliers[3] | 16,896,824 | 0.0099 | 0.0106 | 83.7 | 89.9 | 6.2 |
| Data Corrected for Flow & Include Outliers | 16,896,824 | 0.0105 | 0.0138 | 88.5 | 116.6 | 28.1 |
| Test Burn Data Only (corrected) | 16,896,824 | 0.0099 | 0.0106 | 83.3 | 89.9 | 6.6 |
| Test Burn Data Only (uncorrected) | 16,896,824 | 0.0117 | 0.0160 | 98.5 | 135.4 | 36.9 |

## $SO_2$ Past Actual Annual Comparison to Future Projected Annual Emissions

| | 2-yr $SO_2$ Emmision Evaluation 2003-2004 (MMBtu[1]) | Past Actual Emission Rate (lb/MMBtu[2]) | Future Projected Emission Rate (lb/MMBtu) | Past Actual Annual Emissions (Tns/yr) | Future Projected Annual Emissions (Tns/yr) | Difference (Tns/yr) |
|---|---|---|---|---|---|---|
| Test Burn Data Only (corrected) | 14,802,848 | 0.1324 | 0.1265 | 979.8 | 936.4 | -43.3 |
| Test Burn Data Only (uncorrected) | 14,802,848 | 0.0955 | 0.0969 | 706.9 | 717.6 | 10.7 |

Table 4

Notes:
1. based on gasifier (solid fuel) heat input evaluation for 2003-2007
2. Based on 2005-2007 AOR average heat input (annualized) = 2,434 MMBtu/hr
3. Past actual emissions based on average of 2002-2007 emissions test
4. Based on 2003-2004 AOR average heat input (annualized) = 2,320 MMBtu/hr

5% molar ratio ≈ 8.1% by wt.

4.7% max Sulfur w/o major changes to

Request: ↑ in acid production
4.7% S in 85/15 blend

$SO_2$ & SAM Not expected to increase (hourly)