Adams, Patty

From: Adams, Patty
Sent: Monday, December 18, 2006 4:33 PM
To: Kirts, Christopher; 'Robinson, Richard'; 'worley.gregg@epa.gov'
Cc: Arif, Syed
Subject: SJRPP SCR Installation Units 1 and 2
Attachments: SJRPP 12-4-06 letter.pdf

Attached is a response received by DEP from SJRPP for the above referenced project.

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BUREAU OF AIR REGULATION

st. johns river POWER PARK

December 4, 2006

Ms. Trina L. Vielhauer, Chief Bureau of Air Regulation
Bureau of Air Regulation
Department of Environmental Protection
2600 Blair Stone Road
Tallahassee, FL 32399

Attention: Mr. Syed Arif, P.E., Administrator

RE: Northside Generating Station/St. Johns River Power Park (SJRPP)
DEP File No. 0310045-017-AC
Selective Catalytic Reduction (SCR) Installation in SJRPP Units 1 and 2

Dear Mr. Arif:

This correspondence provides the information requested in the Department's November 15, 2006 letter regarding the installation of SCRs on SJRPP Units 1 and 2. Presented below is the information requested.

1. Please provide material balance calculations for ammonia injection that will remove 90 percent of the sulfuric acid mist emissions (SAM) after the air heater. The calculations should provide the ammonia injection amount required in pounds per hour and gallons per minute to ensure that SAM emissions do not increase more than 7 tons per year above the baseline SAM emissions. These calculations should be based on when the units are operating as base load units and when operating at 50 percent load. If any actual test data is available for a similar type operation, please provide that to the Department. Also, indicate if any ammonia slip will be taking place due to ammonia injection.

Additional Information: The SJRPP Unit's 1 and 2 SCRs will include an ammonia injection system that will be controlled by proprietary software from PECO-FGC, Incorporated. The control system regulating the amount of ammonia injected to control SAM will be integrated into the plant digital control system (DCS). The design of the injection grids, including the locations and sizes of the nozzles regulating the amount of ammonia, was performed using computerized modeling of the ductwork leading to the ESP. The amount of ammonia injected through the injection grid into the flue gas conditioning system will be regulated based on load and sulfur dioxide (SO_2) content of flue gas. A portion of the SO_2 will further oxidize in the SCR system to sulfur trioxide (SO_3), which ultimately forms SAM after the FGD system. A control algorithm will regulate the system within the DCS to remove up to 90 percent of SAM from the flue gas.

When ammonia is introduced to the flue gas stream, it reacts with the SO_3 to produce two primary chemical reactions:

$$NH_3 + H_2O + SO_3 = NH_4HSO_4 \quad (1)$$

and

$$2NH_3 + H_2O + SO_3 = (NH_4)_2HSO_4 \quad (2),$$

The reaction of ammonia and SO_3 produces ammonium sulfate (Equation 1) and ammonium bisulfate (Equation 2). In order to control SO_3 and maximize the amount of particulate formed that is easily collected in the electrostatic precipitators (ESPs), the amount of NH_3 injected is maintained at a ratio of less than 2-1 to produce ammonium bi-sulfate, which reduces ammonia slip and produces an agglomerating particle which is easily collected. The ammonia slip is reduced by regulating the amount of ammonia and the design of the injection grid. Ammonia slip after the ESP is expected to be 2 ppm or less. Non-reacted ammonia entering the wet FGD system will be absorbed in the limestone slurry since ammonia gas is soluble in water. The actual ammonia slip exiting the stack would be 10 percent or less of the ammonia slip entering the FGD system.

When the SCRs and ammonia injection systems are installed, testing will be performed to demonstrate the effectiveness of the ammonia injection system to control SAM. The ammonia injection control system will have outputs that will be monitored and recorded in the plant's DCS. The required performance test data and the information in the DCS will demonstrate that SAM will not increase with the installation of SCR.

There are no stack tests available on a similar system since each system is individually designed based on the requirements. However, ammonia injection is a recognized method for SO_3 removal. In addition, as discussed previously, the design of the system is based on computer modeling of the injection system and included a control system to minimize SO_3 emissions which ultimately are emitted as SAM.

Table RAI-1 presents a worst-case emission calculation for SAM emissions using ammonia injection. The calculations are based on a procedure developed by Southern Company that accounts for conversions and reductions on SAM emissions along the path of the exhaust gases. SO2 is oxidized in the combustion process and SCR. The air heater, ammonia injection/ESP and FGD system will remove SAM. This procedure was supported by tests data taken by SJRPP at various points during the design of the SCR Project. The calculation shows that using a 90% reduction from ammonia injection along with worst-case SAM generation by the SCR, projected future emissions minus the baseline actual emissions can be kept below the PSD significant emission rate for SAM of 7 tons/year. The actual ammonia injection rate will be based on the load and sulfur content of the fuel and regulated by the DCS.

2. Table 2-2 in the application indicates that SAM emissions for 2001 through 2004 were based on the average SAM emission from stack tests during the period of 1997 through 2000. SAM emissions for 2005 were based on stack test performed in 2005. Why was the stack test data for SAM emissions for 2001 through 2004 not used? If the stack tests for SAM emissions were not performed during that time period, provide the reasons to the Department as to why the stack tests were not performed.

Additional Information: The emissions of SAM for 2001 through 2004 were based on an average of tests conducted from 1997 through 2000. These tests were conducted to meet the requirements of PSD-FL-010(B) dated October 14, 1996 that authorized the co-firing of up to 20 percent petroleum coke with coal. During the compliance demonstration period for this permit, a total of 18 tests were conducted on both Units 1 and 2. The SAM emissions in these 18 tests ranged from about 0.052

lb/MMBtu to 0.006 lb/MMBtu, and averaged 0.0274 lb/MMBtu. These tests demonstrated that SJRPP complied with the specific conditions of the co-firing authorization and compliance tests for SAM emissions were no longer required. Since there was considerable variability during the tests, the average of the 18 tests was used to estimate SAM emissions for the period 2001 through 2004. In 2005, SJRPP Units 1 and 2 were authorized to co-fire up to 30 percent of petroleum coke with coal (DEP File No. 0310045-014-AC; PSD-FL-010). As a result of this authorization, testing for SAM was resumed. The tests conducted in 2005 were within the range of previous SAM. SJRPP will continue to perform SAM testing as noted above to demonstrate that SAM emissions will not trigger PSD review by increasing future actual SAM emissions by 7 tons/year over the baseline actual emissions.

If there are any further questions please contact Mr. Jay Worley at (904) 591-2595 or our environmental consultant Mr. Kennard Kosky at (352) 336-5600. The Department's expeditious review of this information is appreciated.

Sincerely,

Michael J. Brost
JEA
Vice President, Electric Services

Enclosures

cc: Mike Halpin, P.E., Siting Coordination Office
Jay Worley, JEA / SJRPP
Ken Kosky, P.E., Golder Associates

Table RAI-1. Calculation of Sulfuric Acid Mist (SAM) Emissions for the SJRPP SCR Project using Ammonia Injection

Category	Units	NH_3 Injection	Units	Mass (lb/hr) at Maximum Heat Input (6,144 MMBtu/hr)
Coal Sulfur Content	%	3.2		
Coal Heat Content	Btu/lb	12,500		
Uncontrolled SO_2 Emissions[a]	lb/MMBtu	5.12	lb/hr	31,457.3
Combustion Factor[b]		0.025		
SAM from Combustion	lb/MMBtu	0.196	lb/hr	1,204.2
SCR Factor[c]		0.025		
SAM produced by SCR	lb/MMBtu	0.193	lb/hr	1,184.6
SAM Leaving SCR[d]	lb/MMBtu	0.389		
Air Heater Factor[e]		1.000		
SAM Leaving Air Heater	lb/MMBtu	0.389	lb/hr	2,388.8
NH_3 Injection and ESP[f]		0.100		
SAM Leaving ESP	lb/MMBtu	0.039	lb/hr	238.9
FGD System Factor[g]		0.470		
SAM Leaving FGD	lb/MMBtu	0.018	lb/hr	112.3
Baseline Heat Input (Table 2-1 of Application)	MMBtu/year	96,231,826		
Baseline SAM Emissions (Table 2-3 of Application)	tons/year	1,316.9		
Projected Actual SAM Emissions	lb/MMBtu	0.018		
	ppm (est.)	4.148		
	MMBtu	96,231,826		
	tons/year	879.251		
Difference: Projectd Actual - Baseline Actual	tons/year	-437.649		
SAM Reduction by Ammonia Injection[h]	lb/hr	2,149.908		
Ammonia Amount based on 1:1 Ratio[i]	lb/hr	372.943		

Note: All calculations based on SAM (molecular weight = 98), although SO_3 is the primary pollutant being removed.

[a] assumes 100 percent of sulfur converted to SO_2 for the purpose of calculating the amount of SAM produced; actual SO_2 emissions are typically 95 percent of the total sulfur due to SAM formed and sulfur containing particles.

[b] SJRPP test data; 2.3% average for full load increased to 2.5%.

[c] 2.5 percent SO_3 produced from SO_2 oxidation; worst-case vendor guarantee.

[d] Excess ammonia slip will scavenge SAM. This is included in the ammonia injection and ESP removal.

[e] No removal assumed. 15% recommended in Table 4-1 (0.85 factor) for high/medium sulfur eastern bituminous (Southern Company, 2005)

[f] 0.10 for 90% removal with ammonia injection.

[g] 0.47 representative of 53 percent removal in FGD system which is supported by SJRPP tests and Southern Company, 2005.

[h] SAM leaving air heater minus SAM leaving ESP.

[i] Adjusted based on molecular weights of SAM (98) and ammonia (17).