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January 22, 2010

Ms. Christy DeVore, P.E.
Bureau of Air Regulation
Department of Environmental Protection
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

SUBJECT: C.D. McIntosh, Jr. Power Plant – facility ID #1050004; E.U. 006
Test Protocol

Dear Ms. DeVore:

Lakeland Electric will be performing stack testing for sulfuric acid mist emissions and ammonia slip on Unit 3 at the C.D. McIntosh, Jr. Power Plant starting February 1, 2010 to satisfy Condition 15 of permit no. 1050004-019-AC. Condition 15.c. of the same permit requires Lakeland Electric to notify the Department of the test date along with submitting a test protocol which was done electronically on January 15, 2010. A hard copy of the test protocol is attached for your records along with a copy of the e-mail in which the original information was submitted to the Department to satisfy the above permit condition. If you have any questions regarding the test protocol please feel free to contact me at (863) 834-8180.

Sincerely,

Bret Galbraith, E.I.
bret.galbraith@lakelandelectric.com

Enclosure: SAM Test Protocol; E-mail to C. DeVore and B. Schroeder (1/15/2010)

cc: Ms. Daniel Henry
Compliance Supervisor
Air Compliance Section
Florida Department of Environmental Protection
13051 North Telecom Parkway
Temple Terrace, FL 33637-0926

Galbraith, Bret

From: Galbraith, Bret
Sent: Friday, January 15, 2010 6:42 PM
To: 'DeVore, Christy'; Schroeder, Bill
Cc: 'Koerner, Jeff'; Henry, Danielle D.; Doerr, Doug; Cooper, Kaley
Subject: Lakeland Electric - Test Notification - Sulfuric Acid Mist and NH3 Slip - Unit 3 SCR - Permit No. 1050004-019- AC
Attachments: McIntosh Unit 3 SAM Protocol_rev.2.pdf; Table 1_rev 1.pdf; Table 2_rev 1.pdf

Good afternoon Christy and Bill,

Please find attached Lakeland Electric's Test Protocol for the upcoming sulfuric acid mist and ammonia slip testing we are planning to begin the week of February 1, 2010. We are confirming exact start times with the pool early next week Bill, so I will be sure to send those start times to your office so that FDEP personnel can attend. Additionally, please feel free to contact me if you have any questions regarding the attached. A hard copy of this protocol is being submitted to both of your offices for your files. Take care and have a great weekend.

Bret Galbraith, E.I. | **Environmental Permitting**| Lakeland Electric
501 E. Lemon St. | Lakeland, FL 33810 |**office**: 863-834-8180 **cell**: 813-351-0149 |**fax**: 863-834-8187 |**e-mail**: bret.galbraith@lakelandelectric.com

LAKELAND ELECTRIC

SITE-SPECIFIC TEST PROTOCOL

McIntosh Unit 3 Sorbent Injection System Performance Test

McIntosh Unit 3 Ammonia (NH3) Slip Compliance Test

Table of Contents

List of Tables

1.0 INTRODUCTION

Lakeland Electric owns and operates the C.D. McIntosh Jr. Power Plant (McIntosh Power Plant) located at 3030 East Lake Parker Drive, Lakeland, Polk County, Florida. The facility is currently operating under Title V Permit No. 1050004-023-AV. On August 31, 2007, Lakeland Electric was issued Air Construction Permit No. 1050004-019-AC to install a selective catalytic reduction (SCR) system with ammonia injection system to control nitrogen oxide (NO_x) emissions from fossil fuel fired steam generator Unit 3 (EU 006) at the McIntosh Power Plant. McIntosh Unit 3 is a coal, residual oil, natural gas, refuse-derived fuel (RDF) (co-firing), and petroleum coke firing nominal 364-megawatt (MW) dry bottom wall-fired boiler. Maximum heat input to the boiler is limited to 3,640 million British thermal units per hour (MMBtu/hr). Unit 3 is equipped with an electrostatic precipitator (ESP), flue gas desulfurization (FGD) system, low NO_x burners (LNB), and an overfire air (OFA) system to control emissions.

While the addition of the SCR will substantially decrease emissions of NO_x, there is the potential for an increase in emissions of sulfuric acid mist (SAM) as a result of the oxidation of sulfur dioxide (SO_2) across the SCR system to sulfur trioxide (SO_3), which forms into SAM. Additionally, there is a potential for unreacted ammonia to be emitted from the system due to possible over-injection of ammonia over the SCR catalyst.

Permit No. 1050004-019-AC authorized Lakeland Electric to install a sorbent injection system downstream of the SCR and upstream of the ESP to control the SAM emissions. The sorbent reacts with SO_3 to form particles, which will be collected in the ESP.

Specific Condition 15 of Air Construction Permit No. 1050004-019-AC requires Lakeland Electric to conduct a series of initial performance tests to determine the SAM emission rate under a variety of operating scenarios and develop a correlation between sorbent injection rates, operating conditions, and SAM emissions.

Permit No. 1050004-019-AC requires Lakeland Electric to submit a test schedule and protocol to the Florida Department of Environmental Protection (FDEP) at least 15 days prior to the initial performance test. The following sections of this document discuss the specific details of the initial performance testing.

Lakeland Electric will also perform ammonia slip testing as required by Specific Condition 19 of Air Construction Permit No. 1050004-019-AC. Ammonia slip testing will be performed using EPA Conditional Test Method CTM-027 as approved in Specific Condition 19. Three, 1-hour tests will be conducted with Unit 3 operating within 90-100% of nominal capacity. Sampling will be performed with the ammonia injection system in operation in order to determine the ammonia slip emission rate.

Testing is tentatively scheduled to begin the week of February 1, 2010 and continue through February 6, 2010. A more detailed schedule including start times will be forwarded to the Southwest District Compliance Office as soon as times are affirmed with the power pool.

2.0 SORBENT INJECTION PERFORMANCE TESTING SCENARIOS

The initial performance test is required to determine the SAM emission rate under a variety of operating scenarios and demonstrate the use of the sorbent injection system on reducing SAM emissions. The tests will be used to evaluate the effect on SAM emissions due to SO_2 emissions, unit load, flue gas flow rate, and sorbent injection rates.

According to Title V permit No. 1050004-023-AV, Unit 3 is permitted to burn the following fuels:

- Coal only;
- Low sulfur fuel oil only (≤ 0.5 percent sulfur by weight);
- Coal and up to 10 percent refuse (based on heat input);
- Low sulfur fuel oil and up to 10 percent refuse (based on heat input);
- Coal and up to 20 percent petroleum coke (based on weight);
- Coal and up to 20 percent petroleum coke (based on weight) and 10 percent refuse (based on heat input);
- High sulfur fuel oil (>0.5 percent sulfur by weight); and
- Natural gas or propane only, or in combination with any of the other fuels or fuel combinations listed above.

SAM performance testing is required to be conducted under a variety of fuel blends and loads that are representative of actual conditions when the SCR is operating. The SCR may only be operated when the flue gas inlet temperature is greater than 605 degrees Fahrenheit (°F), which correlates to approximately 270 MW. Unit 3 typically burns low sulfur bituminous coal from the central Appalachian region of the United States and from South America (Colombia) with no petroleum coke added. The Colombian coal is typically blended with the domestic coal when it is burned.

The results of the performance test will be used to develop a correlation curve between sorbent injection rates, operating conditions, and emissions. Each test scenario will consist of a series of 1-hour test runs using Method 8A for SAM and EPA Method 6C for SO_2.

2.1 Performance Test Scenarios

The proposed performance test scenarios are shown in Table 1. A brief description of each scenario is presented below. These scenarios were designed to meet Specific Conditions 15 a. and b. It should be noted that tests suggested by Specific Condition 15b. for determining SAM emissions that involve "bypass of the SCR reactor" are not possible, as there is no SCR bypass. However, tests will be performed before and after the SCR that accomplish what the condition suggests.

Scenario 1 – In this scenario, a total of three 1-hour tests will be conducted with the SCR operating and sorbent injection system not operating to measure the uncontrolled SO_2 and SAM emission rates. Emissions measurement will be made at five locations – before and after the SCR (four points because two sets of ductwork), and at the stack. The ESP power will be recorded during the tests. These tests

will be conducted at maximum load. Note that SO_2 emissions at the stack will be determined using the continuous emission monitoring system (CEMS).

Scenario 2 – Tests in this scenario are the same as Scenario 1 except that this test scenario is conducted at 88-percent load. A total of two 1-hour tests will be conducted with the SCR operating and sorbent injection system not operating to measure the uncontrolled SO_2 and SAM emission rates.

Scenario 3 – Tests in this scenario are the same as Scenario 1 except that this test scenario is conducted at 69-percent load, which is the minimum point of the expected operating range of the SCR as limited by temperature. A total of two 1-hour tests will be conducted with the SCR operating and sorbent injection system not operating to measure the uncontrolled SO_2 and SAM emission rates.

Scenarios 4 through 6 – In these scenarios, a single 1-hour test will be conducted with the SCR system operating and at variable sorbent injection rates. The sorbent injection rates will be based on vendor recommendations of required calcium hydroxide [$Ca(OH)_2$] flow for the SO_3 concentration expected at the air heater outlet when operating at maximum load. SO_2 and SAM emission rates will be measured at five locations – before and after the SCR (four points because two sets of ductwork), and at the stack. ESP power will be recorded. These tests will be conducted at maximum load.

Scenarios 7 through 9 – These scenarios will be conducted at 88-percent load. One-hour tests will be conducted with the SCR system operating and at variable sorbent injection rates. The sorbent injection rates will be based on vendor recommendations of required $Ca(OH)_2$ flow for the SO_3 concentration expected at the air heater outlet at intermediate load. SO_2 and SAM emission rates will be measured at five locations – before and after the SCR (four points because two sets of ductwork), and at the stack. ESP power will be recorded.

Scenarios 10 through 12 – These scenarios will be conducted at 69-percent load. One-hour tests will be conducted with the SCR system operating and at variable sorbent injection rates. The sorbent injection rates will be based on vendor recommendations of required $Ca(OH)_2$ flow for the SO_3 concentration expected at the air heater outlet at minimum load. SO_2 and SAM emission rates will be measured at five locations – before and after the SCR (four points because two sets of ductwork), and at the stack. ESP power will be recorded.

3.0 PERFORMANCE TEST METHODS

3.1 Sulfuric Acid Mist

Lakeland Electric will perform performance tests to determine emissions of SAM from McIntosh Unit 3 by conducting stack testing using the following FDEP methods and procedures:

1. SAM will be measured using Method 8A.
   a. A minimum of three test runs per load scenario will be performed.
   b. Sampling time for each run will be a minimum of 60 minutes.
2. For determining sample port location and number of traverse points, EPA Method 1 or 1A will be used.
3. Velocity and volumetric gas flow rate will be measured out of the stack using EPA Method 2, 2F, or 2G.
4. Oxygen concentration will be measured using EPA Method 3A or 3B. The gas sample must be taken at the same time and at the same traverse points as the SAM sample.
5. Moisture content of stack gas will be measured using EPA Method 4.

A series of individual runs for each test scenario will be performed, with each run lasting for at least 1 hour. The average of the three test runs will be used to determine SAM emission rates.

Performance tests for SAM and SO_2 emissions from McIntosh Unit 3 will be conducted concurrently as prescribed by individual test scenarios.

3.2 Sulfur Dioxide

The following test methods and procedures will be used:

1. SO_2 will be measured using EPA Method 6C.
   a. A minimum of three test runs per load scenario will be performed.
   b. Sampling time for each run will be a minimum of 60 minutes.
2. For determining sample port location and number of traverse points, EPA Method 1 or 1A will be used.
3. Velocity and volumetric gas flow rate of the stack gas will be measured using EPA Method 2, 2F, or 2G.
4. Oxygen concentration will be measured using EPA Method 3A or 3B. The gas sample must be taken at the same time and at the same traverse points as the SO_2 sample.
5. The moisture content of stack gas will be measured using EPA Method 4.

A series of individual runs for each test scenario will be performed, with each run lasting for at least 1 hour. The average of the test runs will be used to determine the concentration of unconverted SO_2 prior to conversion in the catalyst bed and the conversion rate of SO_2 to SO_3. Performance tests for SAM and SO_2 emissions from McIntosh Unit 3 will be conducted concurrently, as prescribed by individual test scenarios. SO_2 emissions from the stack will be determined using the certified CEMS.

3.3 Additional Parameters

The following parameters will also be recorded:

1. Steam production rate, steam temperature, and steam pressure will be measured by process monitors and recorded by the data acquisition and handling system (DAHS).
2. Secondary voltage and secondary current will be monitored, and then the total secondary power input to the ESP will be calculated. For each test run, the average total power input to the ESP will be determined.
3. The catalyst oxidation rate will be determined from test data.
4. The sorbent injection rate will be monitored and recorded by process monitors and recorded by the DAHS interconnection supplied by the vendor.

4.0 DATA QUALITY OBJECTIVES

Lakeland Electric expects to achieve the precision and accuracy that is required by the reference test method requirements. Lakeland Electric expects to have a complete set of performance test data, including calculations, as outlined in this test plan, by the time the initial performance test plan reports are submitted for the sulfuric acid mist tests. The sulfuric acid mist test reports will be submitted as part of the performance test report required by Specific Condition 15e. in Section 3 of Air Construction Permit No. 1050004-019-AC. Ammonia slip emission test results will be submitted as part of Specific Condition 19 of Air Construction Permit No. 1050004-019-AC.

Lakeland Electric will require the stack testing contractor to use all equipment and procedures as specified by Method 8A, EPA Method 6C, and Conditional Test Method CTM-027. Use and calibration of test equipment, sampling procedures, and analysis shall comply with applicable requirements in Title 40, Part 60 of the Code of Federal Regulations (40 CFR 60), Appendix A.

5.0 REPORTING

Data collected during the sulfuric acid mist tests will be used to develop correlation between sorbent injection rate, emissions, and appropriate parameters such as SO_2 emissions, load, and flue gas flow rate. The results of the sulfuric acid mist and ammonia slip stack tests will be submitted to FDEP within 45 days of completion of the tests.

A test report on the sulfuric acid mist testing will be submitted to FDEP no later than 90 days following the last test run conducted. The report will include:

- Identification of each set of operating conditions evaluated, identifying each operating parameter evaluated.
- Identification of the relative influence of each operating parameter, describing how the automated control system will adjust the sorbent injection rate based on the selected parameters.
- Identification of the frequency with which operational parameters will be reevaluated and adjusted within the automated control system.
- The algorithm used for the automated control system or a series of related performance curves will be provided.
- The details for calculating and estimating the SAM emissions rate based on the level of sorbent injection and operating conditions. The test results will be used to adjust the sorbent injection control system and estimate SAM emissions.

TABLES

TABLE 1
SORBENT INJECTION PERFORMANCE EVALUATION
MCINTOSH UNIT 3

Scenario	Unit Capacity (%)	Heat Input (MMBtu/hr)	Gross Output (MW)	Sorbent Injection Rate [a] [lb/hr $Ca(OH)_2$]	Parameters Recorded				
					Runs	SO_2	SAM	ESP Power [b]	Exhaust Flow Rate [c]
Baseline									
1	100	3,640	364	0	3	X	X	X	X
2	88	3,200	320	0	2	X	X	X	X
3	69	2,511	250	0	2	X	X	X	X
Performance									
4	100	3,640	364	238	1	X	X	X	X
5	100	3,640	364	489	1	X	X	X	X
6	100	3,640	364	1,428	1	X	X	X	X
7	88	3,200	320	209	1	X	X	X	X
8	88	3,200	320	430	1	X	X	X	X
9	88	3,200	320	1,257	1	X	X	X	X
10	69	2,511	250	164	1	X	X	X	X
11	69	2,511	250	337	1	X	X	X	X
12	69	2,511	250	985	1	X	X	X	X

Notes:

1. Sampling will be conducted per Method 8A and EPA Method 6C.
2. Fuel used during the proposed test scenarios will be 100 percent coal with no petcoke, which is the blend currently burned in Unit 3.
3. SO_2 and SAM will be recorded at 5 locations: before and after the SCR (4 points because of 2 sets of ductwork), and at the stack. SO_2 emissions at the stack will be determined using CEMS.

Purpose

1-3. Baseline.
4-6. Sorbent injection performance at 100 percent load (maximum load).
7-9. Sorbent injection performance at 88 percent load (intermediate load).
10-12. Sorbent injection performance at 69 percent load (minimum load).

[a] Sorbent injection rates shown for illustrative purposes. These rates are the expected rates based on manufacturer data for SO_3 concentrations from 10-30 ppmvd @ 3 percent O_2. Actual test conditions and manufacturer control system will dictate injection rates.

[b] Continuous manual recordings during testing.

[c] From CEMS or stack test.

TABLE 2
AMMONIA (NH3) SLIP COMPLIANCE DETERMINATION
MCINTOSH UNIT 3

Scenario	Unit Capacity (%)	Heat Input (MMBtu/hr)	Gross Output (MW)	Injection Operation Injection	Runs[1]
Compliance					
1	90-100	3276-3640	328-364	ON	1
2	90-100	3276-3640	328-364	ON	1
3	90-100	3276-3640	328-364	ON	1

Notes:

1. Sampling will be conducted per EPA conditional test method CTM-027