Section 3 - Monitoring Approach Description

Background

This section provides background information on the pollutant specific emissions unit to which the CAM Plan applies. Existing monitoring requirements and quality assurance/quality control procedures are discussed. Further, a brief description of the CAM monitoring approach has been provided under this section.

The Test and Cap approach is based on a concept from the proposed enhanced monitoring rule [58 FR 54648][3]. This approach allows a source to perform an opacity/mass correlation test where the stack outlet mass loading and opacity are simultaneously at their highest possible condition, yet both still are within their respective permit limits. In some cases, testing was conducted above the permitted limits. The testing is conducted under normal boiler operating conditions burning a typical fuel source. The stack outlet mass loading is adjusted by "detuning" the pollution control device; for example, by removing ESP fields from service or by raising or lowering ESP power input.

Particulate mass emission testing is performed over a range of emission conditions, and results are compared to a secondary trigger indicator (e.g., opacity, ESP power performance, or ESP efficiency). The test scenarios define the minimum operating condition for the ESP. A cap (or trigger level) is established by which a reasonable assurance of compliance is determined. This trigger level when exceeded would then require enactment of the plant operation procedures. Specified performance or corrective action measures would be implemented within a specified period of time to restore compliant operation. This would be indicated when indicator trigger data return to levels below the threshold or within the desired range of operation. The test and cap concept is considered by EPA to be a "presumptively acceptable" monitoring approach under CAM (see 40CFR64, 64.3(d)(3)(i)).

Monitoring Approach

General Criteria

Indicator Range (Threshold): An exceedance is defined where emissions of particulate matter exceed 0.16 lb/mmBtu, based upon any average of three one-hour stack test runs. Alternately, an excursion for **Unit 3** will be identified by an opacity percentage in excess of 25.8% based on three-hour block average data. An excursion for **Unit 4** will be identified by an opacity percentage in excess of 17.3% based on three-hour block average data. An excursion for **Unit 5** will be identified by an opacity percentage in excess of 20.7% based on three-hour block average data. The justification for the selection of the indicator threshold will be discussed in further detail in Section 4. Additionally, the alarm trigger level for **Unit 3, 4** and **5** is an opacity level in excess of 25.8%, 17.3%, and 20.7% respectively, for any hourly average.

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3 The proposed rule was published in the Federal Register on October 22, 1993. Provisions of the Enhanced Monitoring rule were challenge by industry groups. EPA amended the EM provisions to reflect the current CAM rule.

Table 10 summarizes for each unit its indicator range (threshold) and establishes general criteria for determining compliance with the applicable standards.

Table 10: General Criteria for Affected Units

Criteria	Unit 1 and 2	Unit 3	Unit 4	Unit 5
Exceedance[1]	0.07 lb/mmBtu	0.16 lb/mmBtu	0.16 lb PM/mmBtu	0.16 lb/mmBtu
Excursion[2]	Not defined	25.8% Opacity	17.3% Opacity	20.7% Opacity
ATL[3]	Not defined	25.8% Opacity	17.3% Opacity	20.7% Opacity
Opacity Limits[4]	20%	40%	40%	40%

[1] Based upon any average of three one-hour stack test runs.
[2] Based on a calculated three-hour block average of hourly opacity data.
[3] Based on a hourly average opacity data.
[4] Continuous monitoring is based on six-minute average opacity data.

Performance Criteria

The certified Continuous Opacity Monitoring System (COMS) will be used to continuously monitor opacity as a secondary indicator of PM emissions. The COMS on the affected units meet the requirements set forth under Missouri regulations 10 CSR 10-6.220, Part 75 provisions, and the initial Performance Specification 1 for installation and certification of the opacity monitoring system.

Currently, excess opacity reporting is required for all six-minute opacity average data in excess of 40% for JRPS Units 3-5. After the MACT compliance date (September 13, 2007), opacity limits for Units 1 and 2 will be 20 percent pursuant to §63.7500 and Table 8 of the rule. Excess emissions reports will be submitted to the appropriate regulatory authority as required by the standard.

City Utilities believes the COMS data provide a representative sampling of the control device's performance. Plant operation and maintenance personnel use several indicators of proper control device and related control equipment operations. However, the primary indicator for most plant personnel is the COMS result. This definitely is the most useful indicator for assessing proper operation and maintenance of the control equipment. Maintenance is routinely performed by plant personnel on the control equipment. Appropriate checks and periodic maintenance are performed in accordance with the plant's Operation and Maintenance Plan and procedures and good engineering control practices. Specific quality assurance and quality control procedures are performed to assure proper operation and certification of the continuous opacity monitoring system (COMS).

Quality assured opacity data are monitored on a continuous basis using the COMS. The quality of COMS data will continue to be scrutinized through daily calibration error checks and other periodic checks defined in the quality assurance/quality control manual. These periodic checks have been listed in Table 11, below.

Special criteria for Use of COMS

The Continuous Opacity Monitoring System (COMS) will record and store opacity data used in determining compliance with the CAM Plan provisions. Environmental Systems Corporation (ESC) is the CEMS DAS software manufacturer.

Data Collection Frequency

The Continuous Opacity Monitoring System (COMS) records data on a continuously when the boiler is operating. One-minute data, six-minute and hourly averages are recorded. One-minute data is not stored for more than two weeks. Three-hour block averages will be calculated from hourly averages recorded by the COMS. Except for periods of quality assurance (QA), the COMS should record and collect opacity data while the boiler is operating.

Description of Current Opacity Monitors

Currently, the Thermo Electron model 300 Opacity Monitor, located on all three unit stacks, utilize a laser-based technology, consisting of a straight single-pass, dual-path design. The laser is a monochromatic light source which radiates one, well-defined wavelength and provides a collimated beam for more accurate and precise results.[4]The monochromatic light source and the other design features of the opacity monitor are thoroughly discussed in the Thermo Electron Operations and Service Manual. Initial installation and certification testing were conducted with the installation of the Continuous Emission Monitoring Systems (CEMS).

James River is in the process of converting and certifying "new" Monitor Lab LightHawk 560 Opacity Monitors for all its affected units. Certification results will be provided to the MNDR upon completion of all required PS-1 tests. The Monitor Labs LightHawk 560 Opacity Monitors consists of the transceiver, reflector, air purging system and remote monitoring interface panel. Instrument alignment is verified by aligning the green LED signal in the center cross hairs on the transmitter. Calibrations are conducted internally in the transceiver and also verified with optical calibration filters. The transmissometer and the other divisions are thoroughly discussed in the Monitor Labs Technical Information Manual. Initial performance testing will be conducted in December 2005.

QA/QC Requirements

The quality of the opacity data collected for the CAM Plan will require continuous quality assurance/quality control activities be performed. The James River Power Station will continue to utilize guidelines established under the general provisions of the performance specification to Appendix B of Part 60 (PS-1) to validate quality data capture. Daily calibration error checks and periodic quality assurance activities will be

4 Monitor Labs LightHawk 560 Opacity Monitor Operations and Service Manual, release date 11/98.

followed as outlined in the plant's quality assurance/quality control manual. Table 11, indicates the type of continued periodic checks performed by plant personnel each year. The QA/QC procedures are detailed as part of the plant's Quality Assurance Plan and in some cases reference the opacity monitor operations and service manual. A calibration error check is required following any maintenance or corrective action or repair to the opacity monitor.

Table 11: Periodic Checks for Opacity Monitor

	Units 1 through 5
DAILY	Check data logger and opacity monitor controller for faults
	Stack Opacity Dirt Accumulation Check
	Daily Auto-Calibration Test
WEEKLY	Open enclosure and conduct visual inspection
	Check optical alignment by noting position of light beam image
	Inspect purge air system for leaks or damage
MONTHLY	Check/clean flange tube for dirt or build-up of particulate on both transceiver and retroreflector
	Inspect purge air system on both transceiver and retroreflector
	Inspect retroreflector lens condition and clean the glass surface, as needed
	Inspect transceiver lens condition and clean the glass surface, as needed
QUARTERLY	On Stack Checks as Written in Opacity Manufacturer's Manual
SEMI-ANNUAL	Same as Quarterly
ANNUAL	Same as Quarterly/Semi-Annual List
	Annual On-Stack Opacity Filter Calibration

Averaging Period

Continuous opacity measurements – three-hour block average opacity data. One-minute averages will be used to create one-hour opacity averages. Three one-hour averages are used to calculate a three-hour block average from which the indicator threshold level or range can be determined. The ATL is based on one-hour opacity averages as a warning indication.

Record keeping

Records of the COMS data and quality assurance and quality control activities pursuant the facility's quality assurance/quality control procedures will be maintained on-site. Records shall be maintained for a minimum period of five years.

Reporting

Current opacity reports (See applicable record keeping forms proposed in the Operating Permit renewal application) will continue to be submitted quarterly as defined by the applicable opacity standard or requirement of the plant's operating permit. On a
semi-annual basis, excursions and/or deviations from the CAM Plan will be reported to the MDNR. Exceedances of the PM limitation or standard following a required stack test or subsequent testing will be reported within ten (10) days following the receipt of the final test report indicating an exceedance.

Operational QA/QC

The ESPs located at the James River Power Station will be operated and maintained in accordance with manufacturer's recommendation. The James River Power Station will follow its O & M Plan and procedures for its applicable control device equipment to assure continuous compliance with the established emission limitation. It is not in the best interest of the utility to improperly maintain control equipment to the point of a deteriorated condition. Continued poor maintenance practices will eventually cause operational limitations and control device replacement that will cost City Utilities' ratepayers.

Current Baseline Opacity Indicator Ranges

Unit 1&2: Normal operating range of the units is between 5 - 10%. Table 12 shows the average percent opacity during the MACT testing. MACT will require continuous opacity monitoring and parametric monitoring of ESP control set points collected during the initial testing.

Unit 3: Normal operating range of the unit is between 10 - 18% opacity. Table 12 shows the average percent opacity during the baseline CAM testing as compared to the CAM indicator range (threshold)

Unit 4: Normal operating range of the unit is between 10 - 15% opacity. Table 12 shows the average percent opacity during the baseline CAM testing as compared to the CAM indicator range (threshold)

Unit 5: Normal operating range of the unit is between 5 - 10% opacity. Table 12 shows the average percent opacity during the baseline CAM testing as compared to the CAM indicator range (threshold).

Table 12: Unit Specific Baseline Opacity Values

James River Unit(s)	CAM Indicator Threshold	Average Baseline Opacity
	(Percent)	(Percent)
Unit 1&2	N/A	5.5%
Unit 3	25.8%	15.7%
Unit 4	17.3%	10.6%
Unit 5	20.7%	6.8%

Rationale and Documentation

Test results showed a relatively good correlation of opacity data to stack measured PM emission rates. This correlation was used in determining the appropriateness of the selection. The correlation between the PM mass emission and the percent opacity established a level (threshold) the plant could operate at before the CAM plan is triggered. Test data supporting this rationale and selection of the monitoring approach is provided in Section 7. A "reasonable" compliance margin has been incorporated as part of the indicator range (threshold) that establishes a safe operating condition lower than the PM limit based on the corresponding percent opacity. Table 13 shows the percent of operating time at different loads for each unit based on an historical load analysis of the 2004 and 2005[5] CEMS data. Historical load analyses show consistent results between both years.

Table 13: 2004 and 2005[1] Historical Load Analyses

Unit Load	Unit 3 Range of Operation		Unit 4 Range of Operation		Unit 5 Range of Operation	
	30 - 46 MW		40 - 65 MW		50 - 105 MW	
Year of Data	2004	2005	2004	2005	2004	2005
Low (0-30%)	33.1	41.1	24.3	22.0	17.5	15.9
Mid (30-60%)	12.5	11.1	8.0	12.1	14.3	14.4
High (60-100%)	54.4	47.5	67.8	65.9	68.3	69.7

[1] Based on calendar year.

Graphs and Tables of CAM/PM Testing

Graphs and tables supporting James River's selection of the CAM indicator and range (threshold) are provided under Table and Figures of this CAM Plan.

5 Historical Load Analysis for 2005 through November 7, 2005.

Use of Indicators and Rationale

City Utilities believes the COMS data provide a representative sampling of the control device's performance. The opacity data is a useful indicator for identifying and correcting ESP performance problems. Further, plant personnel are familiar with opacity data and the regulatory obligations for each unit. Table 14, summarizes the CAM monitoring approach for the James River Power Station.

Comments or Applicable Reference Information

Quality Improvement Plan (QIP) thresholds are not being considered at the time of the CAM Plan submission. Currently, the CAM Plan does not indicate any deficiencies in the monitoring approach selected. Further, the COMS monitoring requirements provide the specific QA/QC procedures for data collection, record keeping, and reporting appropriate for determining a "reasonable assurance" of compliance with the applicable emission limitation or standard. The COMS can provide a surrogate continuous measurement of opacity/PM corresponding to the standard's averaging period.

Table 14: Monitoring Approach Summary Table

I. Indicator	Opacity of ESP exhaust	
A. Measurement Approach	COMS located in ESP exhaust	When the three-hour average opacity of three consecutive one-hour average opacity data is outside the indicator range during normal unit operation, unit operators have three hours to get average opacity data below the indicator range.
II. Indicator Range	The opacity indicator range is a collection of all one-minute values and average over a one-hour period. The one-hour averages will be collected to calculate a three-hour block average opacity for each unit. The three-hour average opacity trigger for James River Unit 3 is greater than or equal to 25.8 percent. The three-hour average opacity trigger for James River Unit 4 is greater than or equal to 17.3 percent. The three-hour average opacity trigger for James River Unit 5 is greater than or equal to 20.7 percent.	The indicator range is a real-time measurement value of all one-minute opacity readings collected over the averaging period. The three-hour block average data is measured using an opacity monitor and stored in a polling computer used for reporting. One-hour averages used to calculate three-hour block average opacity data is collected and stored for long-term retrieval. One-minute opacity readings are stored for a period not exceeding two weeks.
III. Performance Criteria A. Data Representativeness	The COMS was installed at a representative location in the exhaust stack per 40 CFR Part 60, Appendix B, PS-1 requirements	Testing for PM emissions was performed using EPA Method 17 over a range of ESP conditions. Average opacity data was collected during the same time as the performance testing for comparison.
B. Verification of Operational Status	Results of initial and subsequent performance PM testing have been evaluated and summarized in Tables 17-25 over the history of the plant.	Results of PM versus opacity measurements were evaluated and summarized in Figures 5 and 10.
C. QA/QC Practices and Criteria	COMS installed via PS-1. Daily Zero and Span drift checks are performed. Annual filter audits are performed.	Filters are calibrated and certified annually.
D. Monitoring Frequency	The opacity of the ESP is monitored continuously (instantaneously) will calculate one-minute averages. All one-minute averages are used to calculate and store one-hour opacity data, except for periods of quality assurance. One-hour opacity averages will be used to calculate the three-hour block average used as the monitoring indicator.	The CAM Plan is triggered when the three-hour block average of opacity data is outside the indicator range. Following the trigger level the unit operator has three hours to get the three-hour block average below the indicator range. If after the three hours the opacity average is outside the indicator range the plant's O&M plan will be implement. The plant will follow the reporting requirements for deviation reporting within semi-annual report. Excursions will be reported within the semi-annual report.
E. Data Collection Procedures	The DAHS retains all six-minute, hourly, and three-hour average opacity data.	All records of data collected are retained for a maximum period of five years.
F. Averaging period	The ten (10)-second opacity data is used to calculate one-minute averages. The one-minute data is used to calculate the one-hour average opacity, which is used to create a three-hour block average of opacity.	None

Section 4 - Monitoring Approach Justification

Historical Background

Historical Compliance Testing

Unit 1
Previous testing for Unit 1 was conducted on November 3, 1980. Test results indicated compliance with the applicable 0.16 lb/mmBtu emission limit. The results indicated an average emission rate of 0.05 lb/mmBtu particulate matter emitted at based load.

Unit 2
Previous testing for Unit 2 was conducted on October 6, 1981. Test results indicated compliance with the applicable 0.16 lb/mmBtu emission limit. The results indicated an average emission rate of 0.04 lb/mmBtu particulate matter emitted at based load.

Unit 3
Previous testing for Unit 3 was conducted on February 27, 1979. Test results indicated compliance with the applicable 0.16 lb/mmBtu emission limit. The results indicated an average emission rate of 0.02 lb/mmBtu particulate matter emitted at based load.

Unit 4
Previous testing for Unit 4 was conducted on October 6, 1976. Test results indicated compliance with the applicable 0.16 lb/mmBtu emission limit. The results indicated an average emission rate of 0.10 lb/mmBtu particulate matter emitted at based load.

Unit 5
Previous testing for Unit 5 was conducted in July 1994. Test results indicated compliance with the applicable 0.16 lb/mmBtu emission limit. The results indicated an average emission rate of 0.03 lb/mmBtu particulate matter emitted at based load.

Rationale for Selection of Performance Indicators

Monitoring Approach and Indicator

The selection of a Test and Cap monitoring approach and the use of the COMS (opacity) as the indicator provided an *indirect* but continuous method for assessment of compliance with the PM emission limitation for each affected unit. City Utilities believes this to be the most practical means of continuous monitoring to assure compliance with the applicable PM limitation. The source has provided initial (most recent) PM emission test information to provide a direct means for its compliance evaluation. The monitoring approach is supported by an Operation and Maintenance Plan that assures the equipment is being properly operated and maintained in a manner consistent with continued compliance of the affected units.

The indicator range (threshold) selected for Units 3, 4, and 5 were determined by a PM mass emission and opacity percent correlation of test data. Testing was conducted over a period of three weeks at several ESP conditions for each unit. Results are tabulated and graphed in Section 6: Test Results Summary. A detailed description of the CAM Test Plan is outlined in Section 5.

The average test data for each ESP condition for Unit 3 shows substantial compliance with the standard at opacity percent levels of ~30% or less. The indicator range (threshold) selected for James River Unit 3 was 25.8%, which corresponds to a limitation within 90% of the PM standard. A "reasonable assurance" of compliance can be maintained at the threshold level selected. Unit 3 test results showed exceedance of the standard at 29% opacity.

The average test data for each ESP condition for Unit 4 shows substantial compliance with the standard at opacity percent levels of ~20% or less. The indicator range (threshold) selected for James River Unit 4 was 17.3%, which corresponds to a limitation within 90% of the PM standard. A "reasonable assurance" of compliance can be maintained at the threshold level selected. Unit 4 test results showed exceedance of the standard at 19% opacity.

The average test data for each ESP condition for Unit 5 shows substantial compliance with the standard at opacity percent levels of ~25% or less. The indicator range (threshold) selected for James River Unit 5 was 20.7%, which corresponds to a limitation within 90% of the PM standard. A "reasonable assurance" of compliance can be maintained at the threshold level selected. Unit 5 test results showed exceedance of the standard at 23% opacity.

Confidence in COMS Data Used to Assure Compliance with a PM Standard

An excellent correlation of the test data points can be seen through the graphs shown in Figures 5 through 10, provided as part of this CAM Plan (see Section 6). The confidence coefficient for Unit 3 obtained from each condition is 0.9945. Unit 3's test points and average data for the different test conditions were consistent and reproducible when compared with one another and the original baseline historical testing conducted by the plant. The confidence coefficient for Unit 4 opacity test results is 0.9346.Unit 4's test points and average data for the different test conditions were consistent and reproducible when compared with one another for most test runs. Maintaining steady and consistent ESP control during a few "detuned" test runs may have impacted the results. Certain outliers were identified (Runs 1 and 13) and not included as part of the correlation curve. Unit 5's confidence coefficient is 0.9873.

Section 5 – CAM Test Plan

Test Procedure Summary

The Test and Cap monitoring approach utilizes opacity either as a primary or secondary indicator of compliance. As a result, the main objective of the testing was to determine the opacity/mass relationship for Units 3, 4 and 5. The following describes the general approach that was used for CAM testing at James River.

In order to determine the opacity/mass relationships, particulate testing was conducted on each unit at the stack outlet under multiple test conditions. An initial, baseline test was conducted to determine the particulate mass loading during normal boiler and ESP operation. Additional tests were conducted on each unit at varying degrees of particulate mass emissions by removing power from the ESP ("de-tuning"). Three "de-tuned" test conditions were conducted on all three units during the scheduled CAM testing. Additional runs were performed on specific units as required. One of the "de-tuned" conditions was a "high-level" test where the opacity was near or exceeded the permit limit.[6] The other test conditions were "mid-level" test, with the opacity between the high-level test and the normal operating opacity. Stack opacity, ESP operating data, and various boiler operating data was collected simultaneously with each test and for each "de-tuned" condition.

Request CAM Test Exemption

Since each unit was tested at elevated opacity levels, excess opacity emissions occurred during testing. This was particularly true of the high-level tests where ESP plate rapping caused significant spikes in opacity. City Utilities requested and was granted an exemption from the Missouri Department of Natural Resources (MDNR) for any excess opacity emissions that resulted from the CAM test program. An e-mail communication granting City Utilities request was given by the MDNR. [7]

TEST SCHEDULE

CAM testing was conducted May 10 through 27, 2005. Three to four test conditions were sampled for each unit over the three week period. At each condition, sampling data was collected for three one-hour test runs. Table 15 summarizes the test schedule as performed:

6 This statement assumes that the particulate mass emissions will be at or below the limit while at the opacity limit.

7 See e-mail correspondence from Peter Yronwode enclosed with the CAM documentation.

Table 15: CAM Test Schedule

Date	Description of Schedule or Events
Wednesday, May 11, 2005	Equipment Setup & Preliminary Testing Unit 4
Thursday, May 12, 2005	Pre-test Meeting/ESP Baseline and "De-tuned" Condition 1 and 2
Friday, May 13, 2005	"De-tuned" Conditions 3 and 4
Monday, May 16, 2005	Equipment Setup & Preliminary Testing Unit 3. ESP Baseline and "De-tuned" Condition 1
Tuesday, May 17, 2005	"De-tuned" Conditions 2 and 3
Thursday, May 19, 2005	Additional testing on Unit 4
Monday, May 23, 2005	Equipment Setup & Preliminary Testing Unit 5. ESP Baseline and "De-tuned" Condition 1
Tuesday, May 24, 2005	"De-tuned" Conditions 2 and 3
Wednesday, May 25, 2005	Additional testing on Unit 5

Two test conditions were performed each day. Testing was performed by Catalyst Air Management from Knoxville, Tennessee. The testing schedule beyond the first two days depended on the number of tests that would be performed. A total of two to three days of testing per unit were required for the development of this CAM Plan.

Initially, Catalyst setup its equipment on Unit 4 stack on Monday and Tuesday preceding the start of the first day of testing. The other units would follow along the same schedule for each consecutive week. The stack test crew would have all their equipment setup and have completed any preliminary testing (i.e. stratification testing) so that they were ready to begin testing Tuesday morning. A brief, pre-test meeting was conducted Tuesday morning. The meeting included the stack test crew project manager, City Utilities plant personnel and City Utilities personnel from Government Relations/Environmental Affairs. The purpose of the meeting was to answer any questions that may arise and make sure all affected parties are aware of the test format and their specific roles during the testing. Discussion of appropriate plant operational and ESP parametric data collection was included.

Testing started on Wednesday immediately following morning discussions. For the remainder of the week, testing began each day at 8:00 A.M., barring any operational difficulties. Testing lasted 10-12 hours each day. Additional runs were required to address operational upsets or questionable test results. For the de-tuned test conditions, preliminary ESP setup was not needed after the prior day's testing was completed. Because of the inertial effect of large changes in power, ESP power levels the following morning can sometimes be significantly different than the preliminary setup. As a result, delays to the start of testing for each de-tuned test condition were experienced, to make necessary adjustments to the ESP in order to achieve the desired test condition.

BOILER OPERATION

Each test was conducted with the boiler operated at normal, full load conditions (or as possible based on daily ambient conditions and coal delivery variations). Full operating load will generate the highest level of particulate mass emissions and produce conservative indicator ranges under any of the CAM monitoring approaches. Furthermore, full load is the normal operating condition for each unit's boiler at James River. To the extent practicable, unit load was operated at normal, full load for at least two hours prior to the start of testing each morning. This allowed the boiler and ESP to achieve steady-state conditions prior to testing.

Unit load, air flow, fuel flow, excess air, steam temperatures, etc. were maintained as steady as possible during the entire test period. Since testing was conducted for each unit on multiple days, it was important that boiler operation and load be as similar as possible between each test. This helped to ensure the development of an accurate opacity/mass relationship, which is the ultimate goal of the testing. Air heater blowing was not conducted during the test period. If necessary, air heater blowing was conducted between test runs. Normal soot blowing was discontinued during the testing. Any boiler-related problems that developed during the testing were noted as part of each test condition.

ESP OPERATION

The CAM testing at James River reflected normal operation of both the boiler and the ESPs. As a result, testing was conducted using the existing ESP voltage controller settings, rapper configuration and cycle times, and ash handling operation, except as noted below for the de-tuned test conditions. To the extent practicable, gas temperature and flow remained steady throughout the testing. Slight changes in inlet gas temperature or flow distribution can have significant effects on ESP operation. Testing was conducted under normal operating conditions to the extent possible.

DE-TUNED TEST CONDITIONS

The unit was tested at multiple conditions of reduced ESP performance. The purpose of the tests was to develop the opacity/mass relationship by simulating a partial ESP "failure," in order to demonstrate the level of reduced performance where the permit limits can still reasonably be expected to be met. The most common types of ESP failure (or causes of reduced performance) are either grounded fields or close clearances. In order to simulate these conditions, the ESP was "de-tuned" by reducing and/or eliminating power to various portions of the precipitator. This effectively increased the particulate mass loading and opacity at the exit of the precipitator.

The test program included three to four de-tuned test conditions. The ESP de-tuned test points were conducted at opacity levels of 16, 21, 30, and 40 percent for Unit 3, 11, 20, 24, 27, and 42 for Unit 4, and 7, 22, 25, and 29 for Unit 5.

As a general approach in setting up the ESPs for the high-level test, fields and power were removed to achieve an operating opacity that was close the desired test condition. Additional ESP power was then removed, as necessary, to "fine-tune" the emissions to the desired test condition. The reverse procedure was used for the mid-level test, where certain fields were placed back into service and power levels increased. The procedure was conducted incrementally, as it took some time for the fields downstream of the de-powered section to adjust to the increased dust loading.

ESP operating conditions were established (i.e. adjust power levels) prior to conducting testing at each test condition. ESP setup was performed each morning/afternoon after the successful completion of the previous test condition. Infrequently, additional adjustments were required prior to testing, depending on where the ESP "settled out" prior to the next test condition.

STACK TESTING METHODS AND ON-SITE ANALYSIS

Filterable-only particulate mass emissions were measured at the existing stack sampling location using EPA Reference Method 17. Alternatively, Reference Method 5 could have been used instead of Method 17. However, it was believed that in-stack filter measurements are more accurate and less likely for stack tester error. Prior approval was given by the MDNR to use the alternate test method, since only a reasonable assurance of compliance was required.

Catalyst had the capability of performing preliminary, on-site analysis of the particulate sample after each run. This preliminary data was analyzed by City Utilities personnel to determine subsequent testing (de-tuned) conditions.

DATA COLLECTION REQUIREMENTS

Various coal, ash, boiler and ESP operating data was collected during each test. This data will be used to evaluate operations stability, if required.

Boiler and ESP operating data were collected continuously during each test. However, selected data was manually recorded by City Utilities plant personnel. ESP data included primary and secondary voltages and currents, and spark rate, and in some cases total power. CEMS data included a standard emissions report indicating stack temperature, gross load, and opacity. At a minimum, all data was collected at least every hour. The following is a list of the specific boiler and ESP data collected.

Table 16: Unit, Stack, and ESP Data Collected

Unit Data	Stack (CEMS) Data	ESP Data (each TR Set)
Gross Unit Load	Opacity	Primary Voltage
Total Air Flow	Stack Flow	Primary Current
Total Fuel Flow	Stack NO_x	Secondary Voltage (if available)
Total Steam Flow	Stack SO_2	Secondary Current
Excess O_2	Stack CO_2	Spark Rate
SH Temperature	Stack Temperature	
RH Temperature		
SH Spray		
RH Spray		
AH Gas Out Temperature		

Coal and fly ash samples were taken each test day. A representative fly ash sample was taken during the course of the testing by plant personnel at a consistent/representative location. The samples were collected by the plant and placed in labeled, sealed containers, which will be retained until it is determined whether analysis is required.