ELECTRIC POWER RESEARCH INSTITUTE

ENVIRONMENTAL CONTROL TECHNOLOGY CENTER

REPORT TO THE STEERING COMMITTEE

Monthly Technical Progress Report

US/DOE Patent Clearance is not Required
Prior to the Publication of this Document

November 1996

Prepared by:

EPRI/ECTC
Radian International
Parsons Power

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EXECUTIVE SUMMARY

General Operations

Operations and maintenance continued this month at the Electric Power Research Institute's (EPRI's) Environmental Control Technology Center (ECTC). Testing for the month involved the EPRI Integrated SO_x/NO_x removal process, the DOE PRDA testing of the B&W/Condensing Heat Exchanger (CHX), and support for the Semi-Continuous On-line Mercury Analyzer.

The test configuration utilized in the EPRI Integrated SO_x/NO_x removal process included the 4.0 MW Spray Dryer Absorber (SDA), the Pulse-Jet Fabric Filter (PJFF), and a new Selective Catalytic Reduction (SCR) reactor installed at the ECTC. During this testing, O&M support was also required to conclude the test efforts under the EPRI Hazardous Air Pollutant (HAP) test block. This included the on-site development efforts for the Semi-Continuous On-line Mercury Analyzer.

In the DOE PRDA project with the B&W/Condensing Heat Exchanger (CHX), the effects of the increased particulate loading to the unit were monitored throughout the month. Also, the 1.0 MW Cold-Side Selective Catalytic Reduction (SCR) unit and the 4.0 MW Pilot Wet Scrubber remained idle this month in a cold-standby mode and were inspected regularly.

Pilot Testing Highlights

The testing conducted in November concentrated on the SO_x/NO_x test block. The SO_x/NO_x test block focuses on a proprietary EPRI process which combines alkali injection with low temperature selective catalytic reduction (SCR). Because these test results are proprietary, only limited information about testing in November is provided in this report.

Testing of the SO_x/NO_x concept began during the winter of 1991-1992. A bench-scale system was assembled at EPRI's ECTC using available equipment to minimize costs. A flue gas slipstream was pulled from the ECTC facility inlet duct. A bench-scale particulate removal device was used to test alkali injection. Downstream of the particulate removal device, a smaller slipstream was withdrawn from the gas treated with alkali injection and sent to an SCR reactor. The system was equipped with various CEMs to collect SO_x/NO_x removal data.

Three different batches of catalyst were tested using the above system during February/March 1992, September 1992, and August/September 1993. Some of the test results were encouraging; however, several problems limited the testing. First, alkali injection could never be consistently maintained due to the small injection rate. Second, measurement of flue gas NO_x concentrations was not always reliable, and questions about the accuracy of these measurements limited the usefulness of the results.

The objective of the SO_x / NO_x test block started in November 1996 is to improve on the problems faced previously and collect data which will allow the performance of the SO_x / NO_x process to be evaluated. To maintain a more consistent alkali injection rate, the pilot-scale pulse-jet fabric filter was used. A slipstream was then withdrawn downstream of the PJFF and sent through a larger SCR reactor. Special focus was also placed on fully evaluating the measurement capabilities to minimize measurement problems and obtain accurate SO_x / NO_x removal data.

FACILITY STATUS

General

The NYSEG Kintigh Station provided flue gas to the Center 100% of the time during this performance period. As the Kintigh Station operated with a variety of coals, fluctuations in the Center's inlet SO_2 concentrations were experienced.

Safety training for the month was conducted by the Operations Manager, Maintenance Supervisor and Shift Supervisors. A safety video discussing the prevention of back injuries was reviewed. Also, training videos discussing safe welding techniques and the proper handling of compressed gas bottles were viewed. Inspections of the ECTC Facility and safety equipment (SCR air-packs, fire extinguishers, etc.) were completed and recorded this month. All systems were found to be in good condition. By continuing to emphasize safe work habits at the Center, we have raised the total number of days without a lost time injury to 1640 as of 11/30/96. The monthly safety meeting with the NYSEG Kintigh Station was held on November 26, 1996 with both NYSEG and ECTC representatives. The topics of discussion involved the monthly needs for shared safety training material and the 1997 schedule for training activities at the Kintigh Station.

EPRI Integrated SO_x/NO_x Project

The equivalent and actual availabilities for the ECTC SO_x/NO_x test configuration this month were both 84% during this period. The System did not operate during the following periods this month:

- November 8 through 11 for 71 hrs. due to PJFF bag inspection and replacement.
- November 20 through 21 for 25 hrs. due to PJFF bag inspection and replacement.
- November 30 for 7 hours due to CHX outlet duct cleaning.
- November 30 for 17 hours due to PJFF damper repairs.

The SO_x/NO_x test block was initiated this month with the completion of the following tests: SN-1; SN-3; SN-4; SN-5; SN-6; SN-7; SN-9; SN-11; SN-12; and SN-13. The objectives of these tests were to conduct baseline measurements for SO_3 across the system (using controlled condensation sampling), and to trend the gas effects on several measured (CEM) species (O_2, SO_2, NO_2, No_x). Additionally, temperature and pressure effects across the test configuration and the SCR reactor were characterized. The operational parameters for the System during this test block included: a flue gas flow of 4,000 scfm; inlet SO_2 concentrations of 2,000 ppm; and PJFF outlet temperatures of 250˚F through 325˚F.

The following maintenance work was completed on the EPRI Integrated SO_x/NO_x test configuration during this performance period:

- Six (6) PJFF filter bags were replaced on November 11th.

- Upon further inspection of the PJFF, eight (8) additional filter bags were found to be damaged. On November 20, it was decided that the remaining 39 filter bags should be replaced due to reoccurring bag failures and the upcoming winter season. A total of 47 filter bags were replaced during this outage.
- Several modifications were made to the flue gas flow distribution plates.
- Several pressure surveys were completed across the System as modifications were made to the SCR reactor.
- A containment hood was installed around the SCR inlet flow damper to reduce flue gas leakage into the SCR reactor work area.

Semi-Continuous Mercury Monitor Development

Recall that as part of the HAP test block in October 1996, a semi-continuous mercury monitor was delivered to the ECTC for field testing. This prototype analyzer was designed by Radian/Austin under EPRI (HAP) testing and was based on their successful laboratory on-line analyzer which monitors and provides hourly data for elemental, total, and oxidized forms of mercury. The goal of the project work at the ECTC has been to determine the field unit agreement with manual gas sampling Method 29T, and to support the operation and maintenance of the unit throughout the ECTC test program.

Continued O&M support was required this month to conclude the EPRI Hazardous Air Pollutant (HAP) testing involving the Semi-Continuous On-line Mercury Analyzer. During testing of the system this month, elemental mercury was injected (spiked) into the ECTC flue gas prior to the PJFF as gas sampling for elemental, oxidized, and/or total mercury was then conducted at the PJFF outlet (using the analyzer and Method 29T for comparison).

The following maintenance work was completed on the Semi-Continuous Mercury Analyzer during this performance period:

- Several components within the analyzer required I&C support and maintenance as they were modified or replaced during troubleshooting of the unit.

B&W/Condensing Heat Exchanger (CHX) Project

Operations and testing across the CHX unit for the DOE/PRDA program continued this month. The control system for the inlet flue gas flow damper (installed September 1996) continues to allow the inlet particulate mass loading to the unit to be maintained at an average value of 0.2 lb./MMBtu.

During testing this month, 3 wash samples (1L each) from the heat exchanger were collected on November 7 at discrete periods within the wash cycle (beginning, middle, and end). These samples were forwarded to B&W for analysis. Also, an increase in the operating pressure of CHX system was noted this month (November 30) which indicated a gas flow restriction in the outlet ductwork. Upon inspection

of the CHX outlet ductwork, an accumulation of ash build-up was removed, and the system was returned to service.

The following maintenance work was completed on the B&W/Condensing Heat Exchanger (CHX) project during this performance period:

- The CHX system was removed from service on November 30 to inspect and clean the outlet duct.

Miscellaneous Systems

The following general maintenance work was completed at the ECTC during this performance period:

- Damper 27 (DMP-27) continues to be operated manually until repairs can be scheduled during the December 1996 outage.
- The ECTC process wastewater sump heater was replaced in preparation for the upcoming winter season.
- The Pilot Wet FGD system was inspected and a work list was prepared to complete modifications to the system to begin DOE/PRDA testing of a Clear Liquor Scrubbing (CLS) process in January 1997.

Financial Report

The Financial Report for the four Operations and Maintenance contract tasks are summarized below for the month of November 1996, the year to date, and the contract total. All expenses reported below are expressed in terms of U. S. currency dollars.

Task Definitions:

Task 100: Operations and Maintenance Labor
Task 200: Purchased Materials
Task 300: Engineering Support
Task 400: Training

Table i.

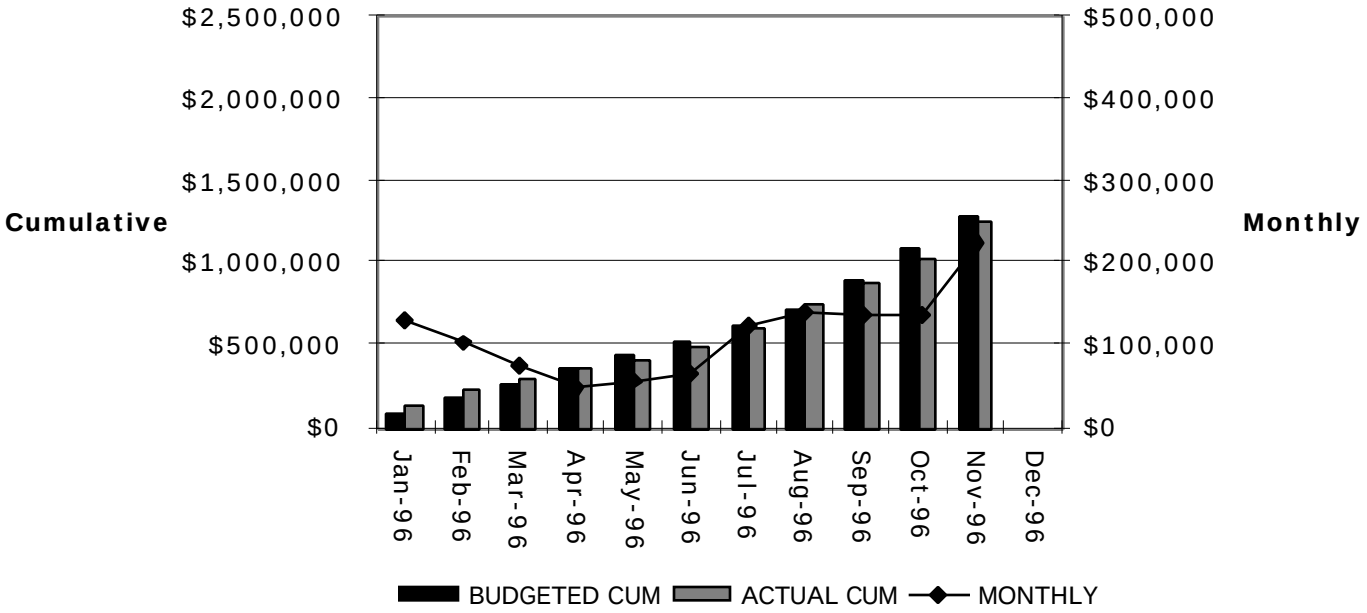
Monthly Operating Costs by Task

	November	Year to Date	Contract Total
Task 100	$ 94,057	$ 743,603	$ 14,415,070
Task 200	$ 125,540	$ 345,075	$ 8,316,199
Task 300	$ 7,248	$ 46,481	$ 1,185,384
Task 400	$ -------	$ 1,500	$ 53,175
DOE Grant	$ -------	$ 116,176	$ 116,176
TOTAL	$ 226,845	$ 1,252,835	$ 24,086,004

The attached graph illustrates the budgeted and actual expenses for ECTC O&M activities through November 1996.

Figure i.

1996 Operation & Maintenance Costs



PILOT AND MINI-PILOT TEST ACTIVITY

Testing Overview

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The objective of the SO_x/NO_x test block started in November 1996 is to improve on the problems faced previously and collect data which will allow the performance of the SO_x/NO_x process to be evaluated. To maintain a more consistent alkali injection rate, the pilot-scale pulse-jet fabric filter was used. A slipstream was then withdrawn downstream of the PJFF and sent through a larger SCR reactor. Special focus was also placed on fully evaluating the measurement capabilities to minimize measurement problems and obtain accurate SO_x/NO_x removal data.

Summary of Operations

The following section summarizes the operation of the pilot equipment used during SO_x/NO_x testing.

Pulse Jet Fabric Filter Performance

In June, all of the bags in the pulse jet fabric filter were replaced with PTFE coated fiberglass bags that were both temperature and acid resistant over the range of conditions tested during the Hazardous Air Pollutants (HAPs) test block. Thirteen bags were replaced from June until the end of the HAPs test block in October. Visolite was added to the pulse jet inlet on October 29 to check the unit for bag or cap leaks. One bag was replaced.

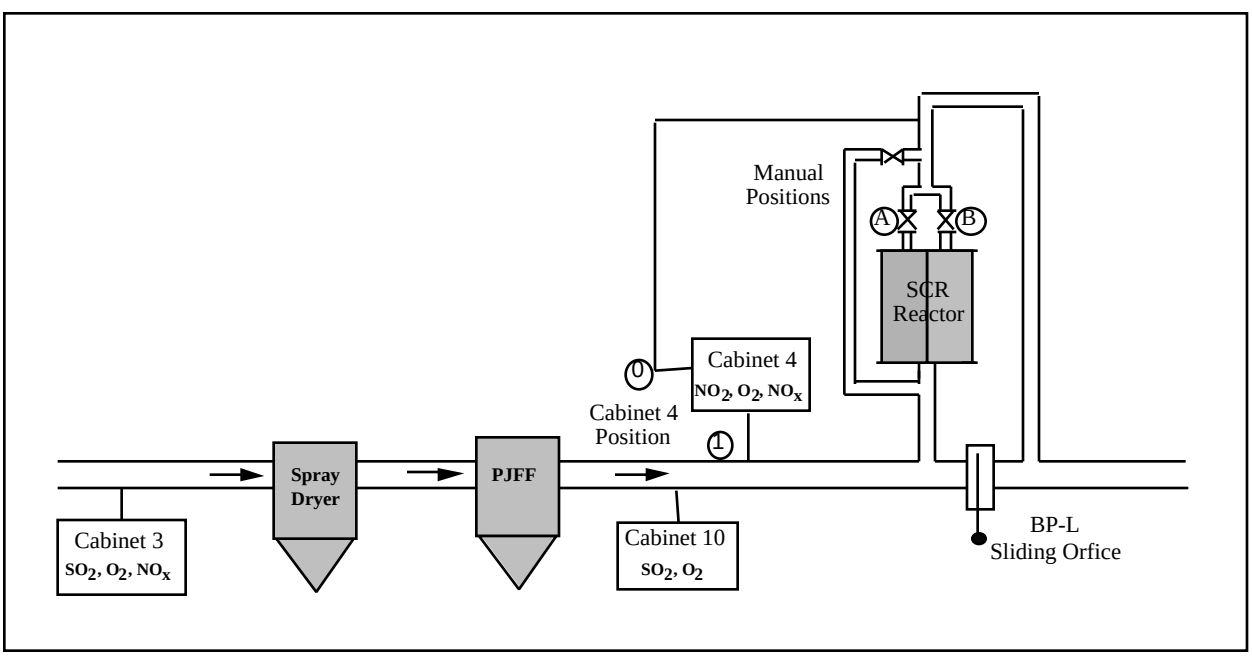
After pulling gas through the SCR system for 24 hours, the perforated plate located at the SCR reactor outlet (used to hold the catalyst in place) was removed and inspected on November 7. A large amount of flyash had deposited on the plate, and a subsequent gas sample showed a 0.141 lb/MMBtu mass loading at the PJFF outlet. After gas sampling on November 8, visolite was added to the pulse jet inlet, and leaks were discovered on six bags. The bags were replaced on November 11.

By November 12, the mass loading after the pulse jet was measured at 0.043 lb/MMBtu. Measurements on November 15, 18, and 19 showed mass loadings of 0.073-, 0.063-, and 0.130-lb/MMBtu. A visolite test on November 19 showed that eight bags had failed; at that point, all remaining bags were replaced to avoid future leaks during the test block. After changing out the remaining 47 bags, the PJFF outlet mass loading dropped to 0.015 lb/MMBtu. The bag failures are believed to be caused from mechanical wear during the heavy cleaning cycles used in the HAPs test block.

Continuous Emissions Monitors

Figure 1 shows the complicated continuous emissions monitor (CEM) configuration used during the SO_x/NO_x test block. Three CEM cabinets were used during the test block. Cabinet #3 measured SO_2 and O_2 using a DuPont analyzer as well as NO and total NO_x using a TECO analyzer at the spray dryer inlet. Cabinet #10 measured SO_2 and O_2 using a DuPont analyzer at the pulse jet outlet.

Figure 1. CEM Cabinet Configuration



Initially, cabinet #4 had the ability to sample gas at either the pulse jet outlet location or the reactor outlet location. After some modifications, this cabinet could also sample gas from the reactor inlet location. Cabinet #4 measured NO_2 and O_2 using a DuPont analyzer and NO and total NO_x using a TECO analyzer. Both the

TECO NOx analyzers and the DuPont NO_2 analyzer were brought on-line on November 14. Since two catalysts were tested (reactors A and B), the reactor outlet location could be manually switched to sample either reactor A outlet gas or reactor B outlet gas.

Reactor Orifice Flow Calibration

Gas flow to the SCR reactor was measured using an orifice plate and determined using the following equation:

$$\text{Gas flow (scfm)} = 94.9\,[DP\,(13.6\,P_b + P_s)\,/\,T]^{1/2}$$

where ΔP is the orifice pressure drop in inches of water; P_b is the barometric pressure in inches of mercury; P_s is the static pressure upstream of the orifice in inches of water; and T is the absolute temperature at the orifice in degrees Rankine. To check the accuracy of the orifice equation, a dilution method was used by injecting SO_2 span gas (2180 ppm) at a fixed flow rate into an air stream passing through the orifice. The diluted SO_2 concentration measured at the orifice outlet was used to estimate the gas rate through the orifice. The first calibration of the orifice plate was completed on November 11. Later, a thermocouple was found to be in error, and the calibration was repeated on November 13 with a new thermocouple. Results from these calibrations are presented in Table 1. The gas flow rate measured using the orifice agreed to within 10% of that measured using the dilution method over the range of 85 to 135 scfm.

Table 1. Reactor Gas Flow Orfice Calibration

Sample #:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Date:	11-Nov	11-Nov	11-Nov	11-Nov	11-Nov	13-Nov	13-Nov	13-Nov	13-Nov	13-Nov	13-Nov
Barometric Pressure (in. Hg):	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8
Reactor Inlet Temp. (°F):	280.0	278.2	284.9	281.8	283.8	285.0	288.2	283.0	283.0	285.2	281.4
Flow Orifice ΔP (in. H_2O):	2.6	2.1	1.5	1.1	1.5	2.2	3.5	3.0	2.5	2.0	1.5
Inlet Static Pressure (in. H_2O):	13.1	12.2	9.4	9.0	9.4	12.2	16.9	14.2	13.1	11.3	9.4
Orifice Air Flow Rate (scfm):	**115.1**	**103.4**	**86.7**	**72.7**	**86.8**	**105.4**	**133.4**	**123.5**	**112.6**	**100.3**	**86.9**
Overall Apparatus ΔP (in. H_2O):	-	-	-	-	-	9.9	13.8	12.1	10.7	9.1	6.8
Blanking Plate ΔP (in. H_2O):	-	-	-	-	-	24.4	23.5	23.3	23.4	24.1	24
Perforated Plate A ΔP (in. H_2O):	-	-	-	-	-	3.1	4.5	3.4	3.2	2.8	2.2
Perforated Plate B ΔP (in. H_2O):	-	-	-	-	-	2.5	3.6	3.1	2.9	2.5	1.9
Dry Gas Meter Rate (sec/0.5 scf):	31.84	31.35	31.08	31.00	31.13	31.50	31.78	31.36	31.62	31.44	31.36
2180 ppm SO_2 Gas Flow Rate (scfm):	0.94	0.96	0.97	0.97	0.96	0.95	0.94	0.96	0.95	0.95	0.96
Measured SO_2 (% span):	18.0	18.5	22.1	27.2	23.9	18.7	15.2	17.5	19.3	21.5	23.0
SO_2 Concentration (ppm):	18.4	18.9	22.5	27.7	24.4	19.1	15.5	17.9	19.7	21.9	23.5
Dilution Air Flow Rate (scfm):	**110.9**	**109.6**	**92.4**	**75.1**	**85.2**	**107.9**	**131.8**	**115.9**	**104.1**	**93.9**	**87.9**
Difference (%):	**3.7**	**-5.6**	**-6.1**	**-3.2**	**1.8**	**-2.3**	**1.2**	**6.6**	**8.1**	**6.9**	**-1.2**

Summary of Results

Most of the SO_x / NO_x testing in November involved controlled condensation gas sampling to measure sulfuric acid mist (SO_3) concentrations upstream of the SCR reactor. The potential for SO_3 condensation or ammonium sulfate salt formation in the catalyst is affected by the SO_3 concentration in the inlet gas to the SCR reactor. Therefore, the effect of alkali injection on the inlet SO_3 concentration was determined.

Controlled Condensation Sampling

The controlled condensation gas sampling method was used to measure the flue gas SO_3 concentration upstream of the SCR reactor both with and without alkali injection. This method pulls flue gas through a temperature controlled coil. The coil temperature is maintained below the SO_3 condensation temperature and above the water condensation temperature. After sampling a known volume of gas, the coil is rinsed with water, and the rinse is analyzed for total sulfate. During some samples, gas exiting the controlled condensation coil was passed through nitric acid / peroxide impingers. In addition to analyzing the coil rinse for total sulfate, the nitric acid / peroxide impingers were analyzed for total sulfate to determine the flue gas SO_2 concentration. The SO_2 measurements were compared to simultaneous CEM measurements.

Results from all of the SO_3 and SO_2 samples taken in November are presented in Table 2. During test SN-1, no alkali was injected, and the PJFF inlet SO_2 concentration was maintained at 1600 ppm. Several controlled condensation samples were collected during this test. The SO_3 concentration varied from 5 to 15 ppmd with an average value of 9 ppmd.

Table 2. Flue Gas SO_3 and SO_2 Concentrations

Test ID	Date	Sample ID	Moisture (%)	Gas Volume (dscf)	Sample Weight Water (g)	Sample Weight HNO_3/H_2O_2 (g)	Sulfate Analysis Water (mM)	Sulfate Analysis HNO_3/H_2O_2 (mM)	Gas Sample SO_2 (ppm dry)	Gas Sample SO_2 (ppm dry)	Gas Sample SO_2 (ppm wet)	CEM SO_2 (ppm wet)	SO_2 Difference (%)
SN-1	Wed, 11/6	X001	8.00	8.175	51.7	-	2.8	-	15	-	-	-	-
SN-1	Thu, 11/7	X002	8.00	6.580	58.5	-	1.5	-	11	-	-	-	-
SN-1	Thu, 11/7	X003	8.00	6.406	94.2	-	1.0	-	12	-	-	-	-
SN-1	Thu, 11/7	X004	8.00	6.084	45.0	-	2.0	-	12	-	-	-	-
SN-1	Thu, 11/7	X005	8.00	5.027	68.2	-	1.3	-	15	-	-	-	-
SN-1	Fri, 11/8	X006	7.00	8.668	30.2	290.2	3.5	59.6	10	1669	1552	1550	0
SN-1	Fri, 11/8	X007	7.00	7.281	26.9	280.0	2.9	54.6	9	1757	1634	1550	5
SN-1	Fri, 11/8	X008	7.00	8.415	32.8	309.8	2.7	57.0	9	1756	1633	1600	2
SN-1	Fri, 11/8	X009	7.00	8.297	42.0	300.1	2.5	56.4	11	1707	1587	1550	2
SN-1	Tue, 11/12	X010	6.50	7.518	47.9	302.2	0.9	53.8	5	1809	1692	1700	0
SN-1	Tue, 11/12	X011	6.50	7.357	29.1	302.6	1.9	49.8	6	1714	1602	1700	-6
SN-1	Tue, 11/12	X012	6.50	7.365	39.8	281.6	1.6	57.2	7	1830	1711	1700	1
SN-1	Thu, 11/14	X013	6.50	7.036	57.9	304.4	1.1	46.6	8	1687	1577	1625	-3
SN-1	Thu, 11/14	X014	6.50	7.712	62.7	305.1	1.3	51.0	9	1688	1578	1600	-1
SN-1	Thu, 11/14	X015	6.50	8.760	63.6	273.0	1.8	58.6	11	1528	1428	1625	-12
SN-3	Tue, 11/19	X016	6.50	35.573	69.1	-	0.062	-	0.101	-	-	-	-
SN-3	Tue, 11/19	X017	6.50	21.690	76.2	-	0.000	-	0.000	-	-	-	-
SN-9	Tue, 11/26	X018	6.50	41.804	56.2	-	0.005	-	0.006	-	-	-	-

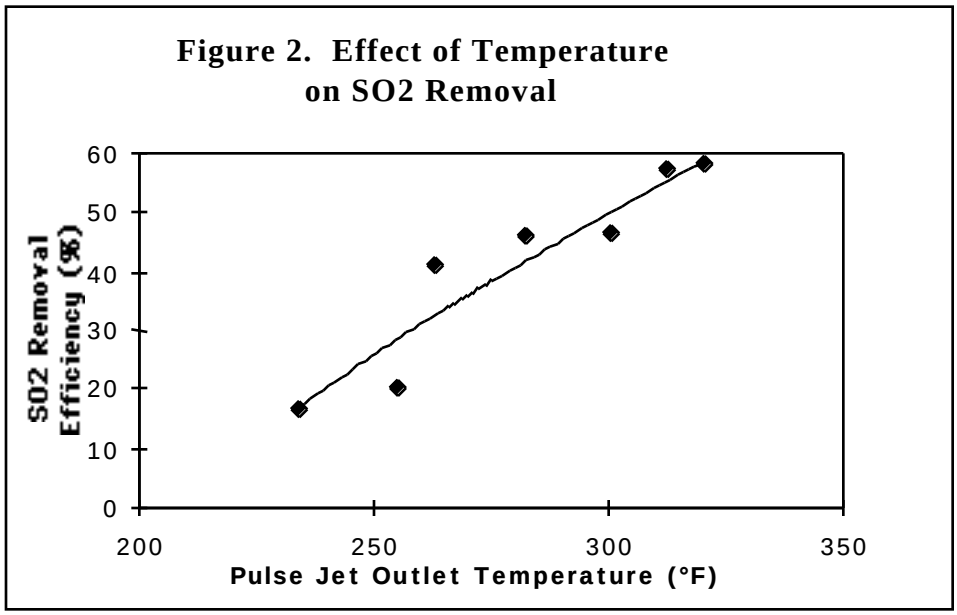
In addition to determining the SO_3 concentration, the flue gas SO_2 concentration was measured several times and compared to the CEM measurement. Initially, results from the first few samples compared very poorly with the CEM measurements, showing almost 30% more SO_2 in the gas than the CEM measurement. Therefore, additional samples were collected while trying to determine the source of the difference in measurement methods. Eventually, the analytical method was modified to incorporate the use of sulfuric acid standards instead of sodium sulfate standards. After changing the standards, the SO_2 concentration measured manually generally agreed to within 5% of that measured by the CEM. The analytical measurements were later verified in Austin using a different IC with a different column.

On November 18, the alkali injection system was started to begin test SN-3. On November 19, two controlled condensation samples resulted in SO_3 concentrations of 0.101 ppmd and 0.000 ppmd. During test SN-9, conditions similar to SN-3 were maintained, and one gas sample showed only 0.006 ppmd SO_3 present in the flue gas. These results indicated that alkali injection reduced the flue gas SO_3 concentration to an extremely low value.

Effect of Temperature on SO_2 Removal Efficiency

Tests SN-3 through SN-8 were performed from November 22 to November 26 to determine the effect of temperature on SO_2 removal efficiency when injecting alkali. The SDA heater and gas flow rate were adjusted to achieve temperatures at the PJFF outlet ranging from 230°F to 320°F. The unit was operated at each condition for a minimum of 4 hours, although some conditions were held for as long as 10 hours.

Figure 2 illustrates the effect of temperature on SO_2 removal while injecting alkali. The SO_2 removal efficiency increased from approximately 15% at 230°F to nearly 60% at 320°F at the 1.5 ratio. Although this trend might continue at even higher temperatures, higher temperatures could not be achieved using the existing test equipment in this program.



Future Tests

The SO_x/NO_x test block will continue in December by adding catalyst to the reactor. During December testing, various ammonia injection rates and locations will be studied, as well as the effects of various temperatures across the system. SO_x/NO_x testing will be completed on 12/20/96 as an outage is conducted to prepare for the upcoming DOE/PRDA Phase I testing of Clear Liquor Scrubbing (CLS) with Anhydrite production.

APPENDIX A

TEST SCHEDULES

EPRI ENVIRONMENTAL CONTROL TECHNOLOGY CENTER
TEST CALENDAR

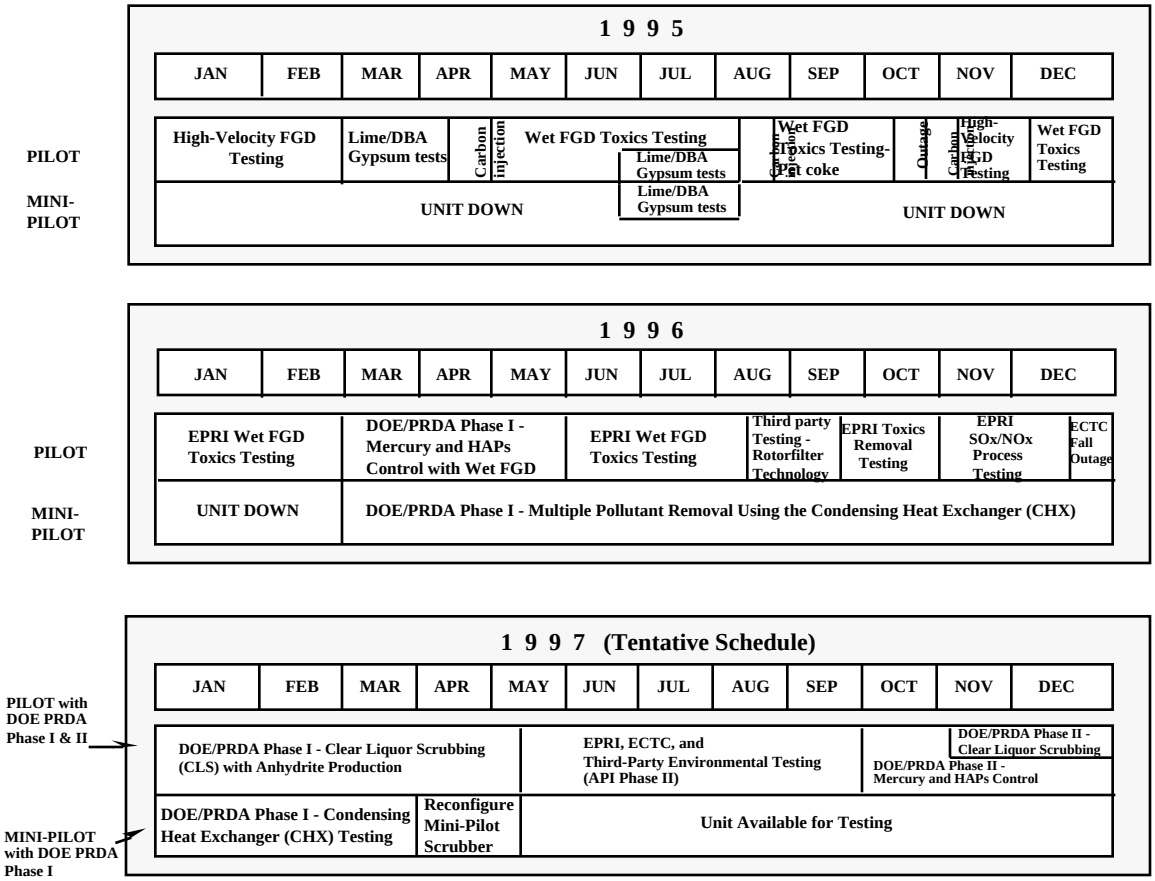
November 1996 (Updated Nov. 30, 1996)

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
					1 SOx/NOx Test Block Outage	2 SOx/NOx Test Block Outage
3 SOx/NOx Test Block	4 SOx/NOx Test Block SN-0 Unit Shake-down	5 SOx/NOx Test Block SN-0 Unit Shake-down	6 SOx/NOx Test Block SN-1 Contrl'd Condensation Test at PJFF Outlet	7 SOx/NOx Test Block SN-1 Contrl'd Condensation Test at PJFF Outlet Mass Loading	8 SOx/NOx Test Block SN-1 Contrl'd Condensation Test at PJFF Outlet	9 SOx/NOx Test Block Unit Off-Line
10 SOx/NOx Test Block Unit Off-line	11 SOx/NOx Test Block Unit Off-line Six Pulse Jet Bags Replaced Orifice Calibration	12 SOx/NOx Test Block SN-1 Contrl'd Condensation Test at PJFF Outlet Mass Loading	13 SOx/NOx Test Block Orifice Calibration	14 SOx/NOx Test Block SN-1 Contrl'd Condensation Test at PJFF Outlet	15 SOx/NOx Test Block Mass Loading	16 SOx/NOx Test Block
17 SOx/NOx Test Block	18 SOx/NOx Test Block SN-3A Mass Loading	19 SOx/NOx Test Block Mass Loading	20 SOx/NOx Test Block Unit Off-line Eight Failed Bags 47 Bags Replaced	21 SOx/NOx Test Block Start Up Unit brought on-line Began warming duct	22 SOx/NOx Test Block SN-3B	23 SOx/NOx Test Block SN-4,5
24 SOx/NOx Test Block SN-6,7	25 SOx/NOx Test Block SN-8	26 SOx/NOx Test Block SN-9	27 SOx/NOx Test Block Unit Off-line Installing Rotameter	28 SOx/NOx Test Block Unit Off-line Holiday	29 SOx/NOx Test Block Unit Off-line Holiday	30 SOx/NOx Test Block Unit Off-line

EPRI ENVIRONMENTAL CONTROL TECHNOLOGY CENTER
TEST CALENDAR

December 1996 (Updated Dec. 31, 1996)

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
1 SOx/NOx Test Block	2 SOx/NOx Test Block	3 SOx/NOx Test Block SN-10	4 SOx/NOx Test Block SN-10	5 SOx/NOx Test Block	6 SOx/NOx Test Block	7 SOx/NOx Test Block
8 SOx/NOx Test Block	9 SOx/NOx Test Block SN-18 New Catalyst Added	10 SOx/NOx Test Block SN-18	11 SOx/NOx Test Block SN-19	12 SOx/NOx Test Block SN-20	13 SOx/NOx Test Block SN-22 Changed Catalysts	14 SOx/NOx Test Block
15 SOx/NOx Test Block SN-24 NH3 Injection Tests	16 SOx/NOx Test Block SN-25,26 NH3 Injection Tests	17 SOx/NOx Test Block SN-27,28 NH3 Injection Tests	18 SOx/NOx Test Block SN-29,30,31,32,33 NH3 Injection Tests	19 SOx/NOx Test Block SN-34 NH3 Injection Tests New Catalysts	20 SOx/NOx Test Block SN-35	21 Winter Outage
22 Winter Outage	23 Winter Outage	24 Winter Outage Holiday	25 Winter Outage Holiday	26 Winter Outage	27 Winter Outage	28 Winter Outage
29 Winter Outage	30 B&W CHX	31 B&W CHX	1 Holiday	2 DOE/PRDA CLS Outage System Modifications	3 DOE/PRDA CLS Outage System Modifications	4 DOE/PRDA CLS



ECTC Pilot-scale Testing Schedule ('95-'97)

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