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ENVIRONMENTAL CONTROL TECHNOLOGY CENTER

REPORT TO THE STEERING COMMITTEE

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This report is a compilation of monthly progress reports by EPRI contractors (Radian International, Parsons Power) connected with the Environmental Control Technology Center (ECTC). This report is intended to provide timely information regarding the status of testing and research to the ECTC co-sponsoring organizations.

All data, results, and remarks contained in this report should be considered preliminary based on the information available to date. Any speculation or conclusions discussed in this report are subject to change as additional information becomes available.

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LIST OF COMMON ABBREVIATIONS

A-S-H.....	Allen Sherman Hoff
BES.....	Bulk Entrainment Separator
CRG.....	Clean Raw Gas
CLS.....	Clear Liquor Scrubbing
DBA.....	Di-Basic Acid
DRG.....	Dirty Raw Gas
ECTC.....	Environmental Control Technology Center
EDR.....	Electrodialysis Reversal Membrane Unit
ESP.....	Electrostatic Precipator
FF.....	Fabric Filter
FGD.....	Flue Gas Desulfurization
FLRT.....	First Loop Reaction Tank
FRP.....	Fiberglass Reinforced Plastic
G/C.....	Gilbert/Commonwealth Inc.
GEESI.....	General Electric Environmental Services Inc.
HME.....	Horizontal Mist Eliminator
HSSD.....	High Sulfur Spray Dryer
HYPAS.....	Hybrid Pollution Abatement System
ID.....	Induced Draft
L/G.....	Liquid to Gas Ratio, (gal/1000ft ³)
MFT.....	Master Fuel Trip
MRT.....	Main Reaction Tank
NTU.....	Number of Transfer Units
NYSEG.....	New York State Gas & Electric
O&M.....	Operations & Maintenance
PJFF.....	Pulse Jet Fabric Filter
RTD.....	Resistance Temperature Detector
RWST.....	Recycle Water Storage Tank
SCBA.....	Scott Air Packs
SDA.....	Spray Dry Absorber
UMIST.....	Univ. of Manchester Inst. of Science & Technology
VME.....	Vertical Mist Eliminator
VSD.....	Variable Speed Drive
WDPF.....	Westinghouse Distributed Process Control System

EXECUTIVE SUMMARY

Operations and maintenance continued this month at the Electric Power Research Institute's Environmental Control Technology Center. Testing on the 4.0 MW Pilot Wet FGD unit continued this month with the Carbon Injection System for the Hazardous Air Pollutant (HAP) test block. With this testing, the mercury measurement (Method 29) studies also continued with various impinger capture solutions. Also, the installation of the B&W/CHX Heat Exchanger unit was completed in March.

The 4.0 MW Spray Dryer Absorber System (Carbon Injection System) and the 4.0 MW Pilot Wet FGD Unit and were utilized in the HAP test configuration this month. The 1.0 MW Cold-Side Selective Catalytic Reduction (SCR) unit remained idle this month in a cold-standby mode. Monthly inspections were conducted for all equipment in cold-standby, as well as for the fire safety systems, and will continue to be conducted by the ECTC Operations and Maintenance staff.

PILOT TESTING HIGHLIGHTS

The Enhanced Control of Mercury and Other Hazardous Air Pollutants by Innovative Modifications to Wet Flue Gas Desulfurization Processes (HAP) test block began in March as part of the DOE Advanced Power Systems Program. The mission of this program is to accelerate the commercialization of affordable, high-efficiency, low-emission, coal-fueled electric generating technologies. This three-month program is being conducted on the 4.0 MW Wet FGD pilot unit and pulse-jet fabric filter (PJFF) at the Electric Power Research Institute's (EPRI's) Environmental Control Technology Center (ECTC). The 1996 HAP test block will focus on three key research areas. These areas, in order of priority, are:

- Catalytic oxidation of vapor-phase elemental mercury;
- Enhanced particulate-phase HAPs removal by electrostatic charging of liquid droplets; and
- Enhanced mercury removal by addition of additives to FGD process liquor.

Testing in March included confirmation (using Tris buffer solutions-M29T) that the wet scrubber removes oxidized mercury generated by catalytic conversion of elemental mercury, an examination of two potential Hg^0 oxidation agents, and an evaluation of different PJFF bag materials to determine their effect on the oxidation of elemental mercury. The two oxidation agents, Norit Darco FGD Carbon and Bituminous #2 fly ash, were deposited onto the PJFF Ryton bags via a screwfeeder, and the oxidation of mercury was tested across the PJFF. All testing with the PJFF during March was conducted with Ryton bags. The PJFF bag materials tested on filters in the M29T gas sampling trains included Ryton, Acrylic, Fiberglass, and Gore-Tex on Fiberglass.

SECTION I 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 SO₂ concentrations were experienced.

Safety training for the month was conducted by the O&M Superintendent, Maintenance Supervisor and Shift Supervisors. "Hand Protection" was the topic of the month. 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 1396 as of 3/31/96.

Concurrent OSHA Safety Training activities at NYSEG were completed by all ECTC personnel. Overhead crane training was also received by the Maintenance Dept. The monthly safety meeting with the NYSEG Kintigh Station was postponed due to a conflict of schedules with NYSEG and ECTC representatives. A tentative date of April 19, 1996 has been set for the next meeting.

PILOT WET FGD SYSTEM

The equivalent and actual availabilities for the ECTC 4.0 MW Pilot Wet FGD System testing this month were both 94% during this period. The Pilot Wet FGD System did not operate during the following periods this month:

- March 1 through 41 hours due to duct reconfiguration.

The Hazardous Air Pollutants (HAP) test block was initiated this month with test HAP-1. The operational parameters for the Pilot Wet Scrubber during this test block included: gas flows of 5,900 scfm; inlet SO₂ concentrations as received; recycle slurry flows of 1300 gpm; 330 scfm oxidation air; and absorber inlet temperatures of 270° to 300°F. No maintenance work was necessary on the Pilot Wet FGD System during this performance period.

CARBON INJECTION SYSTEM

The equivalent and actual availabilities for the ECTC Carbon Injection System testing this month were both 99% during this period. The Carbon Injection System did not operate during the following periods this month:

- March 6 for 5 hours due to duct reconfiguration.

The Hazardous Air Pollutants (HAP) testing with the PJFF were initiated this month with tests HAP-2; HAP-3; HAP-2R; HAP-5; HAP-6A; HAP-6B; HAP-5R; HAP-6B; HAP-10A; HAP-10B; HAP-11; HAP-11A; HAP-11B. These mercury removal tests were conducted with the injection of mercury at different locations while gas sampling at the PJFF inlet and outlet or SDA inlet and outlet locations. Tests HAP-4; HAP-7; HAP-8; HAP-9 were conducted with samples of different bag materials as the filter media in the gas sampling trains. The operational parameters for the PJFF during this test block included: gas flows of 4,000 and 8,000 scfm; inlet SO₂ concentration as received in NYSEG flue gas, PJFF inlet temperatures of 285°F and 300°F. Additionally, the ECTC Flue Gas System was configured so that Clean Raw Gas (CRG) could be supplied to the Carbon Injection System.

The following maintenance work was completed on the Carbon Injection System during this performance period:

- The mercury injection apparatus was moved to various locations for testing.
- The ESP fan wheel was repaired and installed for service in testing.
- Adjustments were made to the ESP fields for various mass loading specifications.

B&W/CHX HEAT EXCHANGER PROJECT

The Heat Exchanger installation for the B&W/CHX Project was completed this month. Both representatives from B&W and CHX were on site and completed the final inspection. Baseline measurements, required before initial startup, were taken and the unit was started. There was a problem experienced with the unit when a wash cycle was initiated. The outlet plenum design did not allow the wash water to settle in the drain; consequently, outlet duct flooding was experienced. A retrofit drain design was fabricated and installed. In addition, the wash nozzle was replaced changing the spray pattern and the amount of wash water allowed through the cycle. The unit was restarted and is currently in operation.

The following maintenance work was completed on the CHX unit during this performance period:

- Fabrication and installation of a retrofit design for the outlet plenum drain.
- The wash nozzle was replaced.
- The inlet plenum was coated with a substance to minimize corrosion.

MISCELLANEOUS

There were no Ball Mill operations required this month. However, the following General maintenance work was completed at the ECTC during this performance period:

- Regularly scheduled maintenance was completed on various ECTC equipment.
- Several Flue Gas System duct reconfigurations were made to support mercury injection and sampling activities.
- Preparations began for the Spring '96 ECTC Steering committee meeting.
- The RGFF was inspected and its condition documented.
- The Fabric Filter opacity monitor was repaired and calibrated.

FINANCIAL REPORT

The Financial Report for the four Operations and Maintenance contract tasks are summarized below for the month of March 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

	March	Year to Date	Contract Total
Task 100	\$ 19,885	\$ 192,510	\$ 13,880,118
Task 200	\$ 3,606	\$ 38,429	\$ 8,009,728
Task 300	\$ 1,343	\$ 12,048	\$ 1,150,760
Task 400	\$ 0	\$ 2,563	\$ 52,764
TOTAL	\$ 24,834	\$ 245,550	\$ 23,093,370

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

Figure i.
1996 Operation & Maintenance Costs

SECTION II PILOT AND MINI-PILOT TEST ACTIVITY

PILOT

Overview

The Enhanced Control of Mercury and Other Hazardous Air Pollutants by Innovative Modifications to Wet Flue Gas Desulfurization Processes (HAP) test block was begun in March as part of the DOE Advanced Power Systems Program, whose mission is to accelerate the commercialization of affordable, high-efficiency, low-emission, coal-fueled electric generating technologies. This three-month program is being conducted on the 4.0 MW wet FGD pilot unit and pulse jet fabric filter (PJFF) at the Electric Power Research Institute's (EPRI's) Environmental Control Technology Center (ECTC). This progress report includes tests run from March 1 to March 31.

The 1996 HAP test block will focus on three key research areas. These areas, in order of priority, are:

- Catalytic oxidation of vapor-phase elemental mercury;
- Enhanced particulate-phase HAPs removal by electrostatic charging of liquid droplets; and
- Enhanced mercury removal by addition of additives to FGD process liquor.

Testing in March included confirmation (using Tris buffer solutions-M29T) that the wet scrubber removes oxidized mercury generated by catalytic conversion of elemental mercury, an examination of two potential Hg^0 oxidation agents, and evaluation of different PJFF bag materials to determine their effect on the oxidation of elemental mercury. The two oxidation agents, Norit's Darco FGD Carbon and Bituminous #2 fly ash, were deposited onto the PJFF Ryton bags via a screwfeeder, and the oxidation of mercury was tested across the PJFF. All testing with the PJFF during March was conducted with Ryton bags. The PJFF bag materials tested on filters in M29T gas sampling trains included Ryton, acrylic, fiberglass, and Gore-Tex on fiberglass.

Summary of Operations

A detailed summary of operations for March is presented in Table 1. Simplified flow diagrams of the wet FGD toxics gas path used during the wet scrubber oxidized Hg^0 removal test and the ESP/SDA/PJFF gas path used during the oxidation catalyst testing are shown in Figures 7 and 8, respectively.

Figure 1 shows the flue gas path during the first test in the HAP test block. The flue gas flowed through the Dirty Raw Gas (DRG) header, through the Spray Dryer Absorber (SDA) and Pulse-Jet Fabric Filter (PJFF), through the clean Raw Gas (CRG)

duct to the wet scrubber, and finally through the Treated Gas Return (TGR) duct to NYSEG. (The SDA was used only as a means to convey gas to the PJFF during these tests—the atomizer was not in service.) Gas sampling was performed at the SDA inlet (mercury pre-spike location), wet scrubber inlet (mercury post-spike location), and wet scrubber outlet.

Figure 2 shows the gas path for the remainder of the pilot testing in March. The flue gas flowed through the DRG header, through the ESP, through the CRG header, through the SDA/ PJFF, and then to the TGR duct. In this particular arrangement, the ESP removes over 99% of the fly ash so that the effect of potential catalysts can be measured somewhat independently from the oxidation caused by the native ash. Gas sampling was done at the SDA inlet (pre-spike), SDA outlet (post spike), and the TGR duct (post PJFF). With elemental mercury injection at the SDA inlet, it was discovered that, despite the relatively low fly ash concentration in the flue gas, the elemental mercury spike was 45% oxidized by the time it reached the SDA outlet and 100% oxidized at the TGR duct. To reduce the level of oxidation in the duct, several changes were made in order to decrease the duct residence time of the mercury spike: the mercury injection location was changed to the SDA outlet, the post-PJFF sampling location was moved closer to the PJFF, and the gas flow was increased from 4000 to 8000 scfm. These changes decreased the residence time from the mercury spiking location to the post-PJFF sampling location from 51 seconds to 12 seconds. No sampling was done at the PJFF inlet for the first several tests with this decreased residence time configuration because a new sampling setup had to be devised. HAP-10A was the first test with elemental mercury injection at the SDA outlet in which samples at the SDA inlet, PJFF inlet, and PJFF outlet were collected.

Ryton bags were in the PJFF for the testing performed in March. After determining that the PJFF equipped with Ryton bags resulted in a high baseline value of elemental mercury oxidation, a study of different bag materials was performed at the CRG duct with elemental mercury injection at the ESP fan inlet. For these tests, different bag materials (some new and some previously contacted with fly ash) were placed on filters in a M29T gas sampling train and the oxidation of mercury across these materials was compared to a baseline M29T train sampling along side the test train. The PJFF bag materials examined during March were Ryton (new and conditioned with fly ash), acrylic (previously contacted with fly ash), fiberglass (previously contacted with fly ash), and Gore-Tex on fiberglass (new and conditioned with fly ash). Acrylic bag material previously contacted with fly ash (used) was taken from stored acrylic bags which had been removed from the PJFF in May 1993. Used fiberglass bag material was taken from the reverse gas fabric filter which had been in place since October, 1990. New bag materials were conditioned by pulling dirty raw gas through the material on a filter holder in a M29 gas sampling train for six hours.

Fly ash used in HAP-3 was collected from the PJFF hopper from March 2 to 3. For the carbon tests, the FGD carbon was deposited onto the PJFF bags via a screwfeeder. Forty-two pounds of carbon was injected over two hours the morning of the first test, HAP-10A.

Summary of Results

This progress report discusses tests conducted from March 1 to March 31. Test conditions of the HAP test block are presented in Table 2. Most process data summary reports and complete analytical data tables for the tests completed in March are included in Appendices A and B, respectively. Because of problems with the calculator which downloads data from the Westinghouse digital control system (DCS), some process summary reports for March tests are not included in this report but will be included in next month's report.

The initial test plan specified a test to confirm that injected Hg^0 which is oxidized by a catalyst or other oxidizing agent would be efficiently removed by the wet scrubber (Figure 1). Following this, a series of potential catalysts were to be tested using the flow configuration shown in Figure 2. However, without a catalyst installed, the oxidation of injected Hg^0 in the ducts, across the SDA, and across the PJFF was found to be quite high, so several tests were conducted to better understand the Hg^0 oxidation which occurs naturally at the ECTC.

Wet Scrubber Removal of Oxidized Hg^0

The results of the wet scrubber removal of oxidized Hg^0 (with the Tris impinger solutions in a M29T gas sampling train used for measurement) are shown in Figure 3. This figure shows that about $20 \mu\text{g}/\text{Nm}^3$ of Hg^0 was spiked into the flue gas and essentially all of this was oxidized in the duct or across the PJFF. The wet scrubber removed more than 98% of the oxidized mercury in the wet scrubber inlet gas. This is consistent with the removal efficiency of the native Hg^{+2} (limited by gas-film mass transfer only) and indicates that the wet scrubber treats the oxidized Hg^0 in the same manner as the native Hg^{+2} . The Tris impingers captured 93% of the total mercury at the wet scrubber inlet, and the wet scrubber removed 94% of the total mercury. This shows that the mercury capture efficiency of Tris impingers is similar to the capture efficiency of a high efficiency wet scrubber, and that the use of Tris impinger solutions in the gas sampling trains (method M29T) should accurately predict the mercury removal that will occur in a high efficiency wet scrubber.

Fly Ash Effect on Elemental Mercury Oxidation

Figure 4 shows the effect of the addition of fly ash to the PJFF with Ryton bags installed. With fly ash on the PJFF bags, 82% of the elemental mercury spike was oxidized across the PJFF (measured from the SDA outlet to the TGR sample point). The baseline test following the fly ash test (HAP-2R) showed 62% oxidation of the mercury spike across the PJFF. The results of these tests indicate that fly ash is effective in oxidizing Hg^0 , but there are several important observations made during the initial tests in this configuration.

One observation made is that the PJFF bags need to be thoroughly cleaned to achieve accurate baseline oxidation results. The first baseline test (HAP-2) which was run before the fly ash test showed a very high mercury oxidation value (90%). This

initial baseline was the first HAP test to be run in the ESP-SDA-PJFF configuration, and the PJFF ΔP was 2.1 in. H_2O . During the baseline test after the fly ash test, HAP-2R, the PJFF ΔP was 0.48 in. H_2O . This difference in ΔP between the two tests was most likely because the PJFF bags in the first baseline test were not adequately pulse-cleaned. The PJFF was pulsed before the first HAP test, but it seems that more aggressive pulsing is required when the bags have not been used for long periods of time.

A second observation is that between 40 and 60% of the injected Hg^0 was oxidized across the combined duct and SDA. This oxidation may occur because the mercury is in contact with residual fly ash for about 25 seconds in SDA at 4000 scfm flow rate. When combined with 60% oxidation of the remaining Hg^0 across the Ryton-bagged PJFF, less than $5 \mu g/Nm^3$ of Hg^0 was left in the PJFF outlet gas stream. This baseline concentration was judged to be insufficient to compare with future results of potential catalyst materials (variability in the 0 to $5 \mu g/Nm^3$ concentration would likely mask some of the differences among catalysts). Additional tests to determine the effect of different bag materials, residence time, and Hg^0 concentration were therefore planned and executed.

PJFF Bag Material Effect on Elemental Mercury Oxidation

A series of experiments were performed at the CRG duct in Method 29-Tris (M29T) sampling trains using several different fabrics. A 46 cm^2 sample of fabric material was placed on the filter of a M29T sampling train, and the split between oxidized and elemental mercury was compared with a baseline (no fabric) M29T sampling train which was run simultaneously. The acrylic and fiberglass materials had been previously used, and they had some fly ash accumulation. The Ryton and Gore-Tex on fiberglass materials had never been used so they were conditioned by pulling high-dust gas through the fabric for 6 hours before some tests.

The effect of different bag materials on the oxidation of mercury is shown in Figure 5. New Ryton material showed the greatest effect with 38% of the mercury spike oxidized. After being conditioned, the Ryton material still showed 20% oxidation of the spike. The acrylic and fiberglass PJFF bag materials did not show any effect on the oxidation of the mercury spike. New Gore-Tex on fiberglass showed 4% oxidation, and when conditioned, this bag material with fly ash resulted in 9% oxidation of the elemental mercury spike. Because of the normal variability in baseline measurements, measured differences of less than 10% in single tests are not assumed to be different from baseline results. [It should be noted that the velocity across the fabric in the M29T train was significantly higher (air-to-cloth ratio of about 25) than across the PJFF (A/C of about 4 during initial HAP testing). This increased velocity, or decreased contact time, may have reduced the Hg^0 oxidation observed with the Ryton material during the M29T experiments]. The M29T runs indicate that the Ryton fabric material is partially responsible for the higher than expected Hg^0 oxidation across the PJFF at baseline conditions.

Figure 6 shows the oxidation of the mercury spike during baseline tests with Ryton bags. The baseline percent oxidation values ranged from 61% to 73% in tests HAP-2R, 5, 6A, and 5R. Operating differences in these baseline runs included velocity (4,000 and 8,000 scfm), amount of Hg^0 spiked into the duct ($\approx 20 \mu\text{g}/\text{Nm}^3$ compared to $\approx 40 \mu\text{g}/\text{Nm}^3$), and changes in location of injection and sampling points to reduce the residence time of the Hg^0 spike. Beginning with test HAP-5, Hg^0 was spiked into the SDA outlet duct rather than the SDA inlet duct. When coupled with the increased gas flow and closer sampling location at the PJFF outlet, the residence between Hg^0 injection and measurement downstream of the PJFF was reduced from ≈ 50 seconds to ≈ 12 seconds. The results in Figure 6 show that these changes did not have a tremendous effect on the fraction of the Hg^0 that was oxidized. However, the amount of Hg^0 remaining in the PJFF outlet gas did increase to greater than $10 \mu\text{g}/\text{Nm}^3$ with the increased spiking. At that time, this PJFF outlet concentration was judged to be sufficient to measure differences in catalysts performance.

Effect of Residence Time

The effect of residence time on the oxidation of the elemental mercury spike is shown in Figure 7. Data for clean raw gas and dirty raw gas are shown. These data include both previous EPRI test results as well as current HAPs PRDA project results. Residence times for the dirty raw gas include the time required to pass through the particulate removal device [ESP or PJFF (with Ryton bags)]. There appears to be an effect of increased Hg^0 oxidation with increased residence time with either high-dust (dirty) gas or clean gas. This led to the injection of Hg^0 as closely as feasible to the PJFF to minimize the oxidation occurring prior to the flue gas reaching the PJFF. Sufficient data are not available at this time to separate the effects of ash loading, particulate control device, and residence time (although M29T data do indicate that Ryton fabric has an effect on Hg^0 oxidation). It is interesting to note that the Hg^0 oxidation across the ESP is similar to that measured across the PJFF with Ryton bags, perhaps indicating that the ESP may increase oxidation other than by just providing residence time for reaction.

FGD Carbon Effect on Elemental Mercury Oxidation

Figure 8 shows the effect of Norit FGD carbon on the oxidation/removal of mercury when tested with Ryton bags. The carbon was put on the PJFF bags the morning before the first day of testing. The first day of testing, HAP-10A, showed that 77% of the total mercury was removed and that 90% of the Hg^0 entering the PJFF was either oxidized or removed (these tests cannot differentiate between oxidation and removal if significant total mercury removal is occurring). The second day of testing, HAP-10B, showed that there was no removal and the oxidation of the mercury spike was 83%. After these two days of testing, the PJFF was pulse-cleaned, and a baseline test was performed the following day. The baseline, HAP-11, was conducted after the carbon tests and showed that 87% of the spike was still oxidized/removed. This indicates (and was later confirmed by visual inspection) that the carbon can not be easily pulse-cleaned off of the PJFF bags even though the

ΔP returned to baseline levels. The effect of carbon on the bags seemed to continue into the fine fly ash accumulation tests seen two and three days after the end of the carbon tests in HAP-11A and HAP-11B (when the oxidation of the mercury spike was 88% and 89%, respectively). Since there was still some concern about the repeatability of the baseline tests with Ryton bags, it was decided to change bag material. Acrylic bags (the only ones available on site) were installed in early April.

Future Work

Laboratory testing in April will include repeat tests to explore some of the differences between laboratory and ECTC results. Testing with NOXSORB™ will be conducted as soon as the material arrives from Olin.

The HAP test block will continue in April with acrylic bags installed to replace the Ryton bags in the PJFF to establish a lower baseline Hg^0 oxidation. The effect of various catalytic candidates on the oxidation of elemental mercury will be tested.

Table 1. March Process Operating Conditions Summary

Date	Test ID	Gas Sampling Summary	Process Summary
Fri. 3/1			Reconfiguration of facility gas path for HAP test block. Gas path is PJFF-CRG-WS
Sat.-Sun. 3/2 - 3/3	HAP-1		PJFF and pilot WS on line at 1700 hrs. PJFF fly ash collected for HAP-3
Mon. 3/4		Mercury injection started at the SDA inlet.	SO ₂ spiking will maintain minimum of 1000 ppm at the SDA inlet.
Tue. 3/5		Gas sampling at the SDA inlet, WS inlet and WS outlet. Testing spike oxidation and subsequent removal by the WS with comparison to the Tris impinger capture.	After gas sampling, facility shutdown to reconfigure gas path to DRG-ESP-CRG-SDA-PJFF-TGR.
Wed. 3/6			Facility down for gas path configuration.
Thur. 3/7	HAP-2 4000 scfm 275°F PJFF outlet temp. Baseline	Sampling at the DRG header (pre-spike), SDA outlet (post spike), and TGR (post PJFF). Mercury injection at the ESP fan inlet set at 15.6 µg/Nm ³ .	ESP removing maximum particulate from gas before the SDA. PJFF ΔP increased from 2.05 to 2.10 inches H ₂ O during gas sampling.
Fri. 3/8	HAP-3 Fly Ash	Sampling at the DRG header (pre-spike), SDA outlet (post spike), and TGR (post PJFF). Mercury injection at the ESP fan inlet set at 15.6 µg/Nm ³ .	50 lbs of fly ash was added to the PJFF using the weigh belt screw feeder. PJFF ΔP increased from 1.4 to 3.1 in. H ₂ O.
Sat.-Sun. 3/9-3/10			Pulse cleaned the PJFF for one hour every six hours.
Mon. 3/11	HAP-2R Baseline	Sampling at the DRG header (pre-spike), SDA outlet (post spike), and TGR (post PJFF). Mercury injection at the ESP fan inlet set at 15.6 µg/Nm ³ .	Pulse-cleaned for one hour prior to run 1, and then for 15 minutes prior to runs 2 and 3.
Tue. 3/12	HAP-4 Ryton and Acrylic material at the CRG duct.	Testing new Ryton bag material and previously used (ash-covered) acrylic bag material. Mercury injection at the ESP fan inlet with sampling at the CRG duct using three trains: baseline filter, Ryton, and acrylic materials on M29 filters.	At 8000 scfm the PJFF pulse-cleaning set to initiate at 5.0 in. H ₂ O.
Wed. 3/13			Ash collected and weighed from the PJFF showed 43 lbs/8 hrs and then 15 lbs/8 hrs.

Table 1. March Process Operating Conditions Summary (cont.)

Date	Test ID	Gas Sampling Summary	Process Summary
Thur. 3/14	HAP-5 8000 scfm Baseline	Gas sampling at the SDA inlet (pre-spike) and PJFF outlet (outside shed). Mercury injection at the SDA outlet and set at 29 $\mu\text{g}/\text{Nm}^3$.	PJFF was pulse-cleaned for 15 min. on the hour overnight and between test runs.
Fri. 3/15	HAP-6 8000 scfm Baseline	Gas sampling at the SDA inlet (pre-spike) and PJFF outlet (outside shed). Mercury injection at the SDA outlet and set at 29 $\mu\text{g}/\text{Nm}^3$.	PJFF was pulse-cleaned for 15 min. on the hour overnight and between test runs. Air inleakage from the SDA inlet to the PJFF outlet is approx. 10%.
Sat.-Sun. 3/16-3/17			Mercury injection continued with no pulsing of the PJFF. ΔP increased from 1.0 to 3.3 in. H_2O over 65 hrs over the weekend.
Mon. 3/18	HAP-6B 8000 scfm Fine fly ash accumulation	Gas sampling at the SDA inlet (pre-spike) and PJFF outlet (outside shed). Mercury injection at the SDA outlet and set at 12 $\mu\text{g}/\text{Nm}^3$.	PJFF ΔP was constant at 3.4 in. H_2O during sampling.
Tue. 3/19	HAP-7 Ryton and Acrylic material at the CRG duct.	Testing "conditioned" Ryton and previously used acrylic bag materials. The Ryton was conditioned by pulling ash-laden gas through the material on a M29 filter in a gas sampling train for six hours. Mercury injection at the ESP fan inlet with sampling at the CRG duct using three trains: baseline filter, Ryton, and acrylic materials on M29 filters.	Identified the bags in the RGFF as fiberglass.
Wed. 3/20	HAP-8 Gore-Tex on fiberglass and fiberglass materials at the CRG duct.	Mercury injection at the ESP fan inlet with sampling at the CRG duct using three trains: baseline filter, new Gore-Tex on fiberglass, and previously used fiberglass materials on M29 filters.	

Table 1. March Process Operating Conditions Summary (cont.)

Thur. 3/21	HAP-5R 8000 scfm Baseline	Gas sampling at the SDA inlet (pre-spike) and PJFF outlet (outside shed). Mercury injection set at 29 $\mu\text{g}/\text{Nm}^3$.	PJFF was pulse-cleaned for 15 min. on the hour overnight and between test runs.
Date	Test ID	Gas Sampling Summary	Process Summary
Fri. 3/22	HAP-9 Gore-Tex on fiberglass material at the CRG duct.	Mercury injection at the ESP fan inlet with sampling at the CRG duct using two trains: baseline filter and "conditioned" Gore-Tex on fiberglass on M29 filter. Conditioning involves pulling ash-laden flue gas through the material on a M29 filter in a gas sampling train for six hours.	Bag material from Midwesco.
Sat.-Sun. 3/23-3/24			Mercury injection started on Sat. at the SDA outlet set at 29 $\mu\text{g}/\text{Nm}^3$. Beginning Sun. at 16:00, the PJFF was pulse-cleaned for 15 min. on the hour until 05:00 Mon.
Mon. 3/25	HAP-10A Darco carbon Day 1 8000 scfm	Gas sampling at the SDA inlet (pre-spike), PJFF inlet (post spike), and PJFF outlet. Mercury injection at the SDA outlet and set at 29.0 $\mu\text{g}/\text{Nm}^3$.	42 lbs of Darco carbon added to the PJFF over two hours via the screw feeder starting at 05:00. The PJFF ΔP increased from 0.89 to 9.0 in. H_2O with the addition of the carbon.
Tue. 3/26	HAP-10B Darco carbon Day 2 8000 scfm	Gas sampling at the SDA inlet (clean raw gas from ESP, pre-spike), PJFF inlet (post spike), and PJFF outlet. Mercury injection at the SDA outlet and set at 29.0 $\mu\text{g}/\text{Nm}^3$.	Original 42 lbs carbon remain on the PJFF bags. By the end of sampling the PJFF ΔP was 9.9 in. H_2O . After gas sampling, the PJFF was pulse-cleaned for 15 min. on the hour.
Wed. 3/27	HAP-11 8000 scfm Baseline	Gas sampling at the SDA inlet (clean raw gas from ESP, pre-spike), PJFF inlet (post spike), and PJFF outlet. Mercury injection at the SDA outlet and set at 29.0 $\mu\text{g}/\text{Nm}^3$.	The PJFF was pulse-cleaned for 15 min. on the hour until 06:00 and for 15 min. prior to each sampling run. At the end of testing, all fields on the ESP were rapped. Collection of fine fly ash started at 16:00.
Thur. 3/28	HAP-11A 8000 scfm Fine fly ash accumulation Day 1.	Gas sampling at the SDA inlet (clean raw gas from ESP, pre-spike), PJFF inlet (post spike), and PJFF outlet. Mercury injection at the SDA outlet and set at 29.0 $\mu\text{g}/\text{Nm}^3$.	PJFF ΔP increased from 2.1 to 2.4 in. H_2O during the three runs of sampling. Discovered that the mercury injection tubing in the hot box had come apart. Repairs were made and injection parameters were reestablished by 23:00.

Table 1. March Process Operating Conditions Summary (cont.)

Fri. 3/29	HAP-11B 8000 scfm Fine fly ash accumulation Day 2.	Gas sampling at the SDA inlet (clean raw gas from ESP, pre-spike), PJFF inlet (post spike), and PJFF outlet. Mercury injection at the SDA outlet and set at 29.0 $\mu\text{g}/\text{Nm}^3$.	PJFF ΔP increased from 2.9 to 3.0 in. H ₂ O during the three runs of sampling. At the end of sampling, the ESP was detuned to allow higher particulate loading to the PJFF
Sat.-Sun. 3/30-3/31		Pulse cleaning 1 - 3 times/hour initiating at 6.0 in. H ₂ O ΔP .	The PJFF was set to pulse clean at 6.0 in. H ₂ O ΔP over the weekend. On Sun, 16:00, the ESP was retuned to remove maximum particulate. Starting at 16:00 Sun. until 06:00 Mon, the PJFF was pulse-cleaned for 15 min. on the hour.

Table 2. PRDA HAP Test Conditions and Results

Test ID	Test Description	Gas Flow scfm	Catalyst Test Temp °F	Pre-spike Hg Conc.		Post-spike Hg Conc.		Post Catalyst Hg Conc.		Spike µg/Nm³	Oxid. %	Spike Location	Post-Catalyst Sample Location	Spike Res. Time sec
				Tris µg/Nm³	KMnO₄ µg/Nm³	Tris µg/Nm³	KMnO₄ µg/Nm³	Tris µg/Nm³	KMnO₄ µg/Nm³					
HAP-1	Compare Tris Impinger Removal to WS Removal	5800	260	11.14	2.10	32.36	2.40	-	-	21.52	-	SDA Inlet	-	NA
HAP-2	Baseline Test	4000	257	9.06	2.34	23.84	19.65	31.67	1.81	32.09	91%	ESP Fan Inlet	TGR	51
HAP-3	50 lbs Fly Ash Deposited on PJFF Bags	4000	254	9.46	2.08	25.12	11.09	31.77	1.95	24.67	82%	ESP Fan Inlet	TGR	51
HAP-2R	Baseline Test	4000	255	11.02	1.60	27.10	11.96	30.89	4.35	26.44	64%	ESP Fan Inlet	TGR	51
HAP-4	Ryton Material at CRG Duct	5500	225	-	-	15.65	18.34	18.12	11.40	-	38%	ESP Fan Inlet	CRG	NA
	Acrylic at CRG Duct	5500	275	-	-	15.65	18.34	17.83	19.43	-	-6%	ESP Fan Inlet	CRG	
HAP-5	Baseline with Higher Hg⁰ Spk	8000	260	13.47	2.05	-	-	43.28	14.31	42.07	68%b	SDA Outlet	PJFF Out.	12

Table 2. PRDA HAP Test Conditions and Results (cont.)

Test ID	Test Description	Gas Flow scfm	Catalyst Test Temp °F	Pre-spike Hg Conc.		Post-spike Hg Conc. (Pre-Catalyst)		Post Catalyst Hg Conc.		Spike µg/Nm³	Spike Oxid. %	Spike Location	Post-Catalyst Sample Location	Spike Res. Time sec
				Tris µg/Nm³	KMnO₄ µg/Nm³	Tris µg/Nm³	KMnO₄ µg/Nm³	Tris µg/Nm³	KMnO₄ µg/Nm³					
HAP-6A	Baseline with Fly Ash Accum	8000	260	10.76	1.64	-	-	21.80	5.70	15.10	63%b	SDA Outlet	PJFF Out.	12
HAP-6B	Baseline with Fly Ash Accum over 3 Days	8000	260	8.20	1.19	-	-	20.10	3.84	14.55	76%b	SDA Outlet	PJFF Out.	12
HAP-7	Conditioned Ryton at CRG	9500	250	-	-	11.86	13.73	16.81	11.02	-	20%	ESP Fan Inlet	CRG	NA
	Used Acrylic at CRG Duct	9500	250	-	-	11.86	13.73	13.14	14.18	-	-3%	ESP Fan Inlet	CRG	NA
HAP-8	Used Fiberglass at CRG Duct	9500	250	-	-	8.85	12.00	9.06	12.45	-	-4%	ESP Fan	CRG	NA
	New Gore-Tex on Fglass at CRG Duct	9500	250	-	-	8.85	12.00	9.44	11.57	-	4%	Inlet	CRG	NA
HAP-5R	Baseline	8000	257	15.24	2.72	-	-	45.39	19.68	47.11	61%b	SDA Outlet	PJFF Out.	12

Table 2. PRDA HAP Test Conditions and Results (cont.)

Test ID	Test Description	Gas Flow scfm	Catalyst Test Temp °F	Pre-spike Hg Conc.		Post-spike Hg Conc.		Post Catalyst Hg Conc.		Spike µg/Nm³	Oxid. %	Spike Location	Post-Catalyst Sample Location	Spike Res. Time sec
				Tris µg/Nm³	KMnO₄ µg/Nm³	Tris µg/Nm³	KMnO₄ µg/Nm³	Tris µg/Nm³	KMnO₄ µg/Nm³					
HAP-9	Conditioned Gore-Tex on Fglass at CRG	9500	250	-	-	7.76	13.19	8.63	12.02	-	9%	ESP Fan Inlet	CRG	NA
HAP-10A	Darco Carbon on Ryton Bags - Day 1	8000	252	7.90	1.02	27.39	25.70	9.57	2.50	44.17	90%	SDA Outlet	PJFF Out.	12
HAP-10B	Darco Carbon on Ryton Bags - Day 2	8000	250	5.53	0.62	12.19	29.85	51.22	5.01	35.89	83%	SDA Outlet	PJFF Out.	12
HAP-11	Baseline	8000	250	9.91	0.87	10.35	25.27	37.98	3.22	24.84	87%	SDA Outlet	PJFF Out.	12
HAP-11A	Baseline	8000	251	7.67	1.03	13.62	31.24	42.24	3.78	36.16	88%	SDA Outlet	PJFF Out.	12
HAP-11B	Baseline	8000	250	10.56	1.22	13.12	29.48	38.59	3.32	30.82	89%	SDA	PJFF Out.	12

Figure 1. Gas Flow Path for HAP-1 (Wet Scrubber Removal of Oxidized Hg^0)

Figure 2. Simplified flow diagram for pilot-plant Hg^0 oxidation testing

Figure 3. Wet Scrubber Removal of Oxidized Hg^0

Figure 4. Oxidation of Hg^0 with Fly Ash on Ryton Bags in PJFF

Figure 5. Effect of Bag Material on Hg⁰ Oxidation (M29T Train Tests)

Figure 6. Baseline Hg⁰ Oxidation Across PJFF with Ryton Bags

Figure 7. Effect of Residence Time on Hg^0 Oxidation at ECTC

Figure 8. Oxidation and Adsorption of Mercury During Carbon Tests and Continued Oxidation Effect after Carbon Tests

APPENDIX A
ECTC TEST SCHEDULES

EPRI ENVIRONMENTAL CONTROL TECHNOLOGY CENTER TEST CALENDAR

March 1996 (Updated Mar 20, 1996)

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
					¹ Haz Air Pollutants Configure Gas Path for HAP Testing SDA/PJFF/WS	² Haz Air Pollutants HAP-1 Comp. of Tris Imp. and Wet Scrubber Oxid. Hg Removal
³ Haz Air Pollutants HAP-1	⁴ Haz Air Pollutants HAP-1	⁵ Haz Air Pollutants HAP-1	⁶ Haz Air Pollutants Reconfigure Gas Path to Run ESP/SDA/PJFF/TGR	⁷ Haz Air Pollutants HAP-2 PJFF Baseline Cond. No Fly Ash Nor Catalyst	⁸ Haz Air Pollutants HAP-3 Bulk Fly Ash On PJFF	⁹ Haz Air Pollutants HAP-2R PJFF Baseline Cond. No Fly Ash Nor Catalyst
¹⁰ Haz Air Pollutants Pulse-cleaned the PJFF on the Hour	¹¹ Haz Air Pollutants HAP-2R	¹² Haz Air Pollutants HAP-4 Ryton and Acrylic Bag Material Tested at CRG Duct	¹³ Haz Air Pollutants HAP-5	¹⁴ Haz Air Pollutants HAP-5 Clean PJFF Bags High Hg(0) Spike 29 µg/Nm ³	¹⁵ Haz Air Pollutants HAP-6A Clean PJFF Bags Low Hg(0) Spike 11 µg/Nm ³	¹⁶ Haz Air Pollutants HAP-6B Fine Fly Ash Accum. (Mat'l Collected that Passes Through ESP)
¹⁷ Haz Air Pollutants HAP-6B	¹⁸ Haz Air Pollutants HAP-6B Fine Fly Ash Accum. (Mat'l Collected that Passes Through ESP)	¹⁹ Haz Air Pollutants HAP-7 "Conditioned" Ryton and Used Acrylic Bag Materials	²⁰ Haz Air Pollutants HAP-8 Gore-tex on Fiberglass and Fiberglass Bag Materials	²¹ Haz Air Pollutants HAP-5R Clean PJFF Bags	²² Haz Air Pollutants HAP-9 "Conditioned" Gore-tex on Fiberglass Bag Material	²³ Haz Air Pollutants Pulse-cleaning on the Hour
²⁴ Haz Air Pollutants Pulse-cleaning on the Hour	²⁵ Haz Air Pollutants HAP-10A	²⁶ Haz Air Pollutants HAP-10B	²⁷ Haz Air Pollutants HAP-11	²⁸ Haz Air Pollutants HAP-11A	²⁹ Haz Air Pollutants HAP-11B	³⁰ Haz Air Pollutants
³¹ Haz Air Pollutants Fine Fly Ash Accum.	Darco Carbon on PJFF Day 1 8000 scfm	Darco Carbon on PJFF Day 2 8000 scfm	Baseline Test after Pulse-cleaning	Fine Fly Ash Accumulation	Fine Fly Ash Accumulation	Fine Fly Ash Accumulation

EPRI ENVIRONMENTAL CONTROL TECHNOLOGY CENTER TEST CALENDAR

April 1996 (Updated May 8, 1996)

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
	¹ Haz Air Pollutants HAP-12 Baseline Test	² Haz Air Pollutants HAP-13 Baseline with incr. mercury spike	³ Haz Air Pollutants HAP-14 Catalysts Tested on M29T Filters at CRG, 250F	⁴ Haz Air Pollutants HAP-14A Catalysts Tested on M29T Filters at CRG, 250F	⁵ Haz Air Pollutants HAP-15; HAP-00 Catalysts Tested on M29T Filters; HCL addition to M29	⁶ Haz Air Pollutants Fly Ash Collected on Newly Installed Acrylic PJFF Bags
⁷ Haz Air Pollutants Fly Ash Collected on Newly Installed Acrylic PJFF Bags	⁸ Haz Air Pollutants Pulse-cleaning the Newly Installed Acrylic PJFF Bags	⁹ Haz Air Pollutants HAP-16 Baseline with Acrylic PJFF Bags 8000 scfm	¹⁰ Haz Air Pollutants HAP-16R Baseline with Acrylic PJFF Bags 8000 scfm	¹¹ Haz Air Pollutants HAP-17; HAP-18 Baseline with Acrylic PJFF Bags, 3000 scfm; Catalyst on Filter, 300F	¹² Haz Air Pollutants HAP-19A Fine Fly Ash Collected on PJFF	¹³ Haz Air Pollutants No Pulse-cleaning to Allow Accumulation of Fine Fly Ash
¹⁴ Haz Air Pollutants No Pulse-cleaning to Allow Accumulation of Fine Fly Ash	¹⁵ Haz Air Pollutants HAP-19B Fine Fly Ash Collected on PJFF	¹⁶ Haz Air Pollutants HAP-19C Fine Fly Ash Collected on PJFF	¹⁷ Haz Air Pollutants Facility Down to remove failed acrylic PJFF bags, and Replace Damper H	¹⁸ Haz Air Pollutants Facility Down to remove failed acrylic PJFF bags, and Replace Damper H	¹⁹ Haz Air Pollutants Facility Down to remove failed acrylic PJFF bags, and Replace Damper H	²⁰ Haz Air Pollutants
²¹ Haz Air Pollutants	²² Haz Air Pollutants HAP-20 Catalysts Tested on M29T Filters at CRG, 300F	²³ Haz Air Pollutants HAP-21 Catalysts Tested on M29T Filters at CRG, 300F	²⁴ Haz Air Pollutants HAP-22 Catalysts Tested on M29T Filters at CRG, 300F	²⁵ Haz Air Pollutants HAP-23 Catalysts Tested on M29T Filters at CRG, 300F	²⁶ Haz Air Pollutants Installation of New Acrylic PJFF Bags	²⁷ Haz Air Pollutants Fly Ash Collected on Newly Installed Acrylic PJFF Bags
²⁸ Haz Air Pollutants	²⁹ Haz Air Pollutants HAP-24 Baseline with Acrylic PJFF Bags 4000 scfm	³⁰ Haz Air Pollutants HAP-25 Baseline with Acrylic PJFF Bags 8000 scfm				

PILOT

MINI-PILOT

1 9 9 5													
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC		
High-Velocity FGD Testing	Lime/DBA Gypsum tests	Carbon injection	Wet FGD Toxics Testing					Carbon injection	Wet FGD Toxics Testing- Pet coke	Outage	Carbon injection	High-Velocity FGD Testing	Wet FGD Toxics Testing
				Lime/DBA Gypsum tests									
				Lime/DBA Gypsum tests									
UNIT DOWN							UNIT DOWN						

PILOT

MINI-PILOT

1 9 9 6											
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
EPRI Wet FGD Toxics Testing		DOE/PRDA Phase I - Mercury and HAPs Control with Wet FGD			EPRI Wet FGD Toxics Testing			Third party Testing - Rotorfilter Technology	Carbon Injection	DOE/PRDA Phase I - Clear Liquor Scrubbing (CLS) with Anhydrite Production	
UNIT DOWN			DOE/PRDA Phase I - Multiple Pollutant Removal Using the Condensing Heat Exchanger (CHX)								

PILOT w/
DOE PRDA
Phase II →

PILOT w/o
DOE PRDA
Phase II →

MINI-PILOT
w/o DOE
PRDA Phase II →

1 9 9 7 (Tentative Schedule)											
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
DOE/PRDA Phase II - Mercury and HAPs Control by Modifications to Wet FGD Processes						DOE/PRDA Phase II - Clear Liquor Scrubbing (CLS) with Anhydrite Production					
CLS Phase I	EPRI Wet FGD Toxics Testing				High Velocity FGD Testing				Advanced FGD Processes (CLS)		
DOE/PRDA Phase I - Condensing Heat Exchanger (CHX) Testing			Unit Available for Testing								

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

APPENDIX B
ECTC PROCESS SUMMARY REPORTS

HAP-1 Process Summary Report
03/05/96 06:00:00 to 03/05/96 15:00:00)

Process Variable	Average	Max	Min	Std.Dev.	Points
SO2 Removal (%)	92.4	92.9	92.2	0.2	9
SO2 Removal (NTU)	2.58	2.65	2.55	0.03	9
L/G Ratio (gal/macf)	186	188	185	1	9
Reaction Tank pH	5.50	5.51	5.49	0.01	9
Absorber pH	4.97	5.06	4.84	0.07	9
Flue Gas Flow Rate (scfm)	5979	6018	5929	36	9
Header 1 Flow (gpm)	650	650	650	0	9
Header 3 Flow (gpm)	650	650	650	0	9
Header 5 Flow (gpm)	0	0	0	0	9
Blowdown to Sump Rate (gpm)	0.21	0.26	0.06	0.05	9
Centrifuge Feed Rate (gpm)	1.42	2.00	1.25	0.26	9
Reagent Feed to FLRT (gpm)	0.20	0.22	0.19	0.01	9
Facility Inlet SO2 Conc. (ppm)	1349	1400	1309	31	9
Inlet SO2 Concentration (ppm)	848	888	820	21	9
Outlet SO2 Concentration (ppm)	61	64	56	3	9
Inlet O2 Concentration (%)	11.45	11.71	11.07	0.20	9
Outlet O2 Concentration (%)	11.23	11.51	10.82	0.21	9
Absorber Gas Velocity (ft/sec)	5.92	5.96	5.88	0.03	9
Inlet Gas Temperature (F)	270	271	269	1	9
Outlet Gas Temperature (F)	112	113	111	0	9
SO2 Absorbed (mmole/L)	1.14	1.19	1.10	0.03	9
Solids Residence Time (hrs)	21.4	22.1	20.6	0.5	9
Slurry Residence Time (min)	1.95	1.95	1.95	0.00	9
Absorber Pressure Drop (in H2O)	1.83	1.86	1.82	0.01	9
Spray Zone Pressure Drop (in H2O)	1.01	1.03	1.00	0.01	9
ME Pressure Drop (in H2O)	0.00	0.00	0.00	0.00	9
Oxidation Air to Rxn Tank (scfm)	330	330	329	0	9
NYSEG Load (MW)	689	691	685	2	9

HAP-1 Process Summary Report
03/05/96 06:00:00 to 03/05/96 15:00:00)

Process Variable	Average	Max	Min	Std.Dev.	Points
Flue Gas Flow Rate (scfm)	3996	4007	3979	8	9
Facility Inlet SO ₂ Conc. (ppm)	1345	1400	1309	30	9
Facility Outlet SO ₂ Conc	59	63	56	3	9
SDA Inlet SO ₂ Conc. (ppm)	1267	1308	1240	20	8
SDA Outlet SO ₂ Conc. (ppm)	1263	1306	1235	22	8
TGR/PJFF Outlet SO ₂ Conc. (ppm)	763	763	763	0	9
SDA Inlet O ₂ Conc. (%)	7.38	7.69	6.90	0.25	8
SDA Outlet O ₂ Conc. (%)	8.28	8.59	7.84	0.23	8
TGR O ₂ Conc. (%)	9.84	9.84	9.84	0.00	8
SDA Inlet Temp. (F)	374	375	370	2	9
SDA Outlet Temp. (F)	338	340	336	1	8
ESP Outlet Temp. (F)	56	56	56	0	9
PJFF Inlet Temp. (F)	318	320	316	1	8
PJFF Outlet Temp. (F)	258	259	257	1	8
PJFF Air/Cloth Ratio	3.9	3.9	3.9	0.0	5
PJFF Cleaning Pulses/Hour	20	20	20	0	5
PJFF Delta P (in H ₂ O)	3.82	3.84	3.80	0.02	8
NYSEG Load (MW)	681	691	619	22	9

HAP-2 Process Summary Report
03/07/96 07:00:00 to 03/07/96 13:00:00)

Process Variable	Average	Max	Min	Std.Dev.	Points
Flue Gas Flow Rate (scfm)	4002	4004	4000	2	5
Facility Inlet SO2 Conc. (ppm)	1415	1467	1365	38	5
Facility Outlet SO2 Conc	974	1008	940	25	5
SDA Inlet SO2 Conc. (ppm)	1260	1310	1196	43	5
SDA Outlet SO2 Conc. (ppm)	1120	1160	1078	29	5
TGR/PJFF Outlet SO2 Conc. (ppm)	830	901	690	73	5
SDA Inlet O2 Conc. (%)	8.70	9.03	8.23	0.29	5
SDA Outlet O2 Conc. (%)	10.24	10.60	9.69	0.34	5
TGR O2 Conc. (%)	12.49	13.01	11.86	0.39	5
SDA Inlet Temp. (F)	377	377	377	0	5
SDA Outlet Temp. (F)	338	338	338	0	5
ESP Outlet Temp. (F)	303	304	302	1	5
PJFF Inlet Temp. (F)	268	269	267	1	5
PJFF Outlet Temp. (F)	257	258	257	1	5
PJFF Air/Cloth Ratio	4.7	4.8	4.7	0.0	5
PJFF Cleaning Pulses/Hour	0	0	0	0	5
PJFF Delta P (in H2O)	2.10	2.14	2.05	0.03	5
NYSEG Load (MW)	707	709	704		5

HAP-3X Process Summary Report
03/08/96 08:00:00 to 03/08/96 12:00:00)

Process Variable	Average	Max	Min	Std.Dev.	Points
Flue Gas Flow Rate (scfm)	4003	4006	4001	2	4
Facility Inlet SO2 Conc. (ppm)	1437	1484	1391	38	4
Facility Outlet SO2 Conc	1006	1047	971	28	4
SDA Inlet SO2 Conc. (ppm)	1252	1280	1221	27	4
SDA Outlet SO2 Conc. (ppm)	1161	1200	1133	26	4
TGR/PJFF Outlet SO2 Conc. (ppm)	909	949	891	23	4
SDA Inlet O2 Conc. (%)	8.51	8.88	8.21	0.29	4
SDA Outlet O2 Conc. (%)	10.07	10.41	9.74	0.27	4
TGR O2 Conc. (%)	12.27	12.52	11.87	0.25	4
SDA Inlet Temp. (F)	377	377	376	0	4
SDA Outlet Temp. (F)	339	339	338	0	4
ESP Outlet Temp. (F)	297	302	294	3	4
PJFF Inlet Temp. (F)	266	267	266	0	4
PJFF Outlet Temp. (F)	254	254	254	0	4
PJFF Air/Cloth Ratio	4.6	4.6	4.6	0.0	4
PJFF Cleaning Pulses/Hour	0	0	0	0	4
PJFF Delta P (in H2O)	3.15	3.17	3.13	0.02	4
NYSEG Load (MW)	700	701	696	2	4

HAP-4 Process Summary Report
03/12/96 10:00:00 to 03/12/96 14:00:00)

Process Variable	Average	Max	Min	Std.Dev.	Points
Flue Gas Flow Rate (scfm)	3998	3999	3996	1	4
Facility Inlet SO2 Conc. (ppm)	1447	1505	1345	65	4
Facility Outlet SO2 Conc	1075	1112	1008	42	4
SDA Inlet SO2 Conc. (ppm)	1236	1299	1150	58	4
SDA Outlet SO2 Conc. (ppm)	1157	1201	1077	51	4
TGR/PJFF Outlet SO2 Conc. (ppm)	943	975	883	37	4
SDA Inlet O2 Conc. (%)	8.39	8.64	8.17	0.21	4
SDA Outlet O2 Conc. (%)	9.91	10.20	9.65	0.23	4
TGR O2 Conc. (%)	11.86	12.10	11.58	0.23	4
SDA Inlet Temp. (F)	376	376	376	0	4
SDA Outlet Temp. (F)	336	337	336	0	4
ESP Outlet Temp. (F)	303	307	296	4	4
PJFF Inlet Temp. (F)	272	272	271	0	4
PJFF Outlet Temp. (F)	261	262	261	0	4
PJFF Air/Cloth Ratio	4.4	4.4	4.4	0.0	4
PJFF Cleaning Pulses/Hour	0	0	0	0	4
PJFF Delta P (in H2O)	3.06	3.13	3.01	0.05	4
NYSEG Load (MW)	618	640	584	21	4

HAP-6A Process Summary Report
03/15/96 08:00:00 to 03/15/96 12:00:00)

Process Variable	Average	Max	Min	Std.Dev.	Points
Flue Gas Flow Rate (scfm)	7993	8000	7984	6	4
Facility Inlet SO2 Conc. (ppm)	1204	1243	1185	23	4
Facility Outlet SO2 Conc	991	1029	954	27	4
SDA Inlet SO2 Conc. (ppm)	1229	1258	1198	26	4
SDA Outlet SO2 Conc. (ppm)	1194	1210	1162	19	4
TGR/PJFF Outlet SO2 Conc. (ppm)	958	987	942	17	4
SDA Inlet O2 Conc. (%)	8.45	8.68	8.03	0.25	4
SDA Outlet O2 Conc. (%)	9.43	9.68	9.17	0.18	4
TGR O2 Conc. (%)	10.04	10.35	9.50	0.32	4
SDA Inlet Temp. (F)	309	309	309	0	4
SDA Outlet Temp. (F)	295	296	295	0	4
ESP Outlet Temp. (F)	281	283	278	2	4
PJFF Inlet Temp. (F)	264	265	264	0	4
PJFF Outlet Temp. (F)	258	258	258	0	4
PJFF Air/Cloth Ratio	7.2	7.2	7.2	0.0	4
PJFF Cleaning Pulses/Hour	116	116	116	0	4
PJFF Delta P (in H2O)	0.91	0.91	0.91	0.00	4
NYSEG Load (MW)	486	508	478	13	4

HAP-6B Process Summary Report
03/18/96 08:00:00 to 03/18/96 13:00:00)

Process Variable	Average	Max	Min	Std.Dev.	Points
Flue Gas Flow Rate (scfm)	7999	8001	7995	2	4
Facility Inlet SO2 Conc. (ppm)	1345	1405	1291	41	4
Facility Outlet SO2 Conc	1053	1092	1008	31	4
SDA Inlet SO2 Conc. (ppm)	1385	1410	1354	20	4
SDA Outlet SO2 Conc. (ppm)	1316	1374	1258	41	4
TGR/PJFF Outlet SO2 Conc. (ppm)	1139	1177	1098	28	4
SDA Inlet O2 Conc. (%)	7.52	7.99	7.04	0.34	4
SDA Outlet O2 Conc. (%)	10.11	10.41	9.74	0.24	4
TGR O2 Conc. (%)	8.80	9.37	8.22	0.41	4
SDA Inlet Temp. (F)	309	309	309	0	4
SDA Outlet Temp. (F)	296	296	296	0	4
ESP Outlet Temp. (F)	281	282	280	1	4
PJFF Inlet Temp. (F)	266	266	266	0	4
PJFF Outlet Temp. (F)	260	260	259	0	4
PJFF Air/Cloth Ratio	7.0	7.0	7.0	0.0	4
PJFF Cleaning Pulses/Hour	0	0	0	0	4
PJFF Delta P (in H2O)	3.42	3.44	3.39	0.02	4
NYSEG Load (MW)	601	635	571	27	4

HAP-7 Process Summary Report
03/19/96 08:00:00 to 03/19/96 12:00:00)

Process Variable	Average	Max	Min	Std.Dev.	Points
Flue Gas Flow Rate (scfm)	8000	8003	7998	2	4
Facility Inlet SO2 Conc. (ppm)	1094	1141	1037	38	4
Facility Outlet SO2 Conc	911	938	867	27	4
SDA Inlet SO2 Conc. (ppm)	1087	1138	1029	39	4
SDA Outlet SO2 Conc. (ppm)	993	1025	947	29	4
TGR/PJFF Outlet SO2 Conc. (ppm)	932	958	894	24	4
SDA Inlet O2 Conc. (%)	7.79	8.26	7.44	0.30	4
SDA Outlet O2 Conc. (%)	9.11	9.54	8.78	0.28	4
TGR O2 Conc. (%)	9.16	9.70	8.74	0.35	4
SDA Inlet Temp. (F)	309	309	309	0	4
SDA Outlet Temp. (F)	296	297	295		4
ESP Outlet Temp. (F)	280	282	278	1	4
PJFF Inlet Temp. (F)	265	266	265	0	4
PJFF Outlet Temp. (F)	259	260	258	0	4
PJFF Air/Cloth Ratio	7.1	7.1	7.1	0.0	4
PJFF Cleaning Pulses/Hour	0	0	0	0	4
PJFF Delta P (in H2O)	3.63	3.64	3.62	0.01	4
NYSEG Load (MW)	596	661	526	49	4

HAP-8 Process Summary Report
03/20/96 08:00:00 to 03/20/96 13:00:00)

Process Variable	Average	Max	Min	Std.Dev.	Points
Flue Gas Flow Rate (scfm)	8000	8002	7999	1	5
Facility Inlet SO2 Conc. (ppm)	1330	1368	1283	30	5
Facility Outlet SO2 Conc	1139	1175	1097	27	5
SDA Inlet SO2 Conc. (ppm)	1307	1341	1263	29	5
SDA Outlet SO2 Conc. (ppm)	1214	1245	1168	29	5
TGR/PJFF Outlet SO2 Conc. (ppm)	1058	1093	1018	26	5
SDA Inlet O2 Conc. (%)	6.30	6.67	5.85	0.28	5
SDA Outlet O2 Conc. (%)	7.70	8.10	7.18	0.32	5
TGR O2 Conc. (%)	7.46	7.87	6.93	0.32	5
SDA Inlet Temp. (F)	309	309	309	0	5
SDA Outlet Temp. (F)	296	297	296	0	5
ESP Outlet Temp. (F)	278	282	276	2	5
PJFF Inlet Temp. (F)	263	263	263	0	5
PJFF Outlet Temp. (F)	256	256	256	0	5
PJFF Air/Cloth Ratio	6.9	6.9	6.9	0.0	5
PJFF Cleaning Pulses/Hour	0	0	0	0	5
PJFF Delta P (in H2O)	3.81	3.82	3.81	0.01	5
NYSEG Load (MW)	688	689	687	1	5

HAP-5R Process Summary Report
03/21/96 07:00:00 to 03/21/96 12:00:00)

Process Variable	Average	Max	Min	Std.Dev.	Points
Flue Gas Flow Rate (scfm)	8001	8005	7996	3	5
Facility Inlet SO2 Conc. (ppm)	1102	1182	1043	47	5
Facility Outlet SO2 Conc	915	971	876	32	5
SDA Inlet SO2 Conc. (ppm)	1100	1128	1085	16	5
SDA Outlet SO2 Conc. (ppm)	1010	1075	964	38	5
TGR/PJFF Outlet SO2 Conc. (ppm)	879	934	840	32	5
SDA Inlet O2 Conc. (%)	7.52	7.97	6.91	0.36	5
SDA Outlet O2 Conc. (%)	8.91	9.34	8.34	0.33	5
TGR O2 Conc. (%)	8.96	9.62	8.15	0.48	5
SDA Inlet Temp. (F)	313	314	309	2	5
SDA Outlet Temp. (F)	299	301	296	2	5
ESP Outlet Temp. (F)	273	280	267	5	5
PJFF Inlet Temp. (F)	265	267	262	2	5
PJFF Outlet Temp. (F)	257	260	255	2	5
PJFF Air/Cloth Ratio	7.0	7.0	7.0	0.0	5
PJFF Cleaning Pulses/Hour	110	110	110	0	5
PJFF Delta P (in H2O)	0.85	0.86	0.85	0.00	5
NYSEG Load (MW)	612	677	577	36	5

HAP-9 Process Summary Report
03/22/96 07:00:00 to 03/22/96 12:00:00)

Process Variable	Average	Max	Min	Std.Dev.	Points
Flue Gas Flow Rate (scfm)	8000	8001	7999	1	5
Facility Inlet SO2 Conc. (ppm)	1033	1057	1017	13	5
Facility Outlet SO2 Conc	911	932	891	13	5
SDA Inlet SO2 Conc. (ppm)	1013	1048	983	23	5
SDA Outlet SO2 Conc. (ppm)	946	962	926	14	5
TGR/PJFF Outlet SO2 Conc. (ppm)	833	848	815	13	5
SDA Inlet O2 Conc. (%)	7.02	7.26	6.79	0.17	5
SDA Outlet O2 Conc. (%)	8.47	8.67	8.27	0.16	5
TGR O2 Conc. (%)	8.32	8.57	8.06	0.20	5
SDA Inlet Temp. (F)	314	314	314	0	5
SDA Outlet Temp. (F)	301	301	300	0	5
ESP Outlet Temp. (F)	276	277	274	1	5
PJFF Inlet Temp. (F)	266	267	266	0	5
PJFF Outlet Temp. (F)	260	260	259	0	5
PJFF Air/Cloth Ratio	7.0	7.0	7.0	0.0	5
PJFF Cleaning Pulses/Hour	0	0	0	0	5
PJFF Delta P (in H2O)	1.09	1.12	1.06	0.02	5
NYSEG Load (MW)	661	679	628	19	5

HAP-10A Process Summary Report
03/25/96 10:00:00 to 03/25/96 15:00:00)

Process Variable	Average	Max	Min	Std.Dev.	Points
Flue Gas Flow Rate (scfm)	8005	8017	7997	8	5
Facility Inlet SO2 Conc. (ppm)	1491	1709	1379	124	5
Facility Outlet SO2 Conc	1223	1288	1157	54	5
SDA Inlet SO2 Conc. (ppm)	1325	1364	1249	41	5
SDA Outlet SO2 Conc. (ppm)	1316	1370	1267	42	5
TGR/PJFF Outlet SO2 Conc. (ppm)	1169		1107	50	5
SDA Inlet O2 Conc. (%)	6.98	7.52	6.41	0.46	5
SDA Outlet O2 Conc. (%)	8.40	8.94	7.83	0.46	5
TGR O2 Conc. (%)	8.22	8.91	7.57	0.55	5
SDA Inlet Temp. (F)	296	298	295	1	5
SDA Outlet Temp. (F)	286	287	284	1	5
ESP Outlet Temp. (F)	287	291	284	2	5
PJFF Inlet Temp. (F)	258	261	256	2	5
PJFF Outlet Temp. (F)	252	254	249	2	5
PJFF Air/Cloth Ratio	6.9	6.9	6.9	0.0	5
PJFF Cleaning Pulses/Hour	0	0	0	0	5
PJFF Delta P (in H2O)	9.18	9.26	9.13	0.05	5
NYSEG Load (MW)	622	693	567	55	5

HAP-11A Process Summary Report
03/28/96 07:00:00 to 03/28/96 12:00:00)

Process Variable	Average	Max	Min	Std.Dev.	Points
Flue Gas Flow Rate (scfm)	7995	7999	7984	5	5
Facility Inlet SO2 Conc. (ppm)	1565	1655	1466	66	5
Facility Outlet SO2 Conc	1330	1392	1260	47	5
SDA Inlet SO2 Conc. (ppm)	1450	1513	1375	44	5
SDA Outlet SO2 Conc. (ppm)	1361	1447	1290	57	5
TGR/PJFF Outlet SO2 Conc. (ppm)	1208	1270	1145	45	5
SDA Inlet O2 Conc. (%)	7.38	8.10	6.88	0.44	5
SDA Outlet O2 Conc. (%)	7.78	8.85	7.00	0.61	5
TGR O2 Conc. (%)	8.97	9.84	8.25	0.58	5
SDA Inlet Temp. (F)	301	302	300	1	5
SDA Outlet Temp. (F)	289	290	288	1	5
ESP Outlet Temp. (F)	279	281	277	1	5
PJFF Inlet Temp. (F)	258	259	257	1	5
PJFF Outlet Temp. (F)	251	252	251	0	5
PJFF Air/Cloth Ratio	7.1	7.1	7.1	0.0	5
PJFF Cleaning Pulses/Hour	0	0	0	0	5
PJFF Delta P (in H2O)	2.23	2.38	2.09	0.10	5
NYSEG Load (MW)	632	699	529	61	5

APPENDIX C
ANALYTICAL SUMMARY RESULTS

ECTC Pilot Trace Elements Removal Testing
Mercury Gas Sampling Results
Pre-Spiking Inlet Location

Test ID	Date	Start Time	Other Imp. Cont.	ID	Gas Volume (dscf)	Moisture (% H ₂ O)	DRG O ₂ (%)	Other Sample [Hg] (ng/ml)	Other Sample [Hg] (ng/ml)	H ₂ O ₂ Sample [Hg] (ng/ml)	H ₂ O ₂ Sample [Hg] (ng/ml)	KMnO ₄ Sample [Hg] (ng/ml)	Other Sample Mass (g)	Other Sample Mass (g)	H ₂ O ₂ Sample Mass (g)	H ₂ O ₂ Sample Mass (g)	KMnO ₄ Sample Mass (g)	Other [Hg] In Gas (µg/Nm ³)	Other [Hg] In Gas (µg/Nm ³)	H ₂ O ₂ [Hg] In Gas (µg/Nm ³)	H ₂ O ₂ [Hg] In Gas (µg/Nm ³)	KMnO ₄ [Hg] In Gas (µg/Nm ³)	Total [Hg] In Gas (µg/Nm ³)
Hg Ox/Rem, Hg spk @SDA In																							
HAP-1	Tue-3/5	08:15	TE3	U792	28.51	-	7.68	-	13.80	-	-	4.11	-	585.1	-	-	542.3	-	10.73	-	-	2.96	13.69
HAP-1	Tue-3/5	09:45	TE3	U795	32.76	-	7.12	-	11.30	-	-	2.09	-	614.0	-	-	497.4	-	8.02	-	-	1.20	9.23
HAP-1	Tue-3/5	11:30	TE3	U798	29.46	-	7.20	-	12.50	-	-	1.79	-	604.9	-	-	509.8	-	9.72	-	-	1.17	10.90
HAP-1	Tue-3/5	13:20	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Averages																			9.49	-	-	1.78	11.27
BSL, Inj. at ESP Fan In, 4000scfm, Ryton																							
HAP-2	Thu-3/7	08:15	TE3	U802	34.58	-	6.53	-	29.87	-	-	25.00	-	595.6	-	-	544.9	-	19.49	-	-	14.92	34.41
HAP-2	Thu-3/7	09:00	TE3	U805	31.39	-	5.81	-	12.70	-	-	3.85	-	588.7	-	-	499.3	-	9.02	-	-	2.32	11.34
HAP-2	Thu-3/7	01:00	TE3	U808	31.41	-	5.99	-	11.30	-	-	3.43	-	592.5	-	-	509.1	-	8.08	-	-	2.11	10.18
HAP-2	Thu-3/7	11:00	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Averages																			12.20	-	-	6.45	18.64
50lbs Fly Ash, Ryton Bags																							
HAP-3	Fri-3/8	07:45	TE3	U812	32.77	-	5.72	-	11.90	-	-	3.35	-	589.8	-	-	501.0	-	8.11	-	-	1.94	10.06
HAP-3	Fri-3/8	08:30	TE3	U815	30.52	-	5.72	-	11.80	-	-	3.04	-	600.9	-	-	539.7	-	8.80	-	-	2.04	10.84
HAP-3	Fri-3/8	09:30	TE3	U818	32.52	-	6.49	-	13.60	-	-	3.07	-	610.3	-	-	526.8	-	9.67	-	-	1.88	11.55
Averages																			8.86	-	-	1.95	10.81
BSL, 255F PJFF Outlet																							
HAP-2R	Mon-3/11	08:00	TE3	U821	34.29	-	5.72	-	16.05	-	-	3.50	-	565.2	-	-	491.8	-	10.02	-	-	1.90	11.92
HAP-2R	Mon-3/11	08:45	TE3	U824	31.67	-	5.72	-	14.10	-	-	2.41	-	608.7	-	-	472.9	-	10.27	-	-	1.36	11.63
HAP-2R	Mon-3/11	09:15	TE3	U827	32.80	-	6.49	-	15.40	-	-	2.54	-	602.9	-	-	424.8	-	10.72	-	-	1.25	11.97
Averages																			10.34	-	-	1.50	11.84
Bag Mat'l on Sampling Filter																							
HAP-4	Tue-3/12	10:10	TE3	U830	36.22	-	8.54	-	22.60	-	-	30.80	-	587.9	-	-	471.0	-	13.90	-	-	15.17	29.07
HAP-4	Tue-3/12	11:30	TE3	U833	32.48	-	8.17	-	17.25	-	-	22.55	-	593.6	-	-	536.2	-	11.94	-	-	14.10	26.05
HAP-4	Tue-3/12	12:30	TE3	U836	38.21	-	8.20	-	19.90	-	-	28.00	-	576.3	-	-	517.6	-	11.37	-	-	14.37	25.74
Averages																			12.40	-	-	14.55	26.95
BSL, Inj. @SDA Out, 8000 scfm																							
HAP-5	Thu-3/14	08:00	TE3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAP-5	Thu-3/14	09:20	TE3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAP-5	Thu-3/14	10:20	TE3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAP-5	Thu-3/14	11:50	TE3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Averages																			-	-	-	-	-
BSL, Low Hg Spike																							
HAP-6A	Fri-3/15	08:00	TE3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAP-6A	Fri-3/15	09:10	TE3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAP-6A	Fri-3/15	10:10	TE3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAP-6A	Fri-3/15	11:10	TE3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Averages																			-	-	-	-	-

*Shaded areas indicate sampling problems. H=Peroxide. TE3=Tris/EDTA(10mM). a=Data from testing acrylic bag materials only. FGlass=Fiberglass. G-FGlass=Gortex on Fiberglass.

ECTC Pilot Trace Elements Removal Testing
Mercury Gas Sampling Results
Pre-Spiking Inlet Location

Test ID	Date	Start Time	Other Imp. Cont.	ID	Gas Volume (dscf)	Moisture (% H ₂ O)	DRG O ₂ (%)	Other Sample [Hg] (ng/ml)	Other Sample [Hg] (ng/ml)	H ₂ O ₂ Sample [Hg] (ng/ml)	H ₂ O ₂ Sample [Hg] (ng/ml)	KMnO ₄ Sample [Hg] (ng/ml)	Other Sample Mass (g)	Other Sample Mass (g)	H ₂ O ₂ Sample Mass (g)	H ₂ O ₂ Sample Mass (g)	KMnO ₄ Sample Mass (g)	Other [Hg] In Gas (µg/Nm ³)	Other [Hg] In Gas (µg/Nm ³)	H ₂ O ₂ [Hg] In Gas (µg/Nm ³)	H ₂ O ₂ [Hg] In Gas (µg/Nm ³)	KMnO ₄ [Hg] In Gas (µg/Nm ³)	Total [Hg] In Gas (µg/Nm ³)
Fine Fly Ash Accumulation																							
HAP-6B	Mon-3/18	08:00	TE3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAP-6B	Mon-3/18	08:40	TE3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAP-6B	Mon-3/18	09:30	TE3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAP-6B	Mon-3/18	10:20	TE3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAP-6B	Mon-3/18	11:20	TE3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAP-6B	Mon-3/18	12:00	TE3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Averages																							
Bag Mat'l on Sampling Filter																							
HAP-7	Tue-3/19	10:10	TE3	U865	32.70	-	7.45	-	15.30	-	-	18.80	-	555.9	-	-	508.3	CRG-1	CRG-1	CRG-1	CRG-1	CRG-1	CRG-1
HAP-7	Tue-3/19	11:30	TE3	U868	35.77	-	7.68	-	15.70	-	-	20.40	-	599.6	-	-	533.3	-	9.85	-	-	11.07	20.92
HAP-7	Tue-3/19	12:30	TE3	U871	35.87	-	8.25	-	15.20	-	-	20.00	-	594.4	-	-	538.9	-	9.97	-	-	11.52	21.49
Averages																							
Bag Mat'l on Sampling Filter																							
HAP-8	Wed-3/20	10:10	TE3	U874	26.19	-	6.54	-	16.70	-	-	18.50	-	603.4	-	-	516.8	CRG-1	CRG-1	CRG-1	CRG-1	CRG-1	CRG-1
HAP-8	Wed-3/20	11:30	TE3	U877	32.82	-	6.44	-	13.80	-	-	20.90	-	551.8	-	-	481.9	-	14.58	-	-	13.83	28.40
HAP-8	Wed-3/20	12:30	TE3	U880	34.41	-	6.04	-	12.50	-	-	19.90	-	546.5	-	-	479.4	-	8.79	-	-	11.63	20.41
Averages																							
BSL Rylon Bags, 8000scfm																							
HAP-5R	Thu-3/21	08:00	TE3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAP-5R	Thu-3/21	09:20	TE3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAP-5R	Thu-3/21	10:20	TE3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAP-5R	Thu-3/21	11:50	TE3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Averages																							
Bag Mat'l on Sampling Filter																							
HAP-9	Fri-3/22	08:00	TE3	U891	33.63	-	7.13	-	9.23	-	-	19.90	-	602.5	-	-	504.2	CRG-1	CRG-1	CRG-1	CRG-1	CRG-1	CRG-1
HAP-9	Fri-3/22	09:00	TE3	U893	30.80	-	7.06	-	9.74	-	-	21.70	-	580.2	-	-	437.8	-	6.26	-	-	11.30	17.56
HAP-9	Fri-3/22	10:00	TE3	U895	37.68	-	6.86	-	12.00	-	-	23.90	-	591.4	-	-	482.8	-	6.95	-	-	11.68	18.63
Averages																							
Carbon, Rylon Bags, 250F PJFF Out.																							
HAP-10A	Mon-3/25	09:30	TE3	U897	30.83	-	7.02	-	10.55	-	-	1.33	-	592.4	-	-	525.1	SDA In	SDA In	SDA In	SDA In	SDA In	SDA In
HAP-10A	Mon-3/25	10:30	TE3	U900	30.96	-	6.49	-	9.35	-	-	1.52	-	560.8	-	-	486.8	-	7.68	-	-	0.86	8.54
HAP-10A	Mon-3/25	11:15	TE3	U903	32.19	-	6.41	-	10.30	-	-	1.57	-	589.4	-	-	525.4	-	6.42	-	-	0.91	7.32
Averages																							
Carbon, Rylon Bags, 250F PJFF Out.																							
HAP-10B	Tue-3/26	08:00	TE3	U906	30.69	-	6.59	-	7.15	-	-	0.85	-	574.7	-	-	529.5	SDA In	SDA In	SDA In	SDA In	SDA In	SDA In
HAP-10B	Tue-3/26	09:00	TE3	U909	34.61	-	7.79	-	7.60	-	-	0.97	-	578.2	-	-	510.3	-	5.07	-	-	0.56	5.63
HAP-10B	Tue-3/26	09:45	TE3	U912	30.93	-	9.37	-	5.40	-	-	0.66	-	565.1	-	-	535.9	-	4.81	-	-	0.54	5.35
Averages																							

*Shaded areas indicate sampling problems. H=Peroxide. TE3=Tris/EDTA(10mM). a=Data from testing acrylic bag materials only. FGlass=Fiberglass. G-FGlass=Gortex on Fiberglass.

ECTC Pilot Trace Elements Removal Testing
Mercury Gas Sampling Results
Pre-Spiking Inlet Location

										Other	Other	H2O2	H2O2	KMnO4	Other	Other	H2O2	H2O2	KMnO4	Other	Other	H2O2	H2O2	KMnO4	Total
Test			Other	Gas		DRG	Sample	Sample	Sample	Sample	Sample	Sample	Sample	Sample	Sample	Sample	Sample	Sample	Sample	[Hg]	[Hg]	[Hg]	[Hg]	[Hg]	[Hg]
ID	Date	Start	Imp.	Volume	Moisture	O2	[Hg]	[Hg]	[Hg]	[Hg]	[Hg]	[Hg]	Mass	Mass	Mass	Mass	Mass	Mass	Mass	In Gas	In Gas	In Gas	In Gas	In Gas	In Gas
		Time	Cont.	ID	(dscf)	(% H2O)	(%)	(ng/ml)	(ng/ml)	(ng/ml)	(ng/ml)	(ng/ml)	(g)	(g)	(g)	(g)	(g)	(g)	(g)	(µg/Nm³)	(µg/Nm³)	(µg/Nm³)	(µg/Nm³)	(µg/Nm³)	(µg/Nm³)
BSL, Rylon, 250F PJFF Out.																				SDA In	SDA In	SDA In	SDA In	SDA In	SDA In
HAP-11	Wed-3/27	08:00	TE3	U915	29.00	-	6.68	-	11.64	-	-	1.13	-	581.3	-	-	477.8	-	8.84	-	-	0.71	9.54		
HAP-11	Wed-3/27	09:00	TE3	U918	31.92	-	7.16	-	12.59	-	-	1.35	-	573.5	-	-	489.9	-	8.57	-	-	0.79	9.36		
HAP-11	Wed-3/27	09:45	TE3	U921	34.59	-	6.84	-	14.18	-	-	1.36	-	566.8	-	-	538.6	-	8.80	-	-	0.80	9.61		
Averages																					8.74			0.76	9.50
Fine Fly Ash Accumulation																				SDA In	SDA In	SDA In	SDA In	SDA In	SDA In
HAP-11A	Thu-3/28	09:30	TE3	U924	30.26	-	6.97	-	9.98	-	-	1.34	-	585.2	-	-	490.6	-	7.31	-	-	0.82	8.14		
HAP-11A	Thu-3/28	10:30	TE3	U927	28.44	-	6.97	-	8.93	-	-	1.59	-	577.0	-	-	469.1	-	6.86	-	-	0.99	7.86		
HAP-11A	Thu-3/28	11:15	TE3	U930	32.49	-	8.10	-	8.28	-	-	1.45	-	572.2	-	-	489.1	-	5.52	-	-	0.83	6.35		
Averages																					6.57			0.88	7.45
Fine Fly Ash Accumulation																				SDA In	SDA In	SDA In	SDA In	SDA In	SDA In
HAP-11B	Fri-3/29	07:00	TE3	U933	28.02	-	7.26	-	11.95	-	-	1.41	-	569.7	-	-	474.4	-	9.21	-	-	0.90	10.11		
HAP-11B	Fri-3/29	07:45	TE3	U936	25.81	-	6.91	-	11.13	-	-	1.57	-	589.8	-	-	515.9	-	9.63	-	-	1.19	10.82		
HAP-11B	Fri-3/29	08:45	TE3	U939	30.85	-	6.91	-	12.15	-	-	1.89	-	592.3	-	-	479.2	-	8.83	-	-	1.11	9.95		
Averages																					9.22			1.07	10.29

*Shaded areas indicate sampling problems. H=Peroxide. TE3=Tris/EDTA(10mM). a=Data from testing acrylic bag materials only. FGlass=Fiberglass. G-FGlass=G-wites on Fiberglass.

ECTC PRDA HAPS Testing

Mercury Gas Sampling Results

Post-Spiking Inlet Location

ECTC PRDA HAPS Testing
Mercury Gas Sampling Results
Post-Spiking Inlet Location

								Solid Hg		Other		H2O2		H2O2		KMnO4		Solid Hg		Other		H2O2		KMnO4		Total					
Test		Start	Other	Gas	Moisture	Inlet	Sample	Sample	Sample	Sample	Sample	Sample	Sample	Sample	Sample	Sample	Sample	[Hg]	[Hg]	[Hg]	[Hg]	[Hg]	[Hg]	[Hg]	[Hg]	[Hg]	[Hg]				
ID	Date	Time	Imp.	Volume	(% H2O)	O2	[Hg]	[Hg]	[Hg]	[Hg]	[Hg]	[Hg]	[Hg]	Mass	Mass	Mass	Mass	In Gas	In Gas	In Gas	In Gas	In Gas	In Gas	In Gas	In Gas	In Gas					
			Cont.	ID	(dscf)	(%)	(ppm)	(ng/ml)	(ng/ml)	(ng/ml)	(ng/ml)	(ng/ml)	(ng/ml)	(g)	(g)	(g)	(g)	(μg/Nm3)	(μg/Nm3)	(μg/Nm3)	(μg/Nm3)	(μg/Nm3)	(μg/Nm3)	(μg/Nm3)	(μg/Nm3)	(μg/Nm3)					
Fine Fly Ash Accumulation																															
HAP-6B	Mon-3/18	08:00	TE3	U855	31.92	-	7.04	-	-	9.45	-	-	1.53	-	-	602.7	-	-	498.0	SDA In	SDA In	SDA In	SDA In	SDA In	SDA In	SDA In	SDA In				
HAP-6B	Mon-3/18	08:40	TE3	U857	28.85	-	7.24	-	-	7.88	-	-	1.46	-	-	600.4	-	-	507.8	-	-	6.76	-	-	0.90	7.66					
HAP-6B	Mon-3/18	09:30	TE3	U859	31.08	-	7.55	-	-	9.67	-	-	1.75	-	-	604.8	-	-	517.3	-	-	6.21	-	-	0.97	7.19					
HAP-6B	Mon-3/18	10:20	TE3	U861	31.08	-	7.99	-	-	9.89	-	-	1.59	-	-	630.8	-	-	541.6	-	-	7.13	-	-	1.10	8.23					
HAP-6B	Mon-3/18	11:20	TE3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.61	-	-	1.05	8.66					
HAP-6B	Mon-3/18	12:00	TE3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
Averages																				6.93				1.01				7.93			
Bag Mat'l on Sampling Filter																															
HAP-7	Tue-3/19	10:10	TE3	U866	30.58	-	7.45	-	-	19.70	-	-	14.90	-	-	600.0	-	-	520.7	CRG-2	CRG-2	CRG-2	CRG-2	CRG-2	CRG-2	CRG-2	CRG-2				
HAP-7	Tue-3/19	11:30	TE3	U869	31.64	-	7.68	-	-	18.40	-	-	14.10	-	-	586.0	-	-	561.6	-	-	14.64	-	-	9.61	24.25					
HAP-7	Tue-3/19	12:30	TE3	U872	30.62	-	8.25	-	-	18.80	-	-	11.90	-	-	603.6	-	-	559.3	-	-	12.91	-	-	9.48	22.39					
Averages																				13.87				9.11				22.97			
Bag Mat'l on Sampling Filter																															
HAP-8	Wed-3/20	10:10	TE3	U875	33.00	-	6.54	-	-	13.70	-	-	21.60	-	-	584.4	-	-	495.9	CRG-2	CRG-2	CRG-2	CRG-2	CRG-2	CRG-2	CRG-2	CRG-2				
HAP-8	Wed-3/20	11:30	TE3	U878	29.76	-	6.44	-	-	12.50	-	-	20.50	-	-	564.1	-	-	459.2	-	-	9.19	-	-	12.30	21.49					
HAP-8	Wed-3/20	12:30	TE3	U881	31.50	-	6.04	-	-	11.50	-	-	19.60	-	-	558.3	-	-	465.1	-	-	8.97	-	-	11.98	20.96					
Averages																				8.35				11.47				19.82			
BSL, Ryton Bags, 8000scfm																															
HAP-5R	Thu-3/21	08:00	TE3	U883	32.17	-	6.90	-	-	28.40	-	-	18.40	-	-	553.8	-	-	482.6	SDA In	SDA In	SDA In	SDA In	SDA In	SDA In	SDA In	SDA In				
HAP-5R	Thu-3/21	09:20	TE3	U885	38.76	-	7.70	-	-	23.00	-	-	4.49	-	-	596.1	-	-	556.6	-	-	18.52	-	-	10.46	28.98					
HAP-5R	Thu-3/21	10:20	TE3	U887	33.28	-	7.97	-	-	18.50	-	-	3.69	-	-	595.0	-	-	515.0	-	-	13.40	-	-	2.44	15.84					
HAP-5R	Thu-3/21	11:50	TE3	U889	30.31	-	7.65	-	-	15.70	-	-	3.56	-	-	604.4	-	-	481.8	-	-	12.53	-	-	2.16	14.69					
Averages																				12.60				2.25				14.85			
Bag Mat'l on Sampling Filter																															
HAP-9	Fri-3/22	08:00	TE3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	CRG-2	CRG-2	CRG-2	CRG-2	CRG-2	CRG-2	CRG-2	CRG-2				
HAP-9	Fri-3/22	09:00	TE3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
HAP-9	Fri-3/22	10:00	TE3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
Averages																															
Carbon, Ryton Bags, 250F PJFF Out.																															
HAP-10A	Mon-3/25	09:30	TE3	U898	39.27	-	8.38	-	-	29.20	-	-	39.30	-	-	601.1	-	-	523.2	PI In	PI In	PI In	PI In	PI In	PI In	PI In	PI In				
HAP-10A	Mon-3/25	10:30	TE3	U901	32.19	-	7.83	-	-	19.20	-	-	36.60	-	-	587.5	-	-	518.2	-	-	16.93	-	-	19.84	36.77					
HAP-10A	Mon-3/25	11:15	TE3	U904	41.26	-	8.42	-	-	65.05	-	-	44.15	-	-	586.7	-	-	481.9	-	-	13.27	-	-	22.32	35.59					
Averages																				21.75				20.56				42.31			
Carbon, Ryton Bags, 250F PJFF Out.																															
HAP-10B	Tue-3/26	08:00	TE3	U907	35.62	-	8.80	-	-	8.50	-	-	37.56	-	-	598.7	-	-	545.2	PI In	PI In	PI In	PI In	PI In	PI In	PI In	PI In				
HAP-10B	Tue-3/26	09:00	TE3	U910	37.80	-	9.43	-	-	15.34	-	-	39.35	-	-	548.7	-	-	537.5	-	-	5.41	-	-	21.78	27.19					
HAP-10B	Tue-3/26	09:45	TE3	U913	46.41	-	11.16	-	-	23.60	-	-	43.70	-	-	568.8	-	-	546.0	-	-	8.43	-	-	21.20	29.63					
Averages																				8.27				20.82				29.08			

*Shaded areas indicate sampling problems. H=Peroxide. TE3=Tris/EDTA(10mM). a=Data from testing acrylic bag materials only. FGlass=Fiberglass. G-FGlass=Cortex on Fiberglass.

ECTC PRDA HAPS Testing
Mercury Gas Sampling Results
Post-Spiking Inlet Location

Test ID	Date	Start Time	Other Imp. Cont.	ID	Gas Volume (dscf)	Moisture (% H2O)	Inlet O2 (%)	Solid Hg	Other	Other	H2O2	H2O2	KMnO4	Solid Hg	Other	Other	H2O2	H2O2	KMnO4	Solid Hg	Other	Other	H2O2	H2O2	KMnO4	Total			
								Sample [Hg] (ppm)	Sample [Hg] (ng/ml)	Sample [Hg] (ng/ml)	Sample [Hg] (ng/ml)	Sample [Hg] (ng/ml)	Sample [Hg] (ng/ml)	Sample Mass (g)	Sample Mass (g)	Sample Mass (g)	Sample Mass (g)	Sample Mass (g)	Sample Mass (g)	[Hg] In Gas (µg/Nm3)	[Hg] In Gas (µg/Nm3)	[Hg] In Gas (µg/Nm3)	[Hg] In Gas (µg/Nm3)	[Hg] In Gas (µg/Nm3)	[Hg] In Gas (µg/Nm3)	[Hg] In Gas (µg/Nm3)	[Hg] In Gas (µg/Nm3)		
BSL, Ryton, 250F PJFF Out.																													
HAP-11	Wed-3/27	08:00	TE3	U916	36.88	-	8.19	-	-	13.39	-	-	40.97	-	-	543.7	-	-	477.9	PIIn	PIIn	PIIn	PIIn	PIIn	PIIn	PIIn			
HAP-11	Wed-3/27	09:00	TE3	U919	39.71	-	8.19	-	-	13.17	-	-	44.80	-	-	644.5	-	-	489.6	-	-	8.10	-	-	20.93	27.59			
HAP-11	Wed-3/27	09:45	TE3	U922	40.03	-	7.09	-	-	17.82	-	-	49.37	-	-	597.3	-	-	456.7	-	-	10.07	-	-	20.93	29.03			
Averages																						8.55			20.79			29.34	
Fine Fly Ash Accumulation																													
HAP-11A	Thu-3/28	09:30	TE3	U925	37.05	-	7.00	-	-	18.40	-	-	50.50	-	-	594.0	-	-	490.2	PIIn	PIIn	PIIn	PIIn	PIIn	PIIn	PIIn			
HAP-11A	Thu-3/28	10:30	TE3	U928	41.86	-	7.91	-	-	22.90	-	-	62.47	-	-	601.7	-	-	464.9	-	-	12.47	-	-	25.31	36.49			
HAP-11A	Thu-3/28	11:15	TE3	U931	37.64	-	8.85	-	-	16.30	-	-	46.71	-	-	594.9	-	-	527.9	-	-	9.76	-	-	26.28	38.75			
Averages																						11.13			25.47			36.60	
Fine Fly Ash Accumulation																													
HAP-11B	Fri-3/29	07:00	TE3	U934	36.60	-	7.31	-	-	18.99	-	-	55.69	-	-	578.0	-	-	462.5	PIIn	PIIn	PIIn	PIIn	PIIn	PIIn	PIIn			
HAP-11B	Fri-3/29	07:45	TE3	U937	35.54	-	6.91	-	-	18.58	-	-	47.64	-	-	590.4	-	-	498.0	-	-	11.36	-	-	26.66	38.03			
HAP-11B	Fri-3/29	08:45	TE3	U940	36.85	-	6.96	-	-	18.32	-	-	44.08	-	-	596.7	-	-	553.0	-	-	11.70	-	-	25.29	36.99			
Averages																						11.43			25.67			37.10	

*Shaded areas indicate sampling problems. H=Peroxide. TE3=Tris/EDTA(10mM). a=Data from testing acrylic bag materials only. FGlass=Fiberglass G-FGlass=Gravel on Fiberglass.