TOXECON™ RETROFIT FOR MERCURY AND MULTI-POLLUTANT CONTROL ON THREE 90-MW COAL-FIRED BOILERS

Quarterly Technical Progress Report
Reporting Period: January 1, 2007 – March 31, 2007
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DISCLAIMER

ABSTRACT

With the Nation's coal-burning utilities facing tighter controls on mercury pollutants, the U.S. Department of Energy is supporting projects that could offer power plant operators better ways to reduce these emissions at much lower costs. Sorbent injection technology represents one of the simplest and most mature approaches to controlling mercury emissions from coal-fired boilers. It involves injecting a solid material such as powdered activated carbon into the flue gas. The gas-phase mercury in the flue gas contacts the sorbent and attaches to its surface. The sorbent with the mercury attached is then collected by a particulate control device along with the other solid material, primarily fly ash.

We Energies has over 3,200 MW of coal-fired generating capacity and supports an integrated multi-emission control strategy for SO_2, NO_x, and mercury emissions while maintaining a varied fuel mix for electric supply. The primary goal of this project is to reduce mercury emissions from three 90-MW units that burn Powder River Basin coal at the We Energies Presque Isle Power Plant. Additional goals are to reduce nitrogen oxide (NO_x), sulfur dioxide (SO_2), and particulate matter (PM) emissions, allow for reuse and sale of fly ash, demonstrate a reliable mercury continuous emission monitor (CEM) suitable for use in the power plant environment, and demonstrate a process to recover mercury captured in the sorbent. To achieve these goals, We Energies (the Participant) will design, install, and operate a TOXECON™ system designed to clean the combined flue gases of Units 7, 8, and 9 at the Presque Isle Power Plant.

TOXECON™ is a patented process in which a fabric filter system (baghouse) installed downstream of an existing particulate control device is used in conjunction with sorbent injection for removal of pollutants from combustion flue gas. For this project, the flue gas emissions will be controlled from the three units using a single baghouse. Mercury will be controlled by injection of activated carbon or other novel sorbents, while NO_x and SO_2 will be controlled by injection of sodium-based or other novel sorbents. Addition of the TOXECON™ baghouse will provide enhanced particulate control. Sorbents will be injected downstream of the existing particulate control device to allow for continued sale and reuse of captured fly ash from the existing particulate control device, uncontaminated by activated carbon or sodium sorbents.

Methods for sorbent regeneration, i.e., mercury recovery from the sorbent, will be explored and evaluated. For mercury concentration monitoring in the flue gas streams, components available for use will be evaluated and the best available will be integrated into a mercury CEM suitable for use in the power plant environment. This project will provide for the use of a control system to reduce emissions of mercury while minimizing waste from a coal-fired power generation system.

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EXECUTIVE SUMMARY

Wisconsin Electric Power Company (We Energies) signed a Cooperative Agreement with the U.S. Department of Energy (DOE) in March 2004 to fully demonstrate TOXECON™ for mercury control at the We Energies Presque Isle Power Plant. The primary goal of this project is to reduce mercury emissions from three 90-MW units (Units 7, 8, and 9) that burn Powder River Basin (PRB) coal. Additional goals are to reduce nitrogen oxide (NO_x), sulfur dioxide (SO_2), and particulate matter (PM) emissions, allow for reuse and sale of fly ash, demonstrate a reliable mercury continuous emission monitor (CEM) suitable for use in the power plant environment, and demonstrate a process to recover mercury captured in the sorbent.

We Energies has teamed with ADA-ES, Inc., (ADA-ES) and Cummins & Barnard, Inc., (C&B) to execute this project. ADA-ES is providing engineering and management on the mercury measurement and control systems. Cummins & Barnard is the engineer of record and will be responsible for construction, management, and startup of the TOXECON™ equipment.

This project was selected for negotiating an award in January 2003. Preliminary activities covered under the "Pre-Award" provision in the Cooperative Agreement began in March 2003. This Quarterly Technical Progress Report summarizes progress made on the project from January 1, 2007, through March 31, 2007. During this reporting period, work was conducted on the following tasks:

- Task 12. Balance-of-Plant Electrical Installations
- Task 15. Operate, Test, Data Analysis, and Optimize TOXECON™ for Mercury Control
- Task 16. Operate, Test, Data Analysis, and Optimize TOXECON™ for SO_2/NO_x Control
- Task 19. Reporting, Management, Subcontracts, Technology Transfer

INTRODUCTION

DOE awarded Cooperative Agreement Number DE-FC26-04NT41766 to We Energies to demonstrate TOXECON™ for mercury and multi-pollutant control, a reliable mercury continuous emission monitor (CEM), and a process to recover mercury captured in the sorbent. Under this agreement, We Energies is working in partnership with the DOE.

Quarterly Technical Progress Reports will provide project progress, results from technology demonstrations, and technology transfer information.

Project Objectives

The specific objectives of this project are to demonstrate the operation of the TOXECON™ multi-pollutant control system and accessories, and

- Achieve 90% mercury removal from flue gas through activated carbon injection
- Evaluate the potential for 70% SO_2 control and trim control of NO_x from flue gas through sodium-based or other novel sorbent injection
- Reduce PM emission through collection by the TOXECON™ baghouse
- Recover 90% of the mercury captured in the sorbent
- Utilize 100% of fly ash collected in the existing electrostatic precipitator
- Demonstrate a reliable, accurate mercury CEM suitable for use in the power plant environment
- Successfully integrate and optimize TOXECON™ system operation for mercury and multi-pollutant control

Scope of Project

The "TOXECON™ Retrofit for Mercury and Multi-Pollutant Control on Three 90-MW Coal-Fired Boilers" project will be completed in two Budget Periods. These two Budget Periods are:

<u>Budget Period 1</u>: Project Definition, Design and Engineering, Prototype Testing, Major Equipment Procurement, and Foundation Installation. Budget Period 1 initiated the project with project definition activities including NEPA, followed by design, which included specification and procurement of long lead-time major equipment, and installation of foundations. In addition, testing of prototype mercury CEMs was conducted. Activities under Budget Period 1 were completed during 1Q05.

<u>Budget Period 2</u>: CEM Demonstration, TOXECON™ Erection, TOXECON™ Operation, and Carbon Ash Management Demonstration. In Budget Period 2, the TOXECON™ system was constructed and will be operated. Operation will include optimization for mercury control, parametric testing for SO_2 and NO_x control, and long-term testing for mercury control. The mercury CEM and sorbent regeneration processes will be demonstrated in conjunction with the TOXECON™ system operation.

The project continues to move through Budget Period 2 as of the current reporting period. Each task is described in the Statement of Project Objectives (SOPO) that is part of the Cooperative Agreement.

EXPERIMENTAL

None to report.

RESULTS AND DISCUSSION

Following are descriptions of the work performed on project tasks during this reporting period.

Task 1 – Design Review Meeting

Work associated with this task was previously completed.

Task 2 – Project Management Plan

Work associated with this task was previously completed.

Task 3 – Provide NEPA Documentation, Environmental Approvals Documentation, and Regulatory Approval Documentation

Work associated with this task was previously completed.

Task 4 – Balance-of-Plant (BOP) Engineering

Work associated with this task was completed during 1Q05 in Budget Period 1.

Task 5 – Process Equipment Design and Major Equipment Procurement

Work associated with this task was completed during 1Q05 in Budget Period 1.

Task 6 – Prepare Construction Plan

Work associated with this task was completed during 1Q05 in Budget Period 1. The Construction Plan was issued on January 26, 2005.

Task 7 – Procure Mercury Continuous Emission Monitor (CEM) Package and Perform Engineering and Performance Assessment

The overall goal of this task was to have a compliance-grade, reliable, certified mercury CEM installed and operational for use in the TOXECON™ evaluation. Installation and checkout of two CEMs at the inlet and at the outlet of the baghouse was completed in 1Q06. The long-term evaluation of the mercury CEMs is described in Task 15 for the remainder of the project.

Task 8 – Mobilize Contractors

Contractor mobilization was completed in 2Q05. Jamar, Boldt, Northland Electric, United Anco, PCI, Wheelabrator, and CaTS demobilized from the site during 4Q05. CaTS personnel completed their assignments and CaTS Construction Management Team demobilized from the site during 1Q06.

Task 9 – Foundation Erection

All major foundation work by Boldt Construction Company was completed during 1Q05.

Task 10 – Erect Structural Steel, Baghouse, and Ductwork

The erection work associated with this task was initiated during 2Q05.

The work effort for this task during 1Q07 was limited to completion of some minor work associated with moving the penthouse air intake louvers, evaluating options to the HVAC system in the fan building, repairing roof leaks, installing angle iron frames around the compartment covers, and sealing of the baghouse compartment covers to address exception/punch list items.

Task 11 – Balance-of-Plant Mechanical and Civil/Structural Installations

Primary work associated with this task was completed in 4Q05.

Task 12 – Balance-of-Plant Electrical Installations

Primary work associated with this task was completed in 4Q05. Some minor punch list items were completed this quarter.

Task 13 – Equipment Pre-Operational Testing

Pre-operational testing was completed in 4Q05.

Task 14 – Startup and Operator Training

Startup of all major equipment was completed in 4Q05. Final O&M manuals were received for most major equipment in 2005. Startup of the PAC system occurred in 1Q06.

The operator-training program was completed during 4Q05 to train the plant operations personnel.

The baghouse was initially brought into operation on December 17, 2005, with flue gas from Unit 7. Initial operation with Unit 8 occurred on January 5, 2006, and Unit 9 on January 27, 2006.

Task 15 – Operate, Test, Data Analysis, and Optimize TOXECON™ for Mercury Control

CEM Update

During 1Q07, the CEMs were monitored for long-term operation. The following work was performed on the CEMs:

- The boards in all four probes were replaced in order to help with temperature-induced noise
- The CEM software was updated at both the inlet and outlet
- The Hydra software was updated at the inlet
- The redundant solar blind filters in the PMTs were initially removed in late January then replaced in March (details below)
- An oxidized mercury calibration source was installed and tested at the outlet CEM
- The inlet was reconfigured so that it samples from two ducts simultaneously

January Maintenance and Calibration

The following is a maintenance summary and calibration record for PIPP during January 2007, presented separately for the inlet (80) and outlet (90) Thermo analyzers.

Maintenance

- On-site for maintenance and upgrades January 23 through 31, including replacing all the probe controller boards, upgrading the software on the inlet analyzer, correcting the actuator on Unit 9 probe and installing new elemental orifice on Unit 8 probe, as well as increasing PMT voltage on outlet.
- Tests conducted with the sorbent screening device from January 26 through 29, this impacts the calibration record for the inlet.

Calibration at Inlet

NOTE: Acceptance Criteria = Calibration Error (CE) $\leq$5.0% of Span OR |R-A| $\leq$1.0 μg/m^3

- No speciation.
- Dilution ratio changed and span calibration value set to 10 on 1/25.
- Several span calibrations did not pass, zeros were better with all but one passing; zero and span response tended to be low at the end of the month.

January Hg(t):

Zero - Did not pass on 1/18; response range –0.60 to 0.67 μg/m^3 (-3.0 to 3.4% error)

Span - Did not pass on 1/1 – 1/8, 1/12 - 1/13, 1/21, 1/25-1/27, 1/29, 1/31; response range of passing 10.21 to 11.52 µg/m^3 (-3.93 to 2.62% error)

Table 1. January Inlet CEM Maintenance

Date	Maintenance/Impacts on Performance	Corrective Action/Adjustment to Data
On-going	Monitoring cal factors manually.	Based on equations in the spreadsheet the cal factors are manually adjusted for calculating Hg, and adjusted at the analyzer if necessary.

Table 2. January Inlet CEM Calibration Records

			Hg(t) Zero	Hg(t) Span	Hg(t) Zero Error	Hg(t) Span Error	Hg(t) Bkg	Hg(t) Coeff	Hg(0) Zero	Hg(0) Span	Hg(0) Bkg	Hg(0) Coeff
1/1/2007	F-zero	F-Span	-0.29	12.35	-1.47	6.76	19.07	1.19	0.00	0.00	17.34	0.98
1/2/2007	F-zero	F-Span	0.25	0.51	1.27	-52.47	19.07	1.19	0.00	0.00	17.34	0.98
1/3/2007	F-zero	F-Span	0.49	2.14	2.44	-44.32	19.07	1.19	0.00	0.00	17.34	0.98
1/4/2007	F-zero	F-Span	0.34	12.25	1.69	6.27	19.07	1.19	0.00	0.00	17.34	0.98
1/5/2007	F-zero	F-Span	-0.22	12.58	-1.09	7.88	19.07	1.19	0.00	0.00	17.34	0.98
1/6/2007	F-zero	F-Span	0.33	13.12	1.63	10.58	19.07	1.19	0.00	0.00	17.34	0.98
1/7/2007	F-zero	F-Span	-0.06	12.64	-0.32	8.18	19.07	1.19	0.00	0.00	17.34	0.98
1/8/2007	F-zero	F-Span	0.04	12.53	0.20	7.65	19.07	1.19	0.00	0.00	17.34	0.98
1/9/2007	F-zero	F-Span	0.29	11.03	1.47	0.14	16.83	1.04	0.00	0.00	17.34	0.98
1/10/2007	F-zero	F-Span	0.67	11.52	3.37	2.62	16.83	1.04	0.00	0.00	17.34	0.98
1/11/2007	F-zero	F-Span	0.64	11.45	3.18	2.25	16.83	1.04	0.00	0.00	17.34	0.98
1/12/2007	F-zero	F-Span	0.05	4.97	0.26	-30.15	16.83	1.04	0.00	0.00	17.34	0.98
1/13/2007	F-zero	F-Span	-0.33	-0.68	-1.67	-58.40	16.83	1.04	0.00	0.00	17.34	0.98
1/14/2007	F-zero	F-Span	0.62	10.92	3.12	-0.38	16.83	1.04	0.00	0.00	17.34	0.98
1/15/2007	F-zero	F-Span	0.66	10.67	3.32	-1.66	16.83	1.04	0.00	0.00	17.34	0.98
1/16/2007	F-zero	F-Span	-0.29	10.32	-1.46	-3.41	16.83	1.04	0.00	0.00	17.34	0.98
1/17/2007	F-zero	F-Span	-0.09	10.82	-0.44	-0.90	19.24	1.15	0.00	0.00	17.34	0.98
1/18/2007	F-zero	F-Span	-1.53	10.21	-7.65	-3.93	19.24	1.15	0.00	0.00	17.34	0.98
1/19/2007	F-zero	F-Span	-0.49	11.05	-2.43	0.27	19.18	1.93	0.00	0.00	17.34	0.98
1/20/2007	F-zero	F-Span	0.08	11.19	0.42	0.93	19.18	1.93	0.00	0.00	17.34	0.98
1/21/2007	F-zero	F-Span	-0.60	9.79	-3.00	-6.04	19.18	1.93	0.00	0.00	17.34	0.98
1/22/2007	F-zero	F-Span	0.10	11.52	0.52	2.62	19.18	1.93	0.00	0.00	17.34	0.98
1/23/2007	F-zero	F-Span	-0.39	11.02	-1.96	0.12	19.18	1.93	0.00	0.00	17.34	0.98
1/24/2007	F-zero	F-Span	-0.52	11.49	-2.60	2.43	19.18	1.93	0.00	0.00	17.34	0.98
1/25/2007	F-zero	F-Span	-0.50	8.57	-2.52	-7.13	21.53	1.44	0.00	0.00	17.34	0.98
1/26/2007	F-zero	F-Span	-0.43	8.12	-2.13	-9.39	8.74	1.43	0.00	0.00	17.34	0.98
1/27/2007	F-zero	F-Span	-0.27	4.02	-1.37	-29.89	7.87	1.39	0.00	0.00	17.34	0.98
1/28/2007	F-zero	F-Span	-0.36	10.57	-1.79	2.87	8.05	1.42	0.00	0.00	17.34	0.98
1/29/2007	F-zero	F-Span	-0.10	8.19	-0.52	-9.05	6.22	1.13	0.00	0.00	17.34	0.98
1/30/2007	working on system		no calibration data						0.00	0.00	17.34	0.98
1/31/2007	F-zero	F-Span	-0.28	8.61	-1.41	-6.95	6.67	1.22	0.00	0.00	17.34	0.98

Note: Calibration record does not reflect adjustments made to correct for problems.

Calibration at Outlet

- Dilution ratio changed and span calibration value set to 10 on 1/25.
- Hg(t) zero calibrations all passed, Hg(0) zero passed all but two days; Hg(t) span calibrations passed all but one day, Hg(0) spans did not perform as well.
- Hg(t) and Hg(0) zero and span response not consistently high or low.

January Hg(t):

Zero - Response range –0.63 to 0.54 µg/m^3

Span - Did not pass on 1/24; response range -2.54% to 3.28% error

January Hg(0):

Zero - Did not pass on 1/24, 1/29; response range of passing –0.60 to 0.86 µg/m^3

Span - Did not pass on 1/1, 1/3, 1/5, 1/7, 1/22, 1/24-1/25; response range of passing -4.54% to 4.92% error

Table 3. January Outlet CEM Maintenance

Date	Maintenance/Impacts on Performance	Corrective Action/Adjustment to Data
On-going	Monitoring cal factors manually.	Based on equations in the spreadsheet the cal factors are manually adjusted for calculating Hg, and adjusted at the analyzer if necessary.

Table 4. January Outlet CEM Calibration Records

			Hg(t) Zero	Hg(t) Span	Hg(t) Zero Error	Hg(t) Span Error	Hg(t) Bkg	Hg(t) Coeff	Hg(0) Zero	Hg(0) Span	Hg(0) Zero Error	Hg(0) Span Error
1/1/2007	F-zero	F-Span	0.28	5.42	1.38	2.12	30.63	0.58	0.16	4.00	0.79	-5.00
1/2/2007	F-zero	F-Span	0.25	5.28	1.24	1.39	30.63	0.58	0.13	4.09	0.67	-4.54
1/3/2007	F-zero	F-Span	-0.33	4.86	-1.66	-0.72	30.63	0.58	-0.50	3.75	-2.49	-6.27
1/4/2007	F-zero	F-Span	0.10	4.75	0.51	-1.23	30.63	0.58	0.54	4.10	2.70	-4.50
1/5/2007	F-zero	F-Span	-0.16	4.93	-0.81	-0.34	30.63	0.58	-0.18	3.90	-0.90	-5.51
1/6/2007	F-zero	F-Span	-0.17	5.12	-0.87	0.62	30.63	0.58	0.29	5.14	1.47	0.70
1/7/2007	F-zero	F-Span	-0.10	5.03	-0.48	0.14	30.63	0.58	-0.14	6.32	-0.72	6.60
1/8/2007	F-zero	F-Span	-0.06	4.79	-0.31	-1.03	30.63	0.58	0.24	5.98	1.18	4.92
1/9/2007	F-zero	F-Span	0.35	5.05	1.77	0.25	31.47	0.69	0.18	5.53	0.88	2.67
1/10/2007	F-zero	F-Span	-0.02	5.09	-0.09	0.46	31.47	0.69	0.07	5.69	0.34	3.43
1/11/2007	F-zero	F-Span	-0.22	4.81	-1.09	-0.95	30.77	0.75	-0.28	4.59	-1.42	-2.07
1/12/2007	F-zero	F-Span	0.20	5.19	1.00	0.93	30.77	0.75	-0.44	5.09	-2.18	0.45
1/13/2007	F-zero	F-Span	0.06	5.08	0.29	0.40	30.77	0.75	-0.14	5.22	-0.69	1.10
1/14/2007	F-zero	F-Span	-0.02	4.62	-0.10	-1.89	30.77	0.75	-0.37	5.23	-1.86	1.14
1/15/2007	F-zero	F-Span	-0.20	4.98	-1.01	-0.10	30.77	0.75	-0.26	4.65	-1.28	-1.74
1/16/2007	F-zero	F-Span	0.11	4.66	0.57	-1.68	30.77	0.75	0.06	5.35	0.30	1.74
1/17/2007	F-zero	F-Span	-0.08	4.76	-0.40	-1.18	30.77	0.75	-0.32	4.81	-1.59	-0.97
1/18/2007	F-zero	F-Span	0.20	4.75	1.99	-2.54	30.77	0.75	-0.02	4.65	-0.17	-3.49
1/19/2007	F-zero	F-Span	-0.13	5.07	-1.30	0.68	30.77	0.75	-0.60	4.91	-5.97	-0.85
1/20/2007	F-zero	F-Span	-0.10	4.99	-1.03	-0.12	29.47	0.80	0.38	4.75	3.82	-2.53
1/21/2007	F-zero	F-Span	0.02	4.83	0.23	-1.69	29.47	0.80	-0.09	5.32	-0.91	3.16
1/22/2007	F-zero	F-Span	0.35	4.76	3.53	-2.45	29.47	0.80	0.38	5.55	3.78	5.49
1/23/2007	F-zero	F-Span	0.54	5.33	5.43	3.28	29.47	0.80	0.52	5.23	5.24	2.28
1/24/2007	F-zero	F-Span	-0.63	21.54	-6.28	12.30	26.24	1.00	-1.10	16.47	-10.95	-37.64
1/25/2007	F-zero	F-Span	-0.07	9.98	-0.71	-0.12	28.27	0.83	-0.04	8.88	-0.43	-5.58
1/26/2007	F-zero	F-Span	-0.19	9.94	-1.88	-0.30	29.12	0.79	-0.09	9.60	-0.88	-2.01
1/27/2007	F-zero	F-Span	0.47	10.14	4.72	0.71	27.53	0.80	0.86	10.40	8.58	2.00
1/28/2007	F-zero	F-Span	-0.07	10.08	-0.72	0.38	28.60	0.85	0.12	9.79	1.24	-1.05
1/29/2007	F-zero	F-Span	0.34	10.58	3.39	2.90	28.60	0.85	1.03	10.32	10.31	1.59
1/30/2007	F-zero	F-Span	0.02	10.33	0.16	1.64	29.25	0.85	0.04	9.78	0.41	-1.12
1/31/2007	F-zero	F-Span	-0.08	9.51	-0.79	-2.47	29.25	0.85	-0.14	9.48	-1.41	-2.58

Note: Calibration record does not reflect adjustments made to correct for problems.

February 2007 Maintenance and Calibration

The following is a maintenance summary and calibration record for PIPP during February 2007, presented separately for the inlet (80) and outlet (90) Thermo analyzers.

Maintenance

- On-site February 25-26 to conduct maintenance and upgrades.

Calibration at Inlet

NOTE: Acceptance Criteria = Calibration Error (CE) $\leq$5.0% of Span OR |R-A| $\leq$1.0 µg/m^3 with R = 11.0 (reset 2/3)

- No speciation.

- Continuing issues with the analyzer locking up after the new software was installed at the end of January, some data lost overnight 2/5 until the morning of 2/6.
- Averaging time set to 120 sec from 60 sec to reduce noise.
- New software installed on 2/25, however it does not record the calibration span value. The system was put into filter zero on 2/28 until personnel could be on-site to conduct maintenance in March.
- Most zero and span calibrations did not pass while the issues were being resolved; zero and span response tended to be high (>0 and >11).

February Hg(t):

Zero - Response range of passing –0.08 to 0.93 μg/m^3 (-0.4 to 4.6% error)
Span - Response range of passing 10.08 to 11.99 μg/m^3 (-4.6 to 4.95% error)

Table 5. February Inlet CEM Maintenance

Date	Maintenance/Impacts on Performance	Corrective Action/Adjustment to Data
On-going	Monitoring cal factors manually.	Adjusting calibration factors or conducting manual calibrations when necessary as specified in CEMS procedure.

Inlet Calibration Record

Note:

- Red = CE >5% or |R - A| > 1.0 and calibration did not pass (in response a manual cal is done to reset factors)
- Yellow = CE >2.5% or |R - A| > 0.5 and calibration error is above internally set maintenance level (in response cal factors are adjusted)

Table 6. February Inlet CEM Calibration Records

FILTER ZERO / FILTER SPAN CALIBRATION RECORD											
DATE	TIME	PBSPN	REF SPAN	HGO ZERO	HGO SPAN	HGT ZERO	HGT SPAN	HGO BKG	HGT BKG	HGO COEF	HGT COEF
(F) 2/1/2007	20:24 - 20:49	10.0	20.0	-	-	-1.23 (-6.1%)	2.23 (-38.9%)	0.000	7.579	1.000	1.298
(F) 2/2/2007	07:43 - 08:02	10.0	20.0	-	-	-1.18 (-5.9%)	7.99 (-10.1%)	0.000	19.475	1.000	1.708
(F) 2/3/2007	07:43 - 08:02	11.0	20.0	-	-	0.14 (0.7%)	11.56 (2.8%)	0.000	21.318	1.000	1.539
(F) 2/4/2007	07:43 - 08:02	11.0	20.0	-	-	-0.08 (-0.4%)	12.12 (5.6%)	0.000	21.318	1.000	1.539
(F) 2/5/2007	07:43 - 08:02	11.0	20.0	-	-	1.10 (5.5%)	12.76 (8.8%)	0.000	21.318	1.000	1.539
(F) 2/6/2007	13:11 - 13:34	11.0	20.0	-	-	-3.75 (-18.7%)	7.49 (-17.5%)	0.000	24.910	1.000	1.539
(F) 2/7/2007	07:43 - 08:02	11.0	20.0	-	-	0.35 (1.7%)	9.95 (-5.3%)	0.000	19.195	1.000	1.419
(F) 2/8/2007	07:39 - 07:58	11.0	20.0	-	-	1.03 (5.1%)	11.44 (2.2%)	0.000	15.762	1.000	1.153
(F) 2/9/2007	07:39 - 07:58	11.0	20.0	-	-	-1.82 (-9.1%)	11.64 (3.2%)	0.000	27.063	1.000	1.772
(F) 2/10/2007	07:39 - 07:58	11.0	20.0	-	-	3.34 (16.7%)	10.81 (-1.0%)	0.000	9.838	1.000	0.734
(F) 2/11/2007	07:39 - 07:58	11.0	20.0	-	-	3.31 (16.5%)	10.08 (-4.6%)	0.000	9.838	1.000	0.734
(F) 2/12/2007	07:39 - 07:58	11.0	20.0	-	-	3.18 (15.9%)	10.22 (-3.9%)	0.000	9.838	1.000	0.734
(F) 2/13/2007	07:39 - 07:58	11.0	20.0	-	-	-2.80 (-14.0%)	2.59 (-42.0%)	0.000	13.097	1.000	0.734
(F) 2/14/2007	07:39 - 07:58	11.0	20.0	-	-	0.06 (0.3%)	9.87 (-5.6%)	0.000	18.675	1.000	1.363
(F) 2/15/2007	07:39 - 07:58	11.0	20.0	-	-	-1.70 (-8.5%)	9.12 (-9.4%)	0.000	19.440	1.000	1.359
(F) 2/16/2007	07:39 - 07:58	11.0	20.0	-	-	2.99 (14.9%)	11.38 (1.9%)	0.000	11.129	1.000	0.846
(F) 2/17/2007	07:39 - 07:58	11.0	20.0	-	-	1.11 (5.6%)	11.60 (3.0%)	0.000	17.847	1.000	1.280
(F) 2/18/2007	07:39 - 07:58	11.0	20.0	-	-	1.28 (6.4%)	11.48 (2.4%)	0.000	17.847	1.000	1.280
(F) 2/19/2007	07:39 - 07:58	11.0	20.0	-	-	0.40 (2.0%)	11.35 (1.8%)	0.000	17.847	1.000	1.280
(F) 2/20/2007	07:39 - 07:58	11.0	20.0	-	-	0.93 (4.6%)	11.97 (4.9%)	0.000	17.847	1.000	1.280
(F) 2/21/2007	07:39 - 07:58	11.0	20.0	-	-	0.05 (0.2%)	11.20 (1.0%)	0.000	17.847	1.000	1.280
(F) 2/22/2007	07:39 - 07:58	11.0	20.0	-	-	0.83 (4.1%)	11.99 (5.0%)	0.000	17.847	1.000	1.280
(F) 2/23/2007	07:39 - 07:58	11.0	20.0	-	-	1.31 (6.6%)	11.41 (2.1%)	0.000	17.847	1.000	1.280
(F) 2/24/2007	07:39 - 07:58	11.0	20.0	-	-	1.66 (8.3%)	12.23 (6.1%)	0.000	15.587	1.000	1.082
(F) 2/25/2007	07:40 - 07:59	11.0	20.0	-	-	-1.85 (-9.3%)	-2.00 (-65.0%)	0.000	49.796	1.000	1.067
(F) 2/26/2007	07:40 - 07:59	11.0	20.0	-	-	-7.91 (-39.6%)	8.11 (-14.5%)	0.000	51.429	1.000	1.119
(F) 2/27/2007	07:40 - 07:59	11.0	20.0	-	-	0.83 (4.2%)	12.23 (6.1%)	0.000	30.188	1.000	1.119
(F) 2/28/2007	07:40 - 07:59	11.0	20.0	-	-	3.25 (16.3%)	3.05 (-39.8%)	0.000	29.798	1.000	1.119

Calibration at Outlet

NOTE: Acceptance Criteria = Calibration Error (CE) ≤5.0% of Span OR |R-A| ≤1.0 μg/m^3 with R = 5.0

- Removed solar blind filter in front of PMT on 2/25. Due to maintenance on the system there is no calibration for 2/25.
- Hg(0) and Hg(t) zero and span calibrations all passed.
- Hg(0) and Hg(t) zero and span response was not consistently high or low.

February Hg(0):

Zero - Response range –0.83 to 0.83 μg/m^3

Span - Response range 4.07 to 5.85 μg/m^3

February Hg(t):

Zero - Response range –0.90 to 0.71 μg/m^3

Span - Response range 4.28 to 5.67 μg/m^3

Table 7. February Outlet CEM Maintenance

Date	Maintenance/Impacts on Performance	Corrective Action/Adjustment to Data
On-going	Monitoring cal factors manually.	Adjusting calibration factors or conducting manual calibrations when necessary as specified in CEMS procedure.

Outlet Calibration Record

Note:

- Red = For reference span of 10, |R - A| > 1.0 and calibration did not pass (in response a manual cal is done to reset factors)
- Yellow = For reference span of 10, |R - A| > 0.5 and calibration error is above internally set maintenance level (in response cal factors are adjusted)

Table 8. February Outlet CEM Calibration Records

FILTER ZERO / FILTER SPAN CALIBRATION RECORD											
DATE	TIME	PBSPN	REF SPAN	HGO ZERO	HGO SPAN	HGT ZERO	HGT SPAN	HGO BKG	HGT BKG	HGO COEF	HGT COEF
(F) 2/1/2007	08:49 - 09:10	5.0	10.0	0.01 (0.1%)	4.68 (-3.2%)	-0.36 (-3.6%)	4.64 (-3.6%)	28.353	28.896	1.382	1.004
(F) 2/2/2007	07:42 - 08:01	5.0	10.0	0.21 (2.1%)	4.83 (-1.7%)	0.04 (0.4%)	5.12 (1.2%)	30.206	30.616	1.482	1.008
(F) 2/3/2007	07:42 - 08:01	5.0	10.0	-0.28 (-2.8%)	4.71 (-2.9%)	-0.33 (-3.3%)	4.63 (-3.7%)	30.206	30.616	1.482	1.008
(F) 2/4/2007	07:42 - 08:01	5.0	10.0	0.13 (1.3%)	4.97 (-0.3%)	0.00 (0.0%)	5.34 (3.4%)	30.206	30.616	1.482	1.008
(F) 2/5/2007	07:42 - 08:01	5.0	10.0	0.32 (3.2%)	5.52 (5.2%)	0.19 (1.9%)	5.24 (2.4%)	30.206	30.616	1.482	1.008
(F) 2/6/2007	07:42 - 08:01	5.0	10.0	0.59 (5.9%)	5.42 (4.2%)	0.28 (2.8%)	5.13 (1.3%)	30.206	30.616	1.482	1.008
(F) 2/7/2007	07:42 - 08:01	5.0	10.0	-0.83 (-8.3%)	4.07 (-9.3%)	-0.90 (-9.0%)	4.28 (-7.2%)	31.901	31.894	1.535	1.004
(F) 2/8/2007	07:38 - 07:57	5.0	10.0	0.00 (0.0%)	4.98 (-0.2%)	-0.70 (-7.0%)	5.52 (5.2%)	31.166	38.138	1.534	1.205
(F) 2/9/2007	07:38 - 07:57	5.0	10.0	0.12 (1.2%)	4.77 (-2.3%)	-0.33 (-3.3%)	5.58 (5.8%)	31.166	38.138	1.534	1.205
(F) 2/10/2007	07:38 - 07:57	5.0	10.0	-0.11 (-1.1%)	5.09 (0.9%)	-0.01 (-0.1%)	5.09 (0.9%)	33.682	32.004	1.652	0.948
(F) 2/11/2007	07:38 - 07:57	5.0	10.0	0.05 (0.5%)	5.36 (3.6%)	0.00 (0.0%)	4.97 (-0.3%)	33.682	32.004	1.652	0.948
(F) 2/12/2007	07:38 - 07:57	5.0	10.0	0.61 (6.1%)	5.72 (7.2%)	0.25 (2.5%)	5.64 (6.4%)	33.682	32.004	1.652	0.948
(F) 2/13/2007	07:38 - 07:57	5.0	10.0	0.83 (8.3%)	5.81 (8.1%)	0.71 (7.1%)	5.57 (5.7%)	33.682	32.004	1.652	0.948
(F) 2/14/2007	07:38 - 07:57	5.0	10.0	-0.25 (-2.5%)	5.07 (0.7%)	-0.30 (-3.0%)	5.13 (1.3%)	34.646	33.656	1.658	0.972
(F) 2/15/2007	07:38 - 07:57	5.0	10.0	0.11 (1.1%)	5.26 (2.6%)	-0.01 (-0.1%)	5.03 (0.3%)	34.646	33.656	1.658	0.972
(F) 2/16/2007	07:38 - 07:57	5.0	10.0	-0.19 (-1.9%)	4.48 (-5.2%)	-0.13 (-1.3%)	5.33 (3.3%)	34.646	33.656	1.658	0.972
(F) 2/17/2007	07:38 - 07:57	5.0	10.0	0.26 (2.6%)	5.21 (2.1%)	0.11 (1.1%)	5.43 (4.3%)	34.646	33.656	1.658	0.972
(F) 2/18/2007	07:38 - 07:57	5.0	10.0	-0.22 (-2.2%)	4.76 (-2.4%)	-0.12 (-1.2%)	4.85 (-1.5%)	34.646	33.656	1.658	0.972
(F) 2/19/2007	07:38 - 07:57	5.0	10.0	-0.37 (-3.7%)	4.82 (-1.8%)	-0.05 (-0.5%)	5.57 (5.7%)	34.646	33.656	1.658	0.972
(F) 2/20/2007	07:38 - 07:57	5.0	10.0	0.06 (0.6%)	5.08 (0.8%)	0.21 (2.1%)	5.46 (4.6%)	34.646	33.656	1.658	0.972
(F) 2/21/2007	07:38 - 07:57	5.0	10.0	-0.32 (-3.2%)	5.28 (2.8%)	0.19 (1.9%)	5.20 (2.0%)	34.646	33.656	1.658	0.972
(F) 2/22/2007	07:38 - 07:57	5.0	10.0	0.29 (2.9%)	5.80 (8.0%)	-0.07 (-0.7%)	5.46 (4.6%)	34.646	33.656	1.658	0.972
(F) 2/23/2007	07:38 - 07:57	5.0	10.0	0.57 (5.7%)	5.85 (8.5%)	0.43 (4.3%)	5.67 (6.7%)	34.646	33.656	1.658	0.972
(F) 2/24/2007	07:38 - 07:57	5.0	10.0	-0.14 (-1.4%)	4.92 (-0.8%)	0.21 (2.1%)	4.85 (-1.5%)	33.370	32.528	1.571	0.979
(F) 2/25/2007 - working on analyzer, so no auto-cal (data highlighted)											
(F) 2/26/2007	07:39 - 07:58	5.0	10.0	-0.02 (-0.2%)	4.94 (-0.6%)	0.04 (0.4%)	4.99 (-0.1%)	11.579	11.578	1.018	1.004
(F) 2/27/2007	07:39 - 07:58	5.0	10.0	0.04 (0.4%)	4.98 (-0.2%)	0.05 (0.5%)	5.04 (0.4%)	11.579	11.578	1.018	1.004
(F) 2/28/2007	07:39 - 07:58	5.0	10.0	0.04 (0.4%)	5.13 (1.3%)	0.08 (0.8%)	5.12 (1.2%)	11.579	11.578	1.018	1.004

March 2007 Maintenance and Calibration

The following is a maintenance summary and calibration record for PIPP during March 2007, presented separately for the inlet (80) and outlet (90) Thermo analyzers.

Maintenance

- On-site week of March 12 to conduct maintenance and upgrades.

Calibration at Inlet

NOTE: Acceptance Criteria = Calibration Error (CE) $\leq$5.0% of Span OR |R-A| $\leq$1.0 µg/m^3 with R = 11.0

- Due to issues with the new software installed in late February, auto-calibrations were suspended and the system was put into filter zero until personnel could be on-site to conduct maintenance the week of March 12. New software was installed then.
- Most zero and span calibrations did not pass while the issues were being resolved.

March Hg(0):

<u>Zero</u> - Response range of passing –0.95 to 0.75 µg/m^3 (-4.7 to 3.8% error)
<u>Span</u> - Response range of passing 10.21 to 11.73 µg/m^3 (-3.9 to 3.6% error)

March Hg(t):

<u>Zero</u> - Response range of passing –0.75 to 0.68 µg/m^3 (-3.8 to 3.4% error)
<u>Span</u> - Response range of passing 10.04 to 11.83 µg/m^3 (-4.8 to 4.2% error)

Table 9. March Inlet CEM Maintenance

Date	Maintenance/Impacts on Performance	Corrective Action/Adjustment to Data
On-going	Monitoring cal factors manually.	Adjusting calibration factors or conducting manual calibrations when necessary as specified in CEMS procedure.

<u>Inlet Calibration Record</u>

Note:

- Red = CE >5% or |R - A| > 1.0 and calibration did not pass (in response a manual cal is done to reset factors)
- Yellow = CE >2.5% or |R - A| > 0.5 and calibration error is above internally set maintenance level (in response cal factors are adjusted)

Table 10. March Inlet CEM Calibration Records

FILTER ZERO / FILTER SPAN CALIBRATION RECORD											
DATE	TIME	PBSPN	REF SPAN	HGO ZERO	HGO SPAN	HGT ZERO	HGT SPAN	HGO BKG	HGT BKG	HGO COEF	HGT COEF
3/1/07 - suspended auto-cals due to software issue (data highlighted)											
(F) 3/13/2007	17:23 - 17:45	11.0	20.0	-0.04 (-0.2%)	10.72 (-1.4%)	-0.14 (-0.7%)	10.21 (-3.9%)	30.398	47.857	1.037	1.560
(F) 3/14/2007	08:36 - 08:56	11.0	20.0	0.54 (2.7%)	11.83 (4.1%)	0.41 (2.0%)	11.73 (3.6%)	30.823	51.048	1.053	1.640
(F) 3/15/2007	08:36 - 08:55	11.0	20.0	1.10 (5.5%)	12.96 (9.8%)	1.54 (7.7%)	13.88 (14.4%)	31.680	53.771	1.089	1.687
(F) 3/16/2007	08:36 - 08:55	11.0	20.0	1.19 (5.9%)	2.81 (-41.0%)	1.72 (8.6%)	14.41 (17.1%)	31.680	53.771	1.089	1.687
(F) 3/17/2007	08:36 - 08:55	11.0	20.0	2.10 (10.5%)	12.32 (6.6%)	3.26 (16.3%)	15.03 (20.1%)	31.680	53.771	1.089	1.687
(F) 3/18/2007	08:36 - 08:55	11.0	20.0	2.70 (13.5%)	15.62 (23.1%)	4.69 (23.4%)	17.11 (30.6%)	31.680	53.771	1.089	1.687
(F) 3/19/2007	08:36 - 08:55	11.0	20.0	2.58 (12.9%)	14.24 (16.2%)	4.04 (20.2%)	15.86 (24.3%)	31.680	53.771	1.089	1.687
(F) 3/20/2007	08:36 - 08:55	11.0	20.0	0.56 (2.8%)	11.58 (2.9%)	0.42 (2.1%)	11.43 (2.1%)	31.494	51.815	1.080	1.629
(F) 3/21/2007	07:40 - 07:59	11.0	20.0	-0.57 (-2.9%)	10.51 (-2.4%)	-0.95 (-4.7%)	10.96 (-0.2%)	32.752	55.220	1.124	1.688
(F) 3/22/2007	07:40 - 07:59	11.0	20.0	-1.07 (-5.4%)	10.04 (-4.8%)	-1.67 (-8.3%)	9.60 (-7.0%)	32.752	55.220	1.124	1.688
(F) 3/23/2007	07:40 - 07:59	11.0	20.0	0.68 (3.4%)	11.28 (1.4%)	1.17 (5.9%)	10.77 (-1.2%)	31.099	45.817	1.060	1.476
(F) 3/24/2007	07:40 - 07:59	11.0	20.0	0.30 (1.5%)	11.28 (1.4%)	0.33 (1.6%)	11.48 (2.4%)	33.261	48.740	1.143	1.458
(F) 3/25/2007	07:40 - 07:59	11.0	20.0	-0.75 (-3.8%)	9.86 (-5.7%)	-1.25 (-6.3%)	9.75 (-6.2%)	33.261	48.740	1.143	1.458
(F) 3/26/2007	07:40 - 07:59	11.0	20.0	-1.63 (-8.1%)	9.20 (-9.0%)	-2.21 (-11.1%)	8.72 (-11.4%)	33.261	48.740	1.143	1.458
(F) 3/27/2007	07:40 - 07:59	11.0	20.0	0.15 (0.8%)	11.26 (1.3%)	1.02 (5.1%)	12.47 (7.3%)	32.908	48.105	1.089	1.464
(F) 3/28/2007	07:40 - 07:59	11.0	20.0	0.58 (2.9%)	11.59 (3.0%)	0.75 (3.8%)	12.14 (5.7%)	33.052	48.359	1.105	1.456
(F) 3/29/2007	07:40 - 07:59	11.0	20.0	1.32 (6.6%)	12.03 (5.1%)	1.96 (9.8%)	12.82 (9.1%)	32.116	46.658	1.098	1.439
(F) 3/30/2007	07:40 - 07:59	11.0	20.0	1.28 (6.4%)	11.83 (4.2%)	1.63 (8.1%)	12.02 (5.1%)	32.116	46.658	1.098	1.439
(F) 3/31/2007	07:40 - 07:59	11.0	20.0	0.09 (0.4%)	10.79 (-1.0%)	-0.23 (-1.2%)	10.46 (-2.7%)	33.845	51.024	1.173	1.487

<u>Calibration at Outlet</u>

<u>NOTE:</u> Acceptance Criteria = Calibration Error (CE) ≤5.0% of Span OR |R-A| ≤1.0 µg/m^3 with R = 5.0 (set to 10 after software change on 3/13 until reset on 3/22)

- Upgraded software installed on March 13.
- Hg(t) and Hg(0) zero all passed; Hg(t) and Hg(0) span calibrations did not perform as well.

- Hg(t) and Hg(0) zero response was trending high (>0) at the end of the month, the Hg(t) and Hg(0) span response tended to be low (<5) early in the month, then was not consistently high or low.

March Hg(0):

Zero - Response range –0.32 to 0.95 $\mu g/m^3$

Span - Did not pass on 3/15, 3/22, and 3/26; response range of passing 4.64 to 5.92 $\mu g/m^3$

March Hg(t):

Zero - Response range –0.23 to 0.96 $\mu g/m^3$

Span - Did not pass on 3/13, 3/15-3/16, 3/22, and 3/26; response range of passing 4.72 to 5.67 $\mu g/m^3$

Table 11. March Outlet CEM Maintenance

Date	Maintenance/Impacts on Performance	Corrective Action/Adjustment to Data
On-going	Monitoring cal factors manually.	Adjusting calibration factors or conducting manual calibrations when necessary as specified in CEMS procedure.

Outlet Calibration Record

Note:

- Red = For reference span of 10, |R - A| > 1.0 and calibration did not pass (in response a manual cal is done to reset factors)
- Yellow = For reference span of 10, |R - A| > 0.5 and calibration error is above internally set maintenance level (in response cal factors are adjusted)

Table 12. March Outlet Calibration Records

FILTER ZERO / FILTER SPAN CALIBRATION RECORD											
DATE	TIME	PBSPN	REF SPAN	HGO ZERO	HGO SPAN	HGT ZERO	HGT SPAN	HGO BKG	HGT BKG	HGO COEF	HGT COEF
(F) 3/1/2007	07:39 - 07:58	5.0	10.0	-0.01 (-0.1%)	4.90 (-1.0%)	0.07 (0.7%)	5.03 (0.3%)	11.579	11.578	1.018	1.004
(F) 3/2/2007	07:39 - 07:58	5.0	10.0	-0.06 (-0.6%)	4.64 (-3.6%)	-0.09 (-0.9%)	4.72 (-2.8%)	11.579	11.578	1.018	1.004
(F) 3/3/2007	07:39 - 07:58	5.0	10.0	-0.05 (-0.5%)	4.78 (-2.2%)	-0.04 (-0.4%)	4.85 (-1.5%)	11.579	11.578	1.018	1.004
(F) 3/4/2007	07:39 - 07:58	5.0	10.0	0.05 (0.5%)	4.78 (-2.2%)	0.08 (0.8%)	4.85 (-1.5%)	11.579	11.578	1.018	1.004
(F) 3/5/2007	07:39 - 07:58	5.0	10.0	0.17 (1.7%)	4.90 (-1.0%)	0.16 (1.6%)	4.92 (-0.8%)	11.579	11.578	1.018	1.004
(F) 3/6/2007	07:39 - 07:58	5.0	10.0	0.21 (2.1%)	4.68 (-3.2%)	0.23 (2.3%)	4.91 (-0.9%)	11.579	11.578	1.018	1.004
(F) 3/7/2007	07:39 - 07:58	5.0	10.0	0.23 (2.3%)	4.95 (-0.5%)	0.25 (2.5%)	5.12 (1.2%)	11.579	11.578	1.018	1.004
(F) 3/8/2007	07:39 - 07:58	5.0	10.0	0.21 (2.1%)	4.88 (-1.2%)	0.23 (2.3%)	5.08 (0.8%)	11.579	11.578	1.018	1.004
(F) 3/9/2007	07:39 - 07:58	5.0	10.0	0.05 (0.5%)	4.86 (-1.4%)	0.07 (0.7%)	4.93 (-0.7%)	11.579	11.578	1.018	1.004
(F) 3/10/2007	07:39 - 07:58	5.0	10.0	-0.13 (-1.3%)	4.85 (-1.5%)	-0.04 (-0.4%)	4.98 (-0.2%)	11.579	11.578	1.018	1.004
(F) 3/11/2007	07:39 - 07:58	5.0	10.0	0.01 (0.1%)	4.69 (-3.1%)	0.07 (0.7%)	4.83 (-1.7%)	11.579	11.578	1.018	1.004
(F) 3/12/2007	07:39 - 07:58	5.0	10.0	-0.12 (-1.2%)	4.81 (-1.9%)	-0.02 (-0.2%)	4.94 (-0.6%)	11.579	11.578	1.018	1.004
(F) 3/13/2007	08:25 - 08:56	10.0	20.0	0.10 (0.5%)	10.55 (2.8%)	-0.03 (-0.15%)	6.95 (-15.3%)	10.926	7.291	0.594	0.654
(F) 3/14/2007	14:51 - 15:10	10.0	20.0	0.15 (0.75%)	10.01 (0.05%)	-0.23 (-1.15%)	9.50 (-2.5%)	10.335	10.780	0.558	0.997
(F) 3/15/2007	14:20 - 14:49	10.0	20.0	-0.15 (-0.75%)	7.53 (-12.4%)	-0.06 (-0.3%)	8.86 (-5.7%)	10.712	10.163	0.614	0.944
(F) 3/16/2007	07:40 - 07:59	10.0	20.0	-0.15 (-0.75%)	9.95 (-0.25%)	-0.03 (-0.15%)	8.59 (-7.1%)	12.793	9.991	0.752	0.791
(F) 3/17/2007	07:40 - 07:59	10.0	20.0	-0.02 (-0.1%)	9.43 (-2.9%)	-0.15 (-0.75%)	9.55 (-2.3%)	12.596	11.077	0.755	0.876
(F) 3/18/2007	07:40 - 07:59	10.0	20.0	-0.07 (-0.35%)	9.64 (-1.8%)	-0.09 (-0.45%)	9.40 (-3.0%)	11.930	10.723	0.724	0.897
(F) 3/19/2007	07:40 - 07:59	10.0	20.0	0.19 (0.95%)	10.58 (2.9%)	0.28 (1.4%)	10.62 (3.1%)	12.377	11.340	0.743	0.921
(F) 3/20/2007	07:40 - 07:59	10.0	20.0	-0.32 (-1.6%)	9.51 (-2.5%)	-0.19 (-0.95%)	9.66 (-1.7%)	11.942	11.185	0.714	0.938
(F) 3/21/2007	07:40 - 07:59	10.0	20.0	0.14 (0.7%)	10.21 (1.0%)	0.15 (0.7%)	10.10 (0.5%)	11.889	10.902	0.721	0.919
(F) 3/22/2007	07:40 - 07:59	5.0	10.0	0.95 (9.5%)	6.61 (16.1%)	0.96 (9.6%)	6.40 (14.0%)	11.889	10.902	0.721	0.919
(F) 3/23/2007	07:40 - 07:59	5.0	10.0	-0.10 (-1.0%)	4.82 (-1.8%)	0.05 (0.5%)	4.85 (-1.5%)	11.786	10.325	0.672	0.883
(F) 3/24/2007	07:40 - 07:59	5.0	10.0	0.00 (0.0%)	5.33 (3.3%)	0.04 (0.4%)	4.93 (-0.7%)	11.786	10.325	0.672	0.883
(F) 3/25/2007	07:40 - 07:59	5.0	10.0	0.47 (4.7%)	5.92 (9.2%)	0.45 (4.5%)	5.67 (6.7%)	11.786	10.325	0.672	0.883
(F) 3/26/2007	07:40 - 07:59	5.0	10.0	0.79 (7.9%)	6.61 (16.1%)	0.79 (7.9%)	6.19 (11.9%)	11.786	10.325	0.672	0.883
(F) 3/27/2007	07:40 - 07:59	5.0	10.0	0.01 (0.1%)	5.11 (1.1%)	0.06 (0.6%)	5.04 (0.4%)	10.975	10.071	0.581	0.926
(F) 3/28/2007	07:40 - 07:59	5.0	10.0	0.17 (1.7%)	5.25 (2.5%)	0.22 (2.2%)	5.15 (1.5%)	10.975	10.071	0.581	0.926
(F) 3/29/2007	07:40 - 07:59	5.0	10.0	0.22 (2.2%)	5.30 (3.0%)	0.26 (2.6%)	5.23 (2.3%)	10.975	10.071	0.581	0.926
(F) 3/30/2007	07:40 - 07:59	5.0	10.0	0.27 (2.7%)	5.24 (2.4%)	0.25 (2.5%)	5.22 (2.2%)	10.975	10.071	0.581	0.926
(F) 3/31/2007	07:40 - 07:59	5.0	10.0	0.17 (1.7%)	4.85 (-1.5%)	0.15 (1.5%)	4.82 (-1.8%)	10.338	9.425	0.620	0.920

Ash Silo

At the end of 4Q06, there were still some problems with excessive dusting during unloading of the ash silo using the wet unloader, primarily during startup of the pin mixer. Also, the ratio of water to PAC/ash to properly control dusting varies greatly with the amount of PAC. With continuing variations in PAC injection rate during optimization testing, it has proven difficult to operate the wet unloader in a completely dustless manner. United Conveyer Corporation (UCC) continued to work on optimizing the mixer operation to reduce dusting.

A rubber strip curtain was installed at the exit of the unloading area below the ash silo (Figure 1). This curtain was installed to help reduce wind-driven dusting during unloading of the PAC/ash mixture.

Figure 1. Curtain at Exit of Ash Unloading Area

The filter separator in the ash silo consists of two modules with 14 polyester bags in each. This is used to filter the air leaving the ash silo during removal of ash from the hoppers. Problems during 1Q07 included blinding of these bags due to cold weather and condensation coating the fabric. The bags were changed during this quarter and the lines in the filter separator room were insulated and heaters moved to prevent further condensation.

Baghouse Outage

The baghouse went into a scheduled outage for three days from February 25-27. During this time the inlet and outlet ducts were inspected, modifications were made on compartment 4 hopper, work was done on the ash system and level probe, repaired leaks in the filter separator, and bags were tested in compartment 8.

Duct Inspection

On February 25, a walk-through and visual inspection of the supply and return ducts to the baghouse was performed. Due to time constraints both the main supply and return runs were inspected, but only the unit 7 supply and return drops were inspected. Unit 8 and 9 drops appeared to be in good condition.

The inspection showed that the unit 7 portions of both the supply and return ducts have significant in-leakage. Duct corrosion and deposit build-up could become significant over time. The rest of the duct work looked good with minimal build-up, and only one small point-source of apparent in-leakage. There was leakage at the expansion joint in the unit 7 supply duct at the high point of the riser, just before the duct turns 90^o into the main horizontal duct run to the baghouse. Plans have been made to do an external inspection of this area after the weather becomes more temperate.

Hopper Modifications

The compartment 4 hopper had several modifications during the outage as shown in Figure 2. These changes were made to only one hopper to determine if the changes improved operation and to optimize placement of sensors in other hoppers.

The insulation was removed from the bottom portion of the hopper to expose the heaters and vibrator. The vibrator was moved down since normal operation does not allow significant build-up of ash in the hopper in order to prevent hopper fires. The level sensor was also moved down for the same reason.

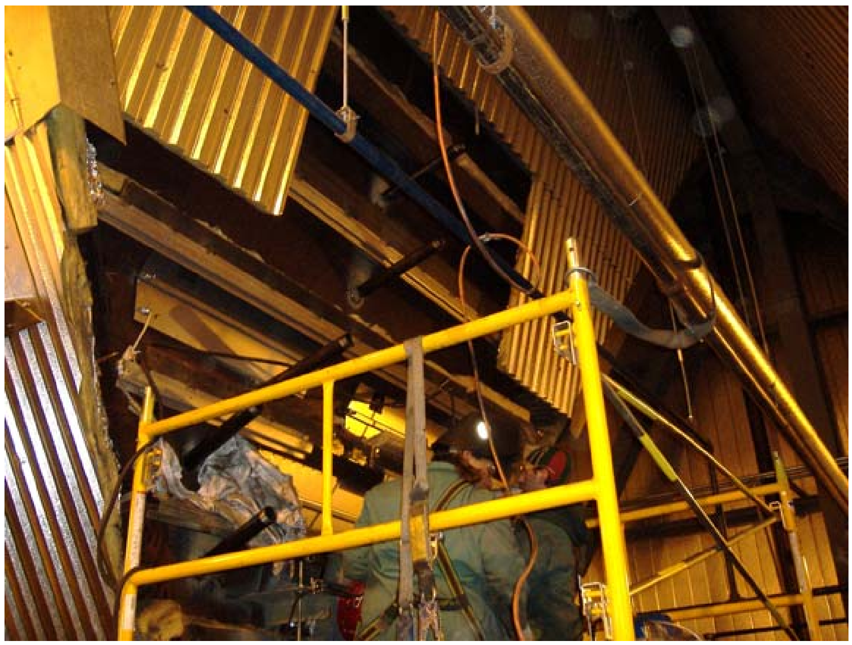

Figure 2. Compartment 4 Hopper Modifications

Four new ports were cut into the hopper to accommodate carbon monoxide probes. As discussed in the previous quarterly report, carbon monoxide was shown to be liberated by burning PAC. Installation of a CO detector in the hopper may indicate when the PAC/ash mixture is overheating. Correct placement of the probe has not been established for optimal CO detection, so four probes will be installed and connected to one CO analyzer.

Drag Testing – Compartment 8

Compartment 8 was opened and the test bags installed in this compartment were checked and drag measurements made. Compartment 8A has OEM bags as well as experimental bags installed. The OEM bags in use are PPS fabric bags with the following specifications:

- Felted, 2.7 denier PPS fabric
- Weight of nominally 18 ounces/yd^2
- Singed on both sides
- Scrim material made from 3 ounces/yd^2 of PPS
- Mullen burst minimum of 500 psi
- Permeability at 0.5 inches H_2O of 25–40 cfm/ft^2

Table 13 presents the array of other bag materials installed for testing.

In the case of the Kermel fabric, five approximately 4” x 11” swatches are installed in the compartment above the bags and pulse pipes. The swatches are exposed to flue gas and periodically one is removed for strength tests. Although full-scale bags are preferred for the tests, using swatches reduces the risk of premature failures with experimental bags. For comparison, five OEM swatches were also installed.

Table 13. Test Bag Materials

Bag ID	Material/Design	Benefit	Quantity
9054	7 denier Torcon with 2.0 oz. PTFE scrim	High Perm fabric with more robust scrim	8
9055	7 denier Torcon with 4.0 oz. PTFE scrim	High Perm fabric with more robust scrim	8
9056	7 denier Torcon with Torcon scrim	High Permeability fabric	12
9065	Dual density Torcon (0.9 and 2 denier blend on filter side, 7 denier on other side)	High Perm on one side, high collection efficiency on other side	10
1342	P84	Higher temperature, higher collection efficiency	13
BHA-TEX	Scrim-supported PPS felt with a BHA-TEX Expanded microporous PTFE Membrane	Membrane provides higher collection efficiency and promotes light dustcake formation	12
Toray	Proprietary material		4
Kermel	Proprietary material		Swatches only

Figure 3 shows the compartment layout, the bag numbering system and locations of the test bags in Compartment 8:

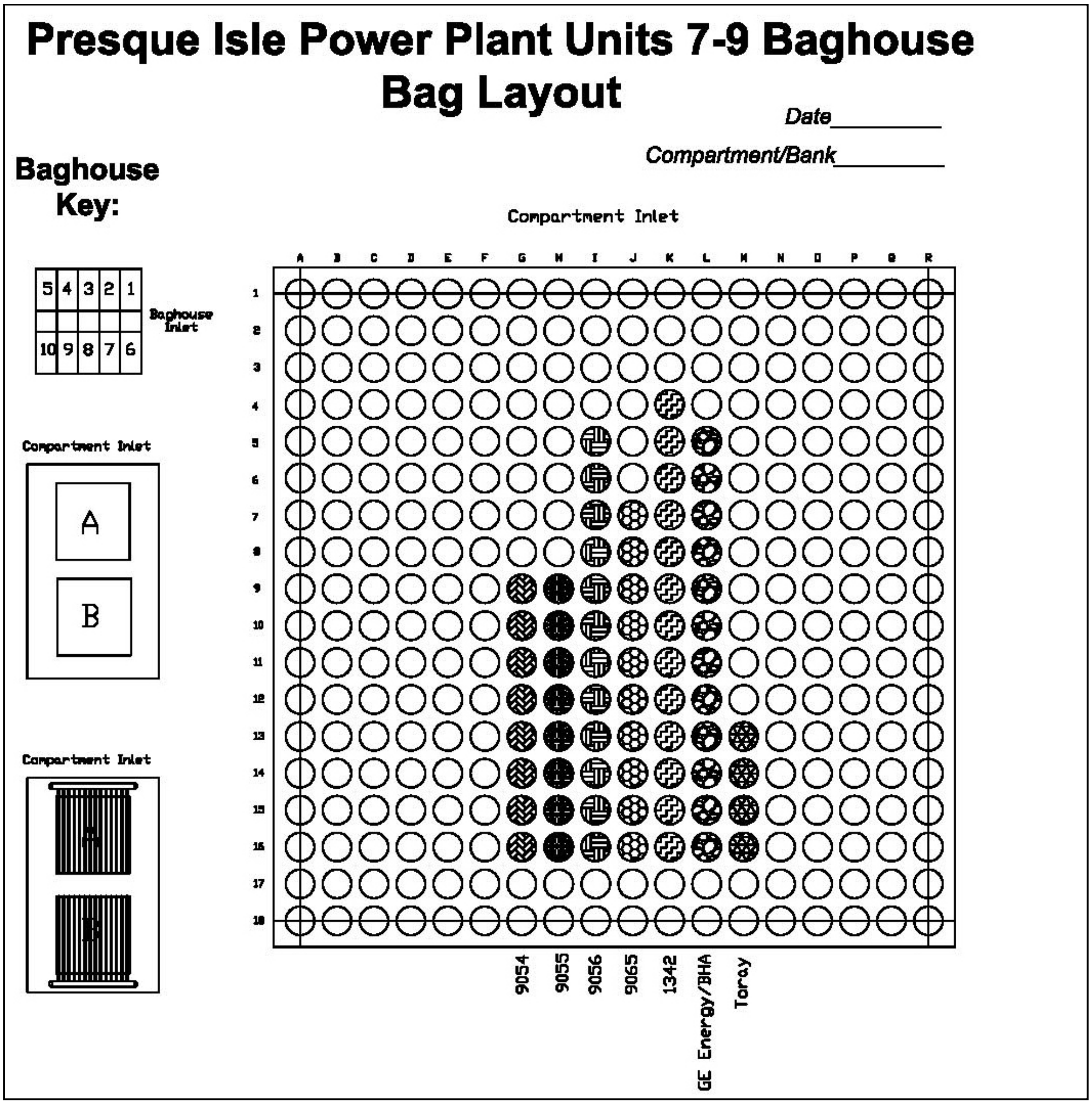

Figure 3. Test Bag Layout

Bag Performance Measurements

Drag

Drag is a critical parameter in evaluating the performance of a fabric filter. Taking drag measurements enables the residual drag to be monitored over time. These data should help our understanding of the TOXECON™ process by providing information on dustcake formation with the ash/PAC mixture and how operational upsets affect the residual dustcake; and how different types of PAC and sorbents for SO_2 control affect the residual dustcake.

The drag tester, shown in Figure 4, consists of a blower, throttling valve, venturi flow meter, and pressure manometer. A flange adapter connects the device to an individual bag/cage outlet and seals the bag opening at the tubesheet. This provides a means for measuring pressure drop across the bag while the blower draws flow through it.

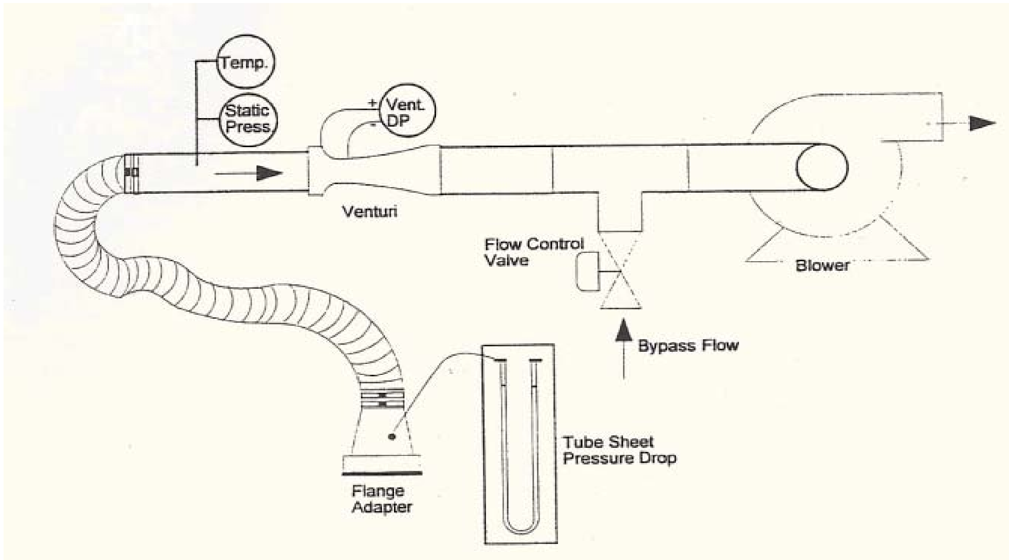

Figure 4. Portable Drag Tester

The formula generally accepted in industry for predicting pressure loss in a fabric filter is:

$\Delta P = \Delta P_R + K_2 V^2 Ct/7000$ Predictive equation for fabric filter pressure loss, where:

ΔP_R	Residual pressure drop (pressure drop after a clean)
K_2	Specific resistance coefficient of freshly deposited dust, (inches of water gauge)/(fpm)/(lb/sq ft)
V	Face velocity or A/C (fpm)
C	Dust loading (grains/acf)
t	Filtration time (minutes)

Because flow and the corresponding air-to-cloth ratio vary with operation of individual baghouses and between different units, drag is usually used as the variable to compare performance. The drag is calculated by dividing the pressure drop across the tubesheet by the air-to-cloth ratio.

Drag = Tubesheet ΔP/(A/C ratio)

Dividing the above equation by air-to-cloth ratio results in a similar equation for predicting drag:

$\text{Drag} = \text{Drag}_R + K_2 VCt/7000$ Predictive equation for fabric filter drag

In these tests we measure residual drag, Drag_R, or the drag after the bags have been cleaned. These data allow tracking of how dustcake filterability develops and changes over time for each bag type.

Bag Weights

Bag weights provide a relative indication of the amount of particulate that accumulates on the bag surface and in the interstices of the fabric.

Laboratory Tests
Periodically bags are removed and sent to a laboratory for testing. These destructive tests provide information on dimensional stability, fabric strength, and permeability as received and after vacuuming.

Air Permeability Tests: The method for direct determination of the air permeability of textile fabrics by the calibrated orifice method is covered by ASTM D 737-75 or FTM 5450. Permeability is measured in cubic feet per minute (cfm) of air flow per square foot of fabric area at a pressure drop across the fabric of 0.5 inches H_2O (unless otherwise specified).

Bursting Strength Tests: One method for measuring the strength of a fabric sample is to measure the pressure required to rupture the fabric. Typically, a hydraulic-diaphragm bursting tester is used (ASTM D 3786 – 80a and FTM 191A – 55122). This method has been modified to be more functional for fiberglass fabric, which has been the standard for utility baghouses. Most laboratories use a B. F. Perkins Model A Mullen Burst tester. These bursting strength tests are commonly called "Mullen Burst" tests.

Summary of Testing:
All testing was conducted in Compartment 8. The drag of 80 bags was measured in the compartment and 8 were removed for weighing and laboratory testing, one each of the seven different types of test bags and one OEM bag. In addition, two swatches were removed. Table 14 provides a list of the test bags and swatches, how many of each were originally installed, how many were still installed on the day the compartment was entered for testing, how many bags were measured for drag and how many were removed. All drag measurements are listed in Appendix A.

Table 14. Summary of test bags installed and testing conducted on February 26, 2007

Bag ID	Number of Bags Jan 2006	Number of Bags 2/26/07	Number of bags tested for drag	Number of bags removed
OEM Standard[a]	581	583	13	1
9054	8	8	8	1
9055	8	8	8	1
9056	12	12	12	1
9065	10	10	10	1
1342	13	12	12	1
GE Energy	12	11	11	1
Toray	4	4	4	1
OEM Standard[a]	5 swatches			1 swatch
Kermel[b]	5 swatches			1 swatch

a. Five 8" x 5" swatches installed in addition to bags
b. Five 8" x 5" swatches installed only

Results, Observations and Analysis

- Looking at the tubesheet, there was obvious discoloration above rows G, H, and I in the area where the test bags were installed. The bags in these rows were all high perm bags, types 9054, 9055, and 9056. The rest of the tubesheet looked clean. This can be seen in Figure 5, which is a picture of the tubesheet before entering the compartment.

Figure 5. Picture of Compartment 8 Tubesheet on February 28, 2007

- Average drag measured for each of the bag sets is presented in Table 15.
- The individual drag measurements for each bag set are presented separately in Appendix A. The variability in drag in these tests was typically ±0.02 inches H_2O/ft/min.
- This first set of drag measurements provides our first opportunity to quantify the filterability of the bags after a period of operation. The bags were cleaned prior to taking the compartment off line, so these measurements should represent the lowest possible drag with the dustcake formed in this application at this site. The trends and observations to note from the drag data include:
  - The drag of a clean, installed OEM bag is 0.05 inches H_2O/ft/min.
  - The average drag of the OEM bags was 0.25 inches H_2O/ft/min. With an air-to-cloth ratio of 5 ft/min, this drag results in a calculated, nominal, clean tubesheet pressure drop of 1.3 inches H_2O. This seems reasonable when considering that the measured tubesheet pressure drop was approximately 1.1 inches H_2O in September when the baghouse was not in a standard cleaning mode, but was in a constant clean while the unit was at full load. This period of continuous cleaning can be seen in Figure 6.

- The average drag of the three different types of high perm bags was similar to the drag of the OEM bags. This is surprising because when high perm bags were evaluated in the COHPAC® baghouses at both Big Brown and Gaston, the drag of the high perm bags was always lower than the 2.7-denier bags with similar operating hours.
- The drag of the P84 bags, type 1342, was similar to the OEM bags.
- The membrane bag provided by GE Energy had the highest drag. This is not that surprising. The membrane alone will increase the drag of a bag. The dual purpose of the membrane is to reduce penetration of the particles into the fabric and provide a "slick" surface to hinder a dustcake from forming. Over time, if a heavy dustcake forms on the standard bags, the membrane bag would probably have a much lighter dustcake and possibly a lower drag.
- The dual density fabric drag was lower than the OEM bag. This behavior will be interesting to track over time.
- The Toray proprietary bags had the lowest drag.

Table 15. Drag Measurements and Bag Weights, 2/26/07 Drag Unit = inches H2O/ft/min

Bag Type	Average Drag 2/26/07	Estimated Operating Hours 2/26/07
2.7-denier Torcon (OEM)	0.25	8089
2.7-denier Torcon (OEM)	0.05	0
9054	0.25	8089
9055	0.24	8089
9056	0.22	8089
9065	0.19	8089
1342	0.25	8089
GE Energy	0.32	8089
Toray	0.16	8089
Clean OEM bag		0

- One of each bag type was removed by first removing the cage, then the bag, and then rolling the bag up tightly and placing it into a plastic bag. For the bags to be weighed and sent out for laboratory tests, the plan was to remove bag number 16 from each of the test bag rows.
- Some bags were difficult to remove because the bags bunched up and prevented the cages from sliding out. When this happened, the cage was reinserted into the bags and the next cage/bag was tried. Only three of the eight bags actually were removed from Row 16.

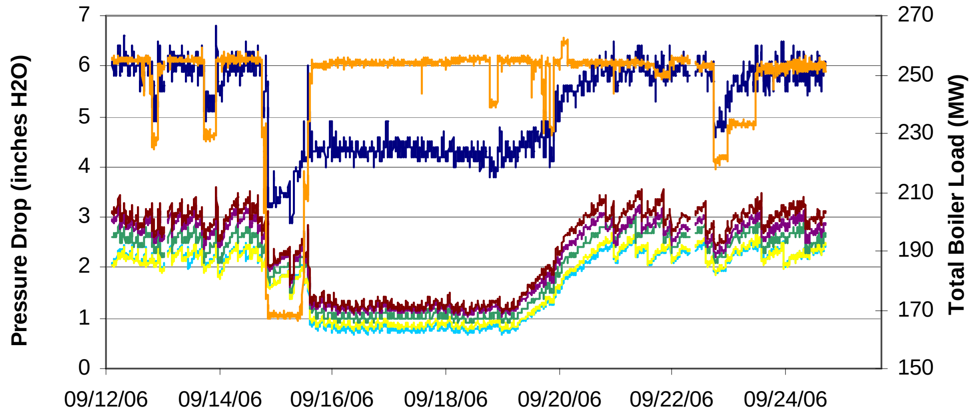

Figure 6. Tubesheet Pressure Drop during a Period with the Baghouse in a Continuous Cleaning Mode

- Figure 7 is a picture of the OEM bag as it was being removed from the tubesheet. Notice that the outside of this bag has a layer of PRB ash on top of the gray, carbon/ash mixture. Also notice that the swatch tester can be seen sitting on the shelf in the background.
- The bags were weighed at the plant along with the plastic bag they were stored in. The bag weights used for comparison are net the new bag weight. Table 16 presents the weights of the different bags.
- The dustcake weight on the OEM bag was 0.78 pounds. In March, after the hopper fires, a bag was pulled and sent to GFTS. The dustcake weight of this bag after less than 2000 hours of operation was 0.6 pounds.
- The high perm bags held a significantly higher amount of dustcake than the standard bag. This trend has been documented at both Big Brown and Gaston. Although the dustcake on the outside of the bags appear similar between the high perm and OEM bags, more dust accumulates in the cross section of the high perm fabric. Ever with the heavier dustcake weights at Big Brown, the high perm bags typically had lower drag.
- The dual density fabric had the lowest dustcake weight, indicating that this fabric had the least dust penetration. Interestingly, this bag type also had low drag.
- The membrane bag had a lower dustcake weight compared to the OEM bag, as would be expected.

Figure 7. Bag number F16 (OEM bag) as it is being removed from the tubesheet on February 26, 2007. Note – swatch tester can be seen on shelf in background

Table 16. Bag Weights (pounds)

Bag #	Bag I.D.	Plastic Bag Tare	Net New Bag Weight	Net Test Bag Weight	Net Wt.
F16	OEM STD	0.25	5.1	5.88	0.78
G15	9054		4.3	7.31	3.01
H14	9055		5.1	8.00	2.90
I16	9056		4.3	6.50	2.20
J16	9065		4.3	4.88	0.58
K15	1342		3.8	5.38	1.58
L15	GE/BHA		4.0 (estimated)	4.88	0.88
M15	Toray		4.6 (estimated)	6.63	2.03

Conclusions

- It appears that the bags are in good condition and that the residual drag is at a value that will result in good pressure drop performance.
- There was a distinct, grayish discoloration on the tubesheet and pulse pipes near the high perm bags. This shows that there is bleedthrough of the carbon through the high perm bags that is not seen on the standard, OEM 2.7-denier bags.

- After over 8000 hours of operation, the dual density bags appear to offer some performance advantages over the OEM fabric.
- Laboratory testing is expected to be completed in April.

Long Term Mercury Control Results

A significant milestone was met on January 19, 2007. The mercury removal was above 90% for 48 consecutive days, and We Energies determined that this was a sufficient time period to prove that the technology was capable of the targeted removal. During this time, both the DARCO® Hg and Hg-LH were being used, so both showed the capability of removing mercury at a high level.

During 1Q07, the PAC injection logic was altered to feed off of coal mill flow instead of flue gas flow rate. This change was done to reflect the actual mercury going into the baghouse instead of gas flow, which isn't always related to coal feed when a unit is at partial load. The logic was put in place to also do trim control off of the mercury CEMs.

The carbon type was switched from DARCO® Hg-LH to DARCO® Hg at the beginning of January. Figure 8 shows that the injection rate was set at 2.5 lb/MMacf through the transition and then kept steady for the rest of the month. At the end of January, sorbent screening tests were performed using the inlet CEM probe, so data was not available for this period. During this period, the new probe boards were installed, which significantly reduced the noise at the outlet CEM.

Figure 9 shows TOXECON data for February 2007. Removal was above 90% for the majority of the month until the outage. The DCS was upgraded during the outage and much of the data was not available for downloading into March. During the outage, the solar blind filters were removed from both CEMs and the outlet shifted upwards approximately 0.7 $\mu g/m^3$, although the noise level was reduced significant at both the inlet and outlet. A problem with the Unit 8 inlet probe resulted in no inlet data for two weeks after the outage.

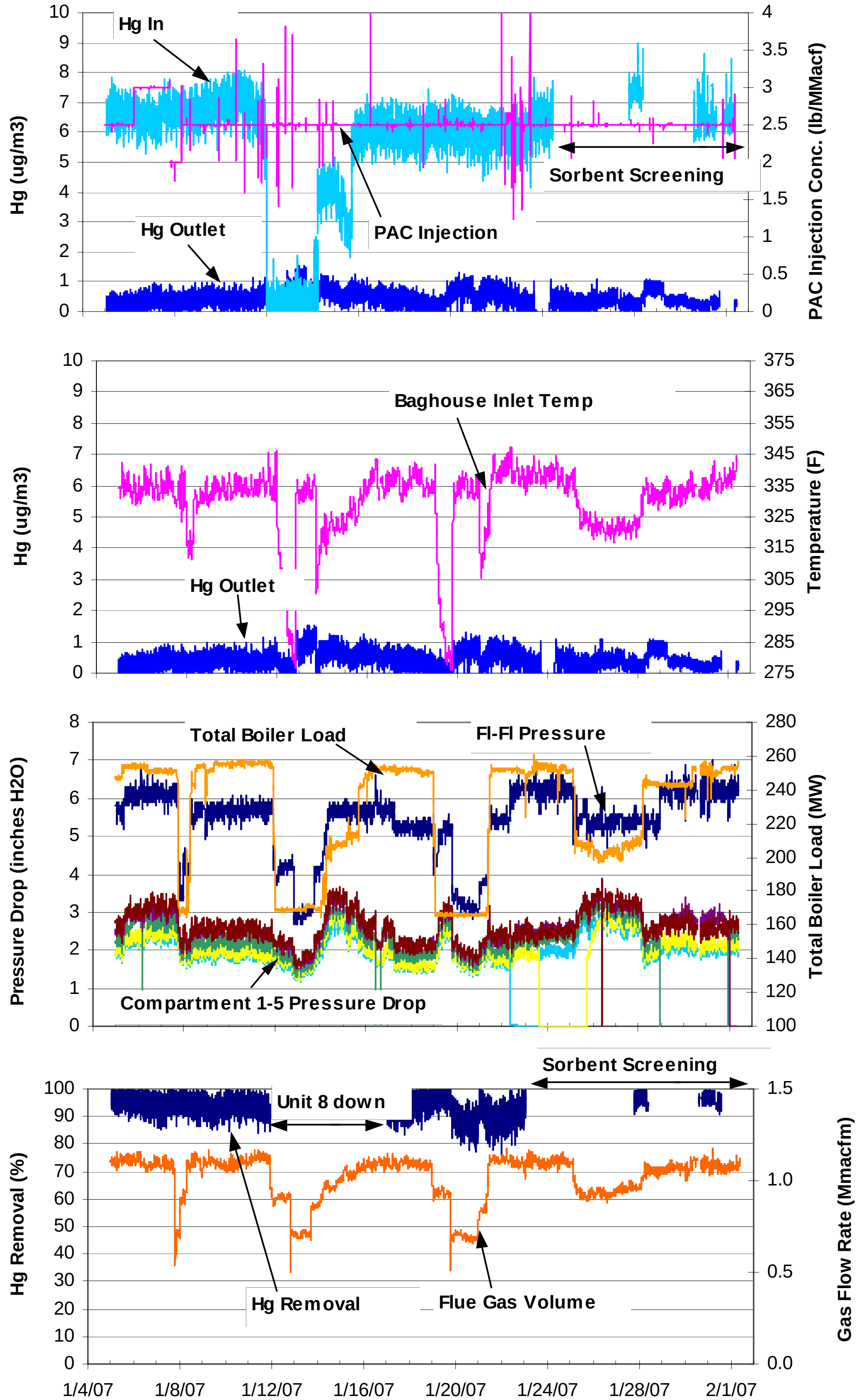

Figure 8. TOXECON™ Performance Data for January 2007

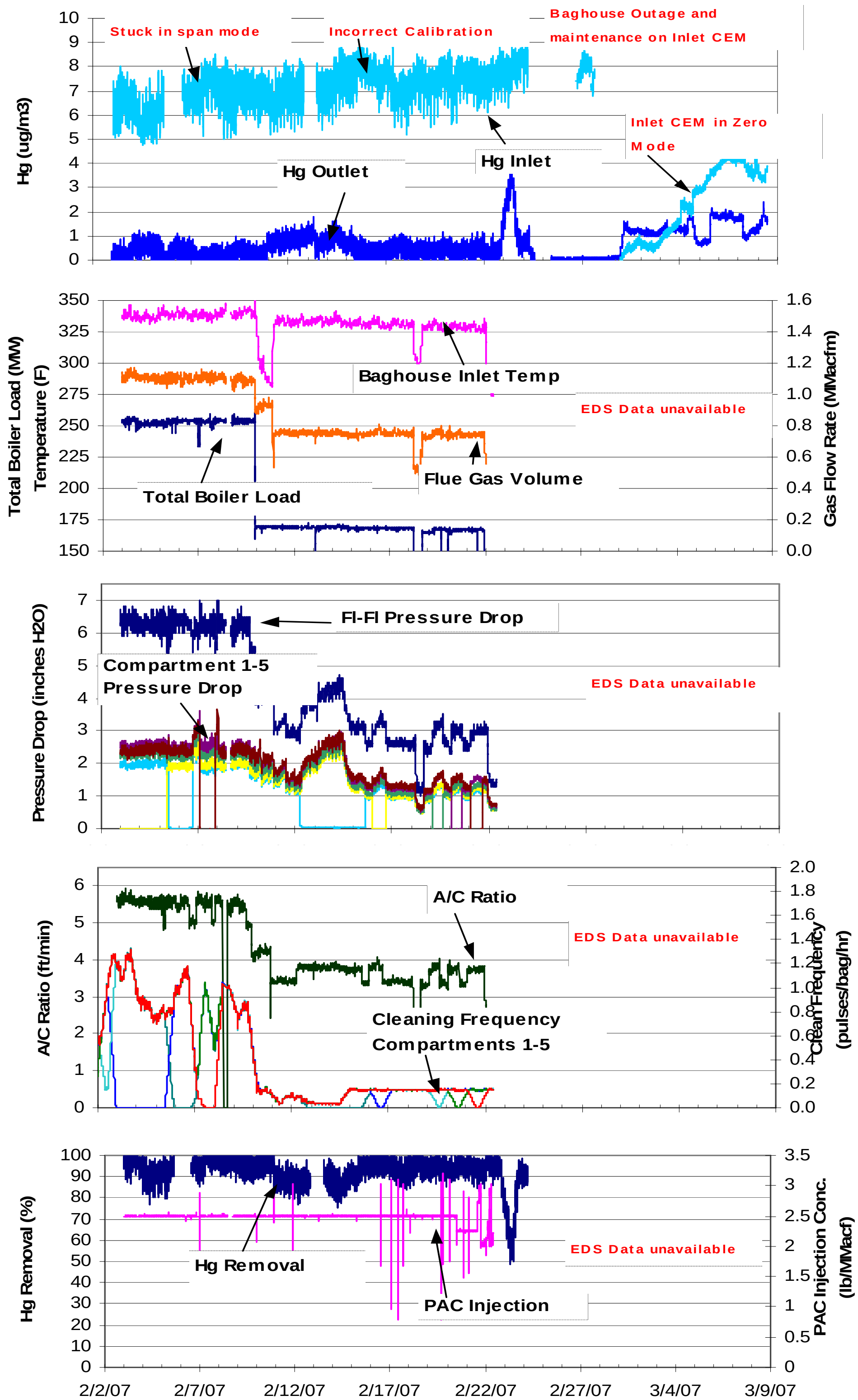

Figure 9. TOXECON Performance Data for February 2007.

Figure 10 shows TOXECON data for March 2007. The outlet CEM remained high during this month, so modified Appendix K sorbent traps were taken at the outlet. Three sets of duplicate traps were run on March 29. Table 17 shows the results of these sorbent trap tests compared to the CEM data. The outlet CEM was showing a bias of 0.67-0.8 μg/m^3. This was related to removal of the redundant solar blind filter in the PMT.

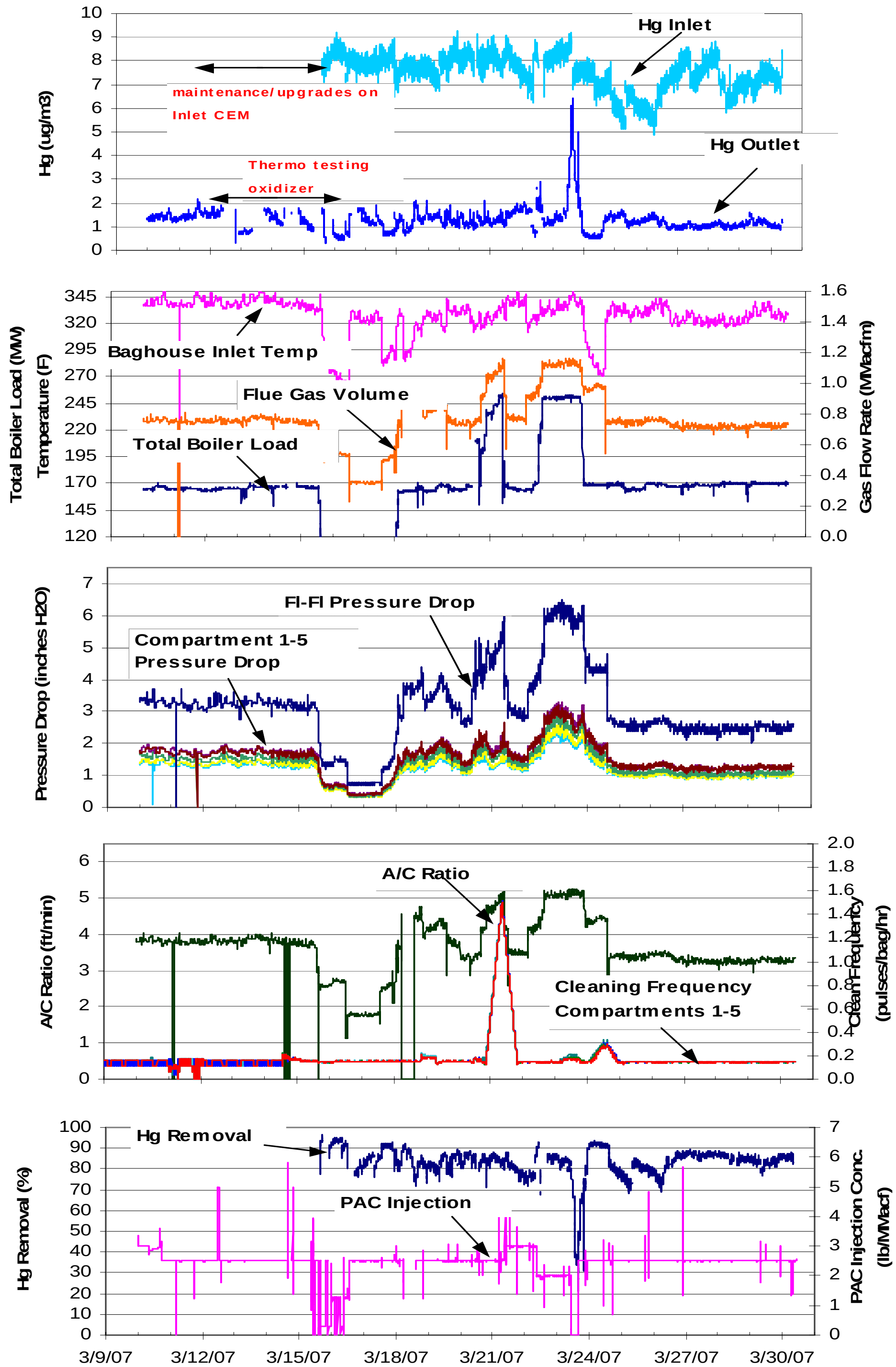

Figure 10. TOXECON Performance Data for March 10 through March 30

Table 17. Sorbent Trap Comparison with Outlet CEM

STM Conc. (µg/wsm^3)	CEM Conc. (µg/wsm^3)	Differential Conc. (µg/wsm^3)
0.58	1.38	0.80
0.59	1.38	0.79
0.46	1.15	0.69
0.46	1.15	0.69
0.54	1.21	0.67
0.54	1.21	0.67

Hopper Temperatures

The hopper wall temperatures remained stable during this quarter and there was no indication of overheating.

Effect of Air-to-Cloth Ratio on Mercury Removal

Figure 11 shows how the air-to-cloth ratio effects mercury removal. Two time periods were chosen having constant PAC injection rate, flue gas temperature, flue gas flow rate, boiler load, and baghouse pressure drop. The only variable was the AC ratio. Figure 11 clearly shows that the mercury removal was not noticeably affected by the AC ratio at these conditions.

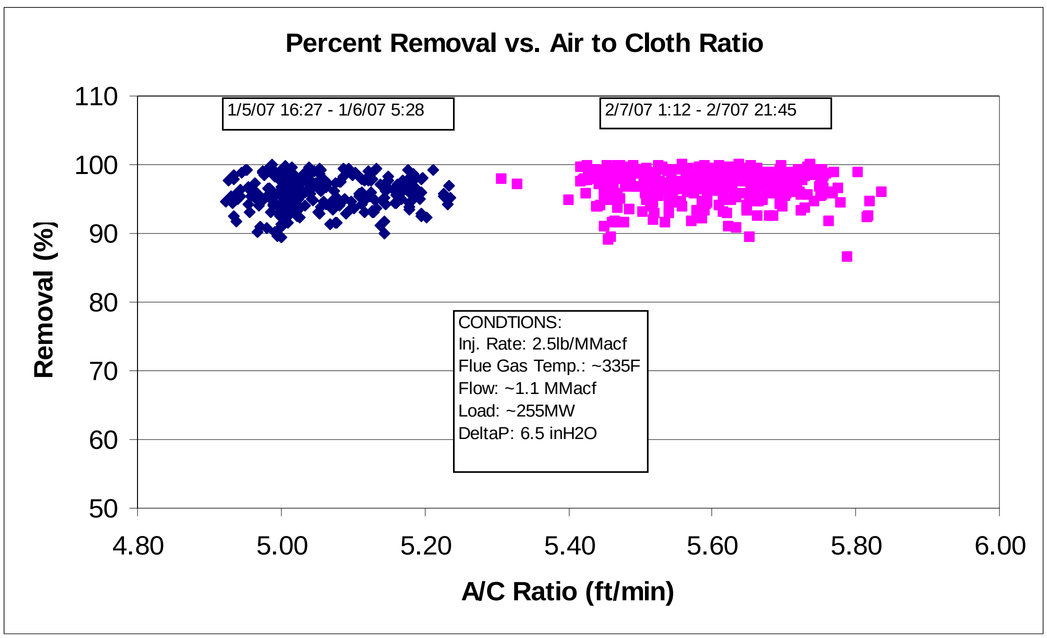

Figure 11. Effect of AC Ratio on Mercury Removal

Mercury Loading on PAC/Ash Mixtures

Samples of PAC/ash mixture from the baghouse were analyzed for mercury content and Loss on Ignition (LOI). The ash at Presque Isle has a measured LOI of less than 1%, so the LOI in the PAC/ash mixture is primarily due to the PAC. Figure 12 shows the mercury loading in the mixture during several injection periods over the last year. The mercury loading increased as the LOI (PAC fraction) increased, which is expected. The loading stabilized around 40-60 ppm.

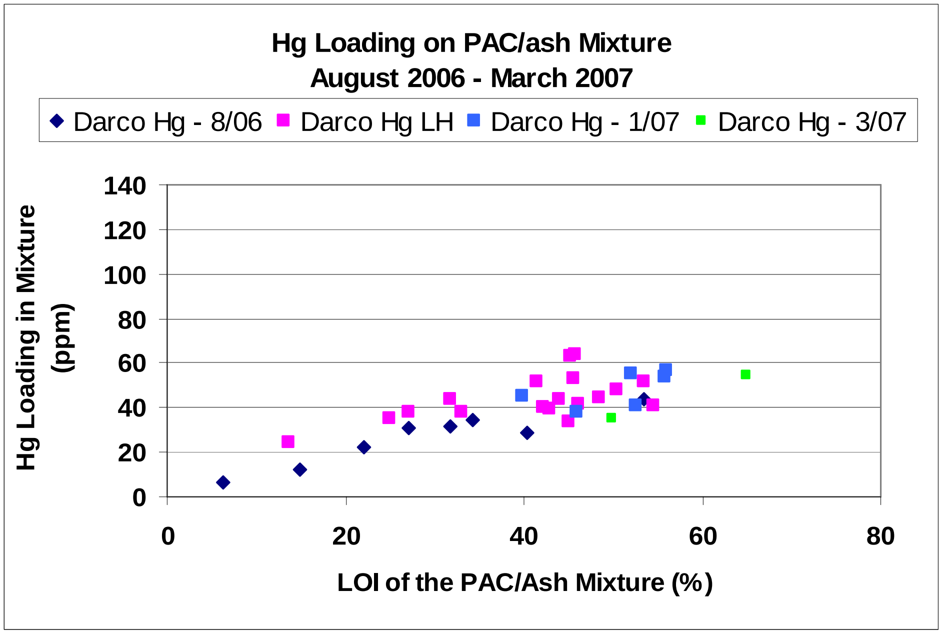

Figure 12. Mercury Loading on the PAC/Ash Mixture

Figure 13 shows the mercury loading on just the PAC fraction in the mixture. This was calculated from a PAC LOI of 69% (measured) and assuming that the ash contribution to the LOI was nominal. At low injection rates, the loading on the halogenated carbon was higher than the non-halogenated, although except for one data point, this was not a large difference. At higher injection rates, the loading for all of the test periods was similar, with the halogenated averaging slightly higher.

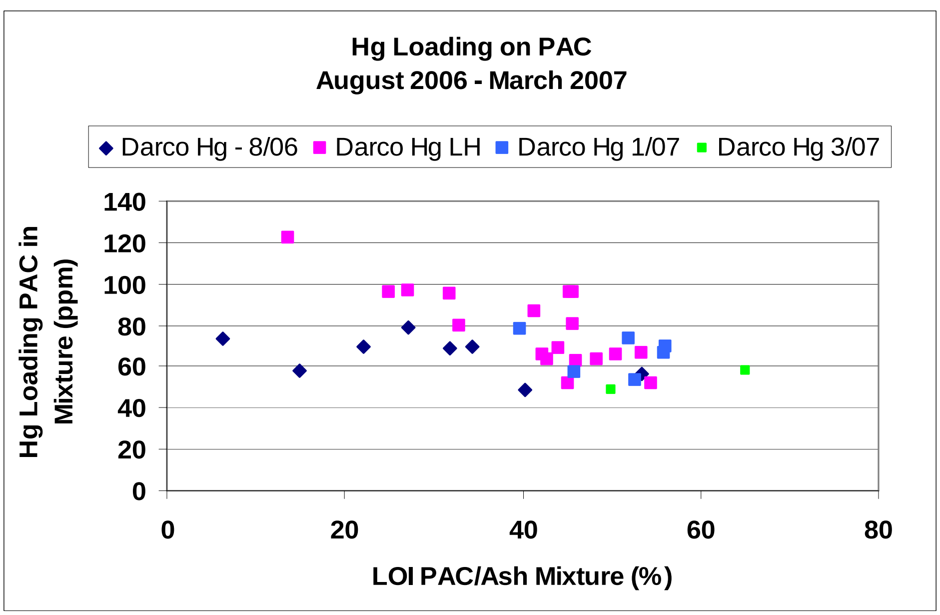

Figure 13. Mercury Loading on the PAC fraction of the Baghouse Mixture

Overheating of PAC/ash

Investigations continue into the development of a model describing the factors that contribute to auto-ignition and resulting overheating of the ash mixture in the baghouse hoppers. Tests are being conducted in the laboratory to determine the effect of bed size, PAC fraction, and ambient temperature on overheating.

During this quarter, laboratory oven tests continued using square containers filled with DARCO Hg PAC and PAC/ash mixtures. Thermocouples were placed in the oven and inserted into the center of the bed of material at different levels to track temperature profiles over time.

Tests were performed using 5 and 7-inch diameter containers filled with PAC. The Frank-Kamenetskii model predicts that larger bed sizes require lower temperatures and longer times to ignite when compared to smaller bed sizes. Laboratory results confirm this behavior. Table 18 shows the results from the tests to date. The critical oven temperature is the lowest temperature at which ignition occurs for that bed size.

Table 18. Critical Temperature and Ignition Time for DARCO Hg PAC.

Bed Diameter (in.)	Critical Oven Temperature (F)	Time to Ignition (hr)
4	482	4.4
5	465	7.1
6	440	10.6
7	427	13.4
8	425	18.0

When the critical temperature and bed dimensions are used in the model calculations, the result should be a linear correlation. Figure 14 shows the results from the first set of data using PAC. The r^2 is over 97%, indicating a good correlation.

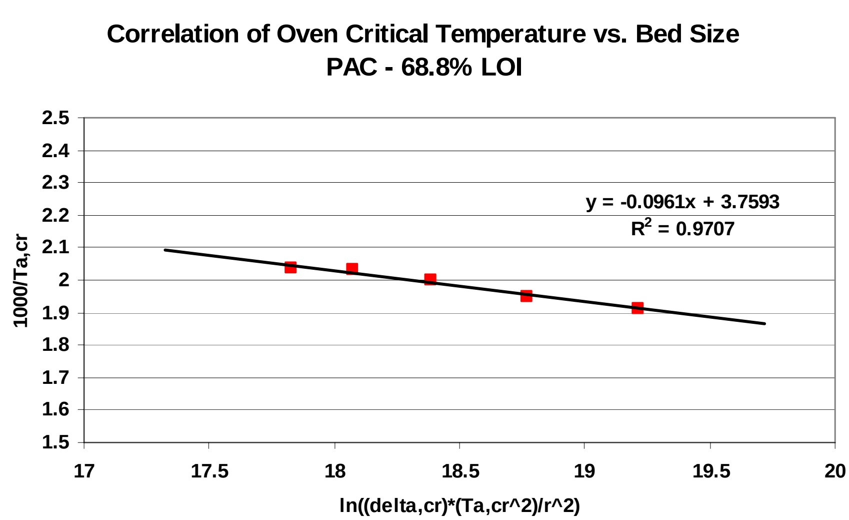

Figure 14. Auto-Ignition Correlation using DARCO Hg PAC.

The time it takes before auto-ignition occurs is also an important factor. This is referred to as the induction period where the bed material is oxidizing and building up heat. Figure 15 shows how larger bed sizes take much longer before ignition to occur.

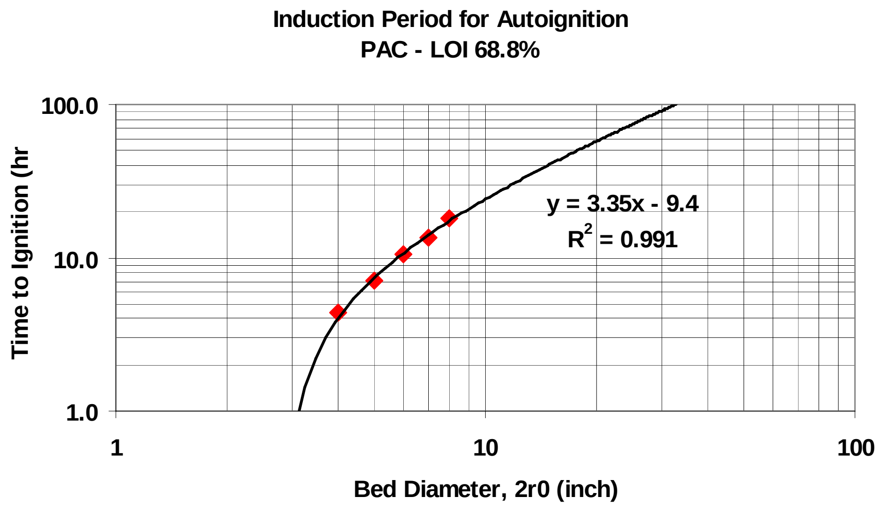

Figure 15. Time to Auto-ignition for DARCO Hg PAC.

Tests will continue in the next quarter to determine the effect of the following on auto-ignition:

- LOI: Low LOI samples did not ignite at the same temperature as higher LOI
- Carbon type: High natural LOI does not seem to ignite at the same temperature as high surface area carbon

Mercury Quality Index Test

Background and Objective

The standard tests used for quality assurance testing of activated carbon (iodine number, etc.) are not specific to mercury. Work began in 1Q06 to develop a test method for mercury uptake in sorbents, referred to as the "Mercury Quality Index," or MQI.

Work to Date

Design and fabrication of the second-generation MQI apparatus was begun in this quarter. This design was based upon lessons learned from the original laboratory MQI.

Task 16 – Operate, Test, Data Analysis, and Optimize TOXECON™ for NO_x and SO_2 Control

Control Options

A review of SO2 and NOx control technologies that could be applied to Presque Isle was undertaken this last quarter. The least expensive, simplest options are the injection of dry sorbents into the flue gas. The most favorable is the dry injection of trona into the flue gas.

Trona is a sodium-based (sodium sesquicarbonate), naturally occurring mineral and has been used in several applications. ADA-ES also tested this material as part of a commercial sorbent screening program. Review of industry literature emphasizes the benefit of injecting trona in a hot-side (greater than 700°F) location. Trona experiences what is referred to as a "popcorn effect" where at high temperature the thermal decomposition reaction results in an expanded particle with a high surface area to mass ratio, improving the chemical availability of the sodium compounds. This effect improves the ratio by a factor of between 5 and 10. Trona will still react with SO_2 if injected at lower temperatures (typical cold-side temperature around 300 to 350°F) but loses the reactivity otherwise gained by the particle expansion. Consequently, for lower temperature applications more trona is required to achieve the same SO_2 removal efficiency.

When injected at high temperature, trona can achieve 80% to 90% removal at 150% stoichiometry (Normalized Stoichiometric Ratio (NSR) = 1.5). In the ADA-ES sorbent screening tests, trona was evaluated at 400°F (below the supposed "popcorn effect" temperature). At an NSR of 2.8, SO_2 removal was about 78%. SO_2 removal exceeded 90% removal at an NSR of 5.6. It seems likely that trona injection can be used to achieve the 70% SO_2 control objective at PIPP, given injection at an NSR above 2.0.

For an NSR of 2, the trona injection rate would be more than 4 tons per hour. This may overwhelm the ash silo and unloading system. Trona is a complex mineral and has a very high molecular weight of 226 lb/lb-mol. This combined with the super-stoichiometric requirement explain the very high projected mass injection rate.

SO_2/NO_x Control Draft Test Plan

A draft test plan for controlling SO_2 and NO_x was created and distributed to the project team. An investigation into equipment requirements and availability also began this quarter.

The tests for SO_2/NO_x control will be conducted in three phases as shown in Table 19. The first priority will be to conduct measurements necessary to establish Baseline conditions. The second phase will determine the performance of the SO_2/NO_x sorbent across a range of injection concentrations. A decision will then be made to conduct more extensive testing which would broaden the general understanding of the process and possibly examine other sorbents. The third phase will be to conduct a Continuous test. The following sections outline the phases of the test program, including the specific tests and objectives.

Table 19. Tentative Schedule of Activities for SO_2/NO_x Control Testing

SO_2-NO_x Control Activity	Duration (Days)	Start Date	Boiler Load
Baseline Testing	2	07/23/2007	Full Load 6AM-6PM
Equipment Installation and Shakedown	2	07/23/2007	NA
Parametric Testing	8	07/25/2007	Full Load 6AM-6PM
Continuous Test Parameter Decision	1	08/02/2007	NA
Continuous Testing	7	08/3/2007	Normal Operation

Sorbent Screening Tests with Trona

Sorbent screening tests were performed in January using mixtures of DARCO® Hg and trona and DARCO® Hg-LH and trona to determine if there might be an effect on the mercury removal capability of the PAC. The results from these tests were compared with identical test beds without the trona. Figure 16 shows the data from the sorbent screening tests. The first 45-50 minutes of the tests with trona show a reduced removal compared to the carbon alone, although the removal seemed to stay steady longer with the halogenated carbon and trona.

These tests indicate that there is the potential to see an effect on mercury removal during full scale injection, although this effect may be transitory.

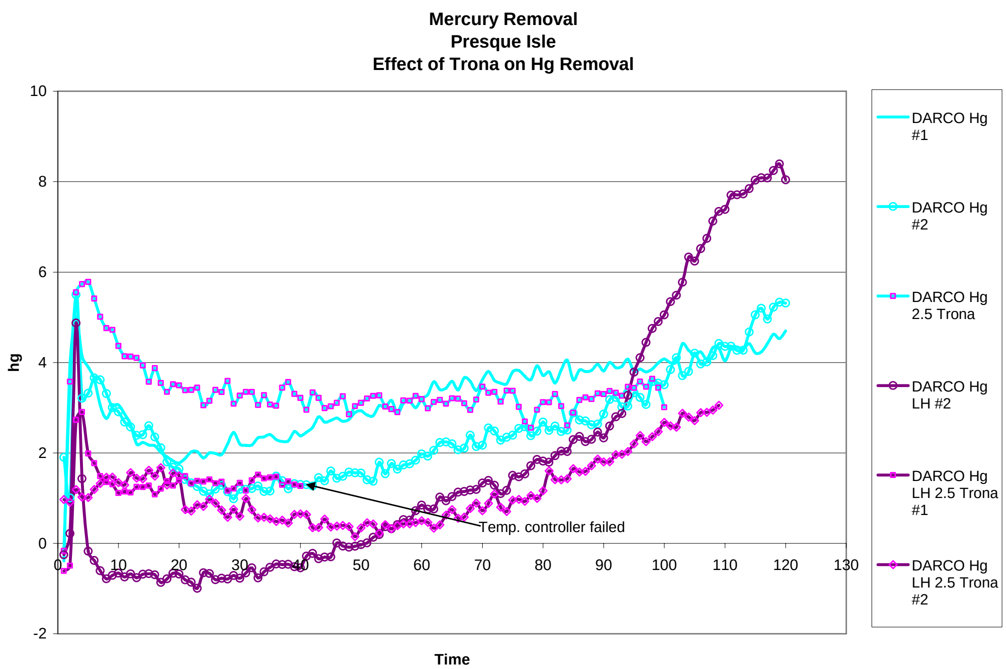

Figure 16. Sorbent Screening Results with Trona

Task 17 – Carbon/Ash Management System

No work was done on this task during this reporting period.

Task 18 – Revise Design Specifications, Prepare O&M Manuals

Work was completed for preparation of C&B as-built drawings for the project during 4Q06.

Task 19 – Reporting, Management, Subcontracts, Technology Transfer

Reports as required in the Financial Assistance Reporting Requirements Checklist and the Statement of Project Objectives are prepared and submitted under this task. Subcontract management, communications, outreach, and technology transfer functions are also performed under this task.

Activity during this Reporting Quarter:

- Quarterly Technical Progress Report delivered
- Quarterly Financial Status Report delivered
- Quarterly Federal Assistance Program/Project Status Report delivered
- The yearly Repayment Report was delivered
- We Energies received the Superior Watershed Partnership 2006 Corporate Conservation Award recognizing the TOXECON™ project as a significant accomplishment in environmental and Great Lakes protection
- Presented a paper at the EUEC in January 2007
- Gave a presentation at the Thermo Super Group Meeting in March 2007
- Participated in a webcast through McIlvaine concerning the TOXECON™ facility
- Technical papers and presentations for future meetings include:
  - Electric Power Conference (May 2007)
  - CoalGen (August 2007)
  - AQVI Conference (September 2007)

CONCLUSION

This is the twelfth Quarterly Technical Progress Report under Cooperative Agreement Number DE-FC26-04NT41766. All major construction efforts were completed during 4Q05, and only punch list items remained during the current quarter. Work performed on punch list items included minor work on: sealing compartment covers, moving the penthouse air intake louvers, evaluating options to the HVAC system in the fan building, and modifying the ash silo wet unloading system to prevent dusting.

The milestone regarding demonstration of 90% mercury removal was met this quarter. The baghouse ran for 48 consecutive days with greater than 90% removal using both halogenated and non-halogenated carbon.

Several upgrades were made to the CEMs, both software and hardware related. An oxidized mercury calibration source was installed and tested at the outlet CEM. The redundant PMT solar blind filters were removed in late February, resulting in a bias in mercury reading. These filters will be replaced next quarter.

A three day outage of the baghouse occurred from February 24-27. During the outage, experimental and OEM bags were tested using a portable drag tester. One bag of each type was removed and sent for analysis. Compartment 4 hopper was modified during the outage also. The vibrator and level sensor were moved down and four new ports installed to accommodate carbon monoxide probes. Work was done on the ash silo level sensor; filter separator bags were replaced in the ash silo; and a rubber curtain installed to prevent dusting during unloading. A duct inspection during the outage showed continued corrosion at places in the duct that should be addressed in the future.

A draft test plan for the SO_2/NO_x control task was issued this quarter. Investigations into equipment options and availability were also started this quarter.

Laboratory tests on PAC auto-ignition continued this quarter, and a good correlation between bed size and ignition temperature using the Frank-Kamenetskii Model was completed. Next quarter tests will study the effect of LOI on ignition temperature.

A Mercury Quality Index apparatus was designed and fabricated in 1Q06. Lessons learned from this first prototype will be used to fabricate a second-generation unit next quarter.

The project team is actively involved in a number of reporting and technology transfer activities, including tours of the facility at Presque Isle.

Appendix A: Drag Measurements

Individual Drag Measurements

Compartment 8 Drag Measurements. February 2007

	Bag Location Row	Bag	Drag		
OEM, 2.7-d PPS	F	4	0.27		
	F	5	0.27		
	F	6	0.28		
	F	7	0.25		
	F	8	0.25		
	F	9	0.25		
	F	10	0.25		
	F	11	0.26		
	F	12	0.25		
	F	13	0.25		
	F	14	0.25		
	F	15	0.25		
	F	16	0.25	Average	0.25
9054	G	9	0.25		
	G	10	0.27		
	G	11	0.23		
	G	12	0.25		
	G	13	0.24		
	G	14	0.25		
	G	15	0.25		
	G	16	0.25	Average	0.25
9055	H	9	0.25		
	H	10	0.25		
	H	11	0.25		
	H	12	0.25		
	H	13	0.23		
	H	14	0.23		
	H	15	0.25		
	H	16	0.25	Average	0.24

Compartment 8 Drag Measurements. February 2007

	Bag Location				
	Row	Bag	Drag		
9056	I	5	0.23		
	I	6	0.25		
	I	7	0.21		
	I	8	0.25		
	I	9	0.23		
	I	10	0.22		
	I	11	0.20		
	I	12	0.21		
	I	13	0.21		
	I	14	0.21		
	I	15	0.25		
	I	16	0.23	Average	0.22
9065	J	7	0.18		
	J	8	0.21		
	J	9	0.18		
	J	10	0.18		
	J	11	0.18		
	J	12	0.18		
	J	13	0.20		
	J	14	0.18		
	J	15	0.18		
	J	16	0.17	Average	0.19

Compartment 8 Drag Measurements. February 2007

	Bag Location				
	Row	Bag	Drag		
1342	K	5	0.29		
	K	6	0.25		
	K	7	0.26		
	K	8	0.25		
	K	9	0.25		
	K	10	0.26		
	K	11	0.25		
	K	12	0.25		
	K	13	0.25		
	K	14	0.25		
	K	15	0.25		
	K	16	0.25	Average	0.25
GE Energy/BHA	L	5	0.35		
	L	6	0.31		
	L	8	0.31		
	L	9	0.32		
	L	10	0.32		
	L	11	0.35		
	L	12	0.33		
	L	13	0.32		
	L	14	0.32		
	L	15	0.35		
	L	16	0.31	Average	0.32
Toray	M	13	0.16		
	M	14	0.17		
	M	15	0.17		
	M	16	0.16	Average	0.16