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

Quarterly Technical Progress Report

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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.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

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 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 was 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 April 1, 2008, through June 30, 2008. During this reporting period, work was conducted on the following tasks:

- 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 17. Carbon-Ash Management System
- Task 18. Revise Design Specifications/O&M Manuals
- 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

Primary work associated with this task was completed in 1Q06.

Task 9 – Foundation Erection

All major foundation work was completed during 1Q05.

Task 10 – Erect Structural Steel, Baghouse, and Ductwork

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

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.

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 2Q08, the mercury Continuous Emissions Monitors (CEMs) located at the inlet and outlet of the baghouse were monitored for long-term operation. A summary of the operation of each system including any maintenance is presented below:

Inlet

Critical calibration failures for total mercury occurred 6 of the 30 days in April, 1 of the 31 days in May, and 3 of the 30 days in June. Failing calibrations often occurred after periods of maintenance and activity. Availability of the system was 51.8% in April, 78% in May, and 85% in June. The poor reliability in April was attributed to a loss in communications with the mercury systems and prevented daily data collection from the systems and the ability to make corrections at the end of March. This computer used for remote communication had stopped functioning and was replaced. Communication was restored in early April but data from April 1 through April 7 was lost. A loss in data indicates reduced availability of the instrument. Note that these systems were operated remotely and it was often several hours before a critical calibration failure was noticed and corrected. If a failure occurred on a Saturday, the system was out of "compliance" from the most recent successful calibration (typically Friday morning) until Monday. Also note that the availability calculations assume that the unit is online for 100% of the quarter and can skew the availability percentage low.

Maintenance:

- April:
  - Could not communicate with the inlet system until April 11.
  - Adjustment of PMT voltage and dilution ratio on April 14.
  - Umbilical set point temperature adjusted from 160 °C to 120 °C on April 17.
- May:
  - Mercury lamp replaced on May 19.
  - Eductor pressure off from May 19 to June 3.
  - Unit offline from May 26 to May 30.
- June:
  - Calibrator general failure (chamber temperature) from June 24 to June 25.
  - Updated alarm min/max settings on March 12th.
  - Switched sampling from probe #3 (Unit 7) to probe #2 (Unit 9) on March 24th due to the Unit 7 outage
  - Probe #2's Hg Elemental line was plumbed into the analyzer on March 25th in order to collect speciation data.

Outlet

Daily zero and span checks on the outlet system from April through June showed very good performance with no critical calibration failures during this time. The availability of the system was 98.5% in April, 97.2% in May, and 97.4% in June. Despite the loss in communications, the outlet system continued to pass all requirements of the calibration check.

Maintenance:

- April:
  - Could not communicate with the outlet system until April 11.
  - Eductor pressure adjusted from 16 psi to 10 psi on April 16
  - Software upgrade on April 30.
- May:
  - None.
- June:
  - Mercury lamp replacement on June 27.

Ash Silo

During 2Q08, there continued to be problems with excessive dusting during unloading of the ash silo using the wet unloader, primarily during startup of the pin mixer. United Conveyer Corporation (UCC) and We Energies continued to work on modifications to the mixer and optimizing its operation to reduce dusting.

The excessive dusting is due to the short material retention time in the mixer that occurs until the material bed height is established. In April, UCC was on site to view the ash being unloaded using the wet mixer. UCC thought that the pressure variations above the rotary valve were causing the erratic feed into the mixer, resulting in dusting issues. A pressure transmitter was installed to record the pressure as the silo was unloaded. There was no evidence of a pressure buildup relating to the dust levels. UCC and We Energies plan to do further investigation of ways to solve this problem during the next quarter.

In May, two We Energies engineers visited the Southern Company Wilsonville facility to see a competing wet ash unloader in operation. This unloader was supplied by Dustmaster and uses a batch process rather than the continuous process employed by UCC. Discussions are ongoing regarding a possible test of the Dustmaster unloader at the Presque Isle Power Plant.

Other Operational Issues

There continued to be intermittent problems with the plant EDS system during the first part of the quarter. Data on baghouse and boiler performance was not available for downloading or archiving during those periods.

During early April, plant workers noticed severe corrosion on some sections of the return duct insulation and lagging. After an inspection, corrosion was also found on the supply duct insulation and lagging. In May plant personnel began removing the lagging from both supply and return ducts. Workers were unable to identify any leaks in the duct. The ducts were inspected from the inside on May 20th during the scheduled baghouse outage (discussed below). Additional removal of lagging and insulation uncovered a weld that was not completed. This was the likely source of flue gas corrosion of the exterior.

There was a problem with the eductor on the Unit 7 PAC injection system. A new eductor was ordered and installed. The old eductor was cut in half to look for wear on the steel. It looked like there was a small amount of wear near the PAC injection nozzle.

The gasket on the discharge end of the Unit 7 PAC blower was leaking during this quarter. This was caused by loose screws that hold the gasket in place. This was fixed and the blower was working correctly.

Carbon Monoxide Detectors

We Energies has been working with Forney Corporation to install a carbon monoxide detector on Compartment #4 hopper. Carbon monoxide is produced during overheating and auto-ignition of activated carbon. Detection of an increase in this gas may be an early indicator of overheating in a hopper. During 2Q08 there continued to be problems with contamination of the sampling system. Forney indicated they would no longer support development of this equipment. It was decided to remove the system and discontinue testing.

Baghouse Outage

During May 19-21, the TOXECON™ baghouse was in a scheduled outage. Several activities were scheduled for this time, including a duct inspection and drag testing on OEM PPS bags and test bags.

Duct Inspection

On May 20, an internal duct inspection was performed on both supply and return ducts to the baghouse. There was no evidence of fallout or problems related to PAC injection, trona injection, alternative carbon testing, or ESP detuning.

Corrosion and rust lines on the walls and floor of the return ducts suggested stratification in duct casing or flue gas temperatures. The corrosion began at the outlet of Unit 9 and was progressively worse towards the Unit 7 outlet. This was not evident in the supply ductwork.

All expansion joints were deteriorating. The pillow material inside the cavity of the expansion joints appeared to be saturated with flue gas condensation and had become brittle, cracked or was missing. The degradation was predominant in the first 6-8 feet from the duct floor.

There was significant flue gas condensation in the area of the Unit 7 booster fan. During startup of Unit 7 during this quarter, fluid ran from a drain in the booster fan casing.

Discussions are underway concerning repairs to the ductwork, including repair of the leaking weld, removal and replacement of corroded insulation and lagging, repair of the expansion joints, and possibly external insulation of the expansion joints.

Bag Testing

Background

The TOXECON™ baghouse is a pulse-jet design supplied by Wheelabrator. It has 10 compartments, each with 648 bags. Each compartment is separated into two, 18 x 18 row bag bundles. The diameter of the circular bag is 5.0 in., the length is 26 ft and the filtering area is 34 ft^2. The total filtration area in the baghouse is 220,320 ft^2. With all units in service at normal full load, the gross air-to-cloth ratio is 5.0 ft/min. The design gross air-to-cloth ratio is 5.5 ft/min.

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

A description of the different types of test fabrics installed in Compartment 8 can be found in Table 1. All test bags are installed in bundle A, or the bundle closest to the inlet and outlet plenums. In the case of the Ahlstrom fabric, four approximately 4” x 11” swatches were installed in frames in a swatch holder, which was placed on the supporting steel above the bags and pulse pipes. Although full-scale bags are preferred for the tests, using swatches reduces the risk of premature failures with experimental bags. For comparison, four OEM swatches were also installed.

Table 1. Test Bag Materials

Bag ID	Material/Design	Benefit	Quantity
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	9
1342	P84	Higher temperature, higher collection efficiency	11
GE/BHA-TEX	Scrim-supported PPS felt with a BHA-TEX Expanded microporous PTFE Membrane	Membrane provides higher collection efficiency and promotes light dustcake formation	10
Toray	Proprietary material		2
Environmental Products and Systems, Inc.	PPS fabric	Alternate source of PPS bags	1
Ahlstrom GFTS #4406	Armorguard felt, proprietary blend		Swatches only

A schematic of the compartment layout, bag numbering scheme and locations of the different bag types in bundle A of Compartment 8 is shown in Figure 1. This schematic also documents when new bags were installed to replace bags that were removed for various reasons, including heat damage from the overheating incident, unacceptable emissions from the high-perm test bags, and the installation of additional test bags.

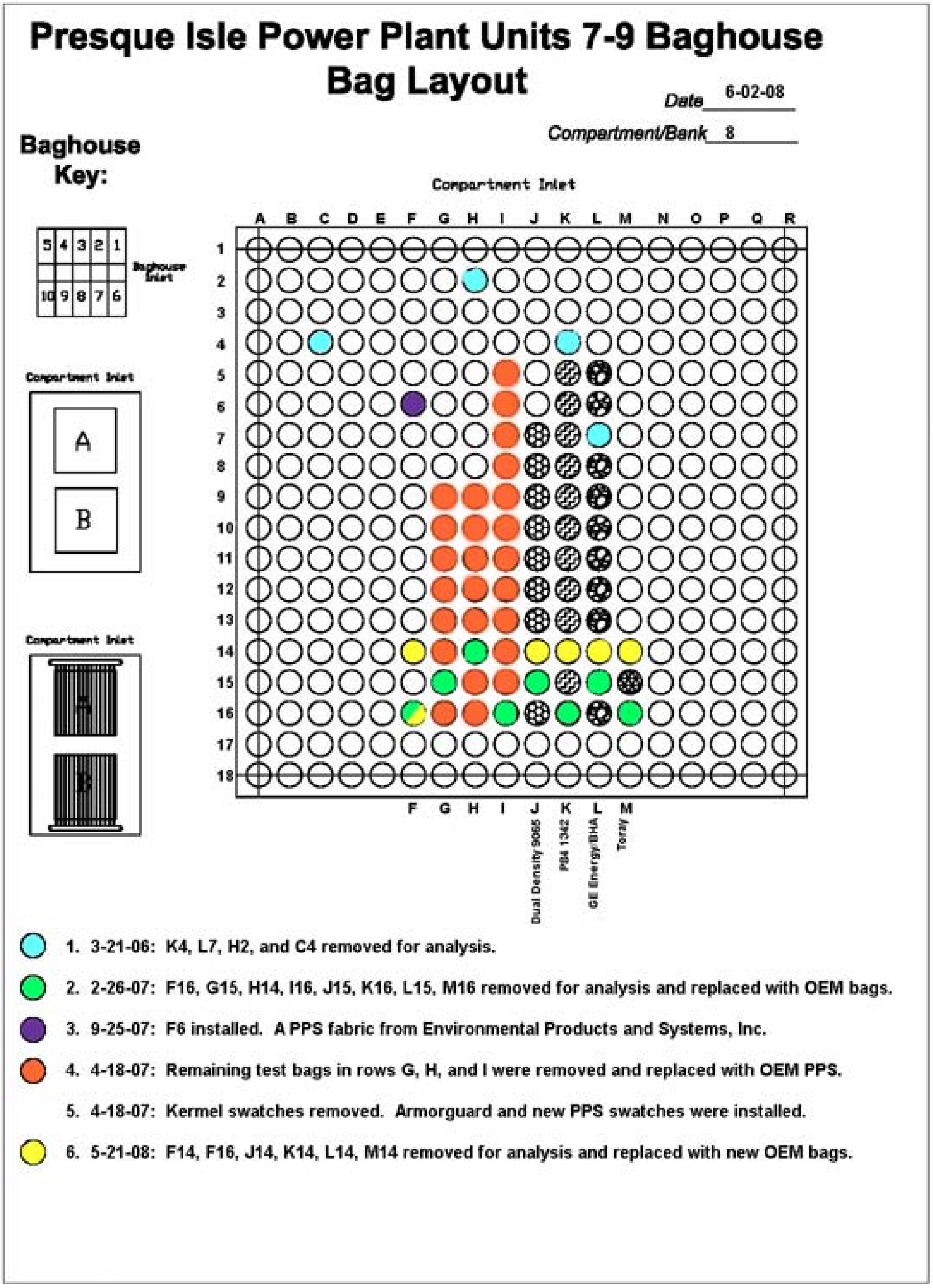

Figure 1. Test Bag Layout in Compartment 8

Summary of Testing

All testing was conducted in Compartment 8. Drag measurements were made on 93 bags. Six of these bags and four swatches were removed for weighing and laboratory testing. Table 2 provides a list of the test bags and swatches, the number of bags in place the day the compartment was entered for testing, the number of bags measured for drag and the number of bags or swatches removed and replaced with new OEM bags.

Table 2. Summary of bags and swatches tested and/or removed on 5/21/08

Bag Description	Installation Date	Number of Bags 5/21/08	Number of bags tested for drag	Number of bags removed
OEM Std	Start-up, Jan 2006	258	27	1
Dual Density – 9065	Start-up, Jan 2006	9	9	1
P84 - 1342	Start-up, Jan 2006	11	11	1
GE/BHA - Membrane	Start-up, Jan 2006	10	10	1
Toray	Start-up, Jan 2006	2	2	1
OEM Std	March 21, 2006	4	2	0
OEM Std	February 26, 2007	8	6	1
OEM Std	April 18, 2007	25	25	0
EPS – PPS Std	Sept. 25, 2007	1	1	0
OEM Std – Swatch	April 18, 2007	4 swatches		2
Armorguard - Swatch	April 18, 2007	4 swatches		2

Results, Observations and Analysis

The tube sheet was clean, indicating that the bags were in good shape with a very low probability that any bags had failed (Figure 2).

Average drag measured for each of the bag sets is presented in Table 3. This table presents data ordered by consecutive rows in the compartment. Table 4 presents this same data ordered by hours of operation.

Individual drag measurements for each bag set are presented separately at the end of this report. The variability in drag in a bag set was typically ±0.02 inches H_2O/ft/min.

Drag provides an indication of the filterability of the bags after a period of operation. Ideally, the bags are cleaned, one pulse per bag, prior to taking the compartment off line so that the measurements represent the lowest possible drag with the dust cake formed in the conditions at this site. Not pulsing all of the bags uniformly can significantly affect the drag measurements.

Drag was measured on an installed, new, OEM bag in February 2007; the drag was 0.05 inches H_2O/ft/min.

Figure 2. Picture of Compartment 8 Tube Sheet

Table 3. Drag Measurements by Row Number, 5/21/08

Bag Description (Installation Date)	Row ID	Number of Bags Tested	Average Drag 5/21/08 (inch H2O/ft/min)	Estimated Operating Hours
OEM Std (Jan 2006)	F	9	0.19	18,745
OEM Std (Apr 2007)	G	7	0.15	9,456
OEM Std (Apr 2007)	H	7	0.14	9,456
OEM Std (Apr 2007)	I	11	0.17	9,456
Dual Density - 9065	J	9	0.10	18,745
P84 - 1342	K	11	0.23	18,745
GE/BHA - Membrane	L	10	0.30	18,745
Toray	M	2	0.27	18,745
OEM Std (Jan 2006)	N	5	0.26	18,745
OEM Std (Jan 2006)	O	12	0.29	18,745
OEM Std (Mar 2006)	Mix	2	0.17	17,765
OEM Std (Feb 2007)	Mix	6	0.16	10,656
EPS – PPS Std	F	1	0.20	5,640

Table 4. Drag Measurements by Operating Hours, 5/21/08

Bag Description (Installation Date)	Row ID	Number of Bags Tested	Average Drag 5/21/08	Estimated Operating Hours
OEM Std (Jan 2006)	F	9	0.19	18,745
OEM Std (Jan 2006)	N	5	0.26	18,745
OEM Std (Jan 2006)	O	12	0.29	18,745
Dual Density – 9065 (Jan 2006)	J	9	0.10	18,745
P84 – 1342 (Jan 2006)	K	11	0.23	18,745
GE/BHA – Membrane (Jan 2006)	L	10	0.30	18,745
Toray (Jan 2006)	M	2	0.27	18,745
OEM Std (Mar 2006)	Mix	2	0.17	17,665
OEM Std (Feb 2007)	Mix	6	0.16	10,656
OEM Std (Apr 2007)	G	7	0.15	9,456
OEM Std (Apr 2007)	H	7	0.14	9,456
OEM Std (Apr 2007)	I	11	0.17	9,456
EPS – PPS (Sep 2007)	F	1	0.20	5,640

For this baghouse, a drag below 0.3 inches H_2O/ft/min should be considered ideal and should result in acceptable filterability. At an air-to-cloth ratio of 5.5 inches H_2O and a drag of 0.3 inches H_2O/ft/min, the tube sheet pressure drop after cleaning would be nominally 1.6 inches H_2O/ft/min.

Trends and observations noted from drag data collected during this inspection include:

- The drag of the standard PPS, OEM bags in rows F, G, H, and I was less than 0.2 inches H_2O/ft/min, which is very low and excellent for bags with over two years of operation.

- The dual density test bags had the lowest drag of any of the bags sets, with an average drag of 0.1 inch H_2O/ft/min. This is very encouraging, as this fabric is showing that it has the permeability characteristics of a high perm fabric with the particulate filtering characteristics of a higher efficiency fabric.

- The average drag of the P84 test bags was 0.23 inches H_2O/ft/min. This is very good and should result in acceptable tube sheet pressure drop for several years, assuming similar operating conditions. P84 is capable of operating at a continuous temperature of 500^{o}F while PPS maximum temperature is 375^{o}F.

- The average drag of the Toray test bags was 0.27 inches H_2O/ft/min. This is good and should result in acceptable tube sheet pressure drop for at least another year, assuming similar operating conditions and no severe upset conditions. In February 2007, this bag type had the lowest average drag. Although the drag measured in these tests is higher than the OEM, dual density and P84 bags in rows F, J and K, it is similar to the drag of the OEM bags in row N. Also, an OEM bag installed as a replacement for the bag that was removed for testing in February 2007 had a drag of 0.27 inches H_2O/ft/min (see individual bag measurements at the end of this memo) compared to similar bags with much lower drag in other rows. This is suspicious and the higher drag measured in this row is most likely caused by inadequate cleaning prior to shut down.

- The average drag of the GE/BHA membrane bags was 0.3 inches H_2O/ft/min, the highest of any of the bag sets. This is expected because 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 dust cake from forming. Over time, if a heavy dust cake forms on the standard bags, the membrane bag would probably have a much lighter dust cake and possibly a lower drag. An OEM bag installed as a replacement for the bag that was removed for testing in February 2007 had a drag of 0.13 inches H_2O/ft/min (see individual bag measurements at the end of this memo). This indicates that the higher drag is due to the fabric design and not due to inadequate cleaning. At this time we are seeing no benefit of the membrane in maintaining lower drag than the standard PPS bags.

- The drag of the recently installed PPS bag from Environmental Products and Systems, Inc, was 0.2 inches H_2O/ft/min, which is similar to the other OEM PPS bags in the same row.

- The average drag of the OEM standard bags installed in April 2007 in rows G, H, and I was very low at 0.15, 0.14 and 0.17 inches H_2O/ft/min, respectively. The average drag of the OEM standard bags installed in January 2006 in rows N and O was measurably higher at 0.26 and 0.29 inches H_2O/ft/min. This difference is most likely due to inadequate cleaning prior to shut down.

- Six bags were removed by first removing the cage, then the bag, and then folding the bag up and placing it into a plastic bag. One each of the dual density, P84, GE/BHA and Toray bags was removed. Two OEM standard bags were removed, one that was installed since startup in January 2006 and one that was installed in February 2007. The bag weight measurements can be found in Table 5.

Trends and observations noted from the bag weight measurements include:

- The bags were weighed at the plant along with the plastic bag they were stored in. The actual bag weights used for comparison are net of the new bag weight and the plastic bag. Bags that had to be cut off the cage are noted in Table 6.

Table 5. Bag Weights, 5/21/08

Bag #	Bag I.D.	Plastic Bag Tare	New Bag Weight (lb)	Test Bag Weight (lb)	Net Wt. (lb)
F14	OEM STD	0.06	5.1	6.1	0.9
F16	OEM STD		5.1	5.9	0.7
J14	Dual Density		4.3	5.0	0.6
K14	P84		3.8	5.5	1.7
L14	GE/BHA		4.0 (estimated)	4.6	0.6
M14	Toray		4.6 (estimated)	7.1	2.4

- The dust cake weight of the OEM bags was 0.9 and 0.7 lbs, which is very low and correlates with the low drag numbers.
- The dual density and GE/BHA membrane bags had the lowest dust cake weights, 0.6 lbs. This matches the low drag of the dual density fabric and illustrates the pressure drop brought about by the membrane.
- The dust cake weight of the P84 bag was 1.7 lbs, which is higher than the OEM bags but well within what is acceptable.
- The dust cake weight of the Toray fabric was higher than the others. In February 2007 the Toray bags also had the highest dust cake weights.

Table 6. Comparison of Drag and Bag Weights - February 2007 and May 2008

Bag Description	Average Drag 2/26/07 (inches H20/ft/min)	Average Drag 5/21/08 (inches H2O/ft/min)	Net Bag Weight 2/26/07 (lbs)	Net Bag Weight 5/21/08 (lbs)
Dual Density - 9065	0.19	0.10	1.1	0.6
P84 – 1342	0.25	0.23	1.1	1.7[c]
GE/BHA - Membrane	0.32	0.30	0.9	0.6[c]
Toray	0.16	0.27	2.0	2.4
OEM Std (Jan 2006)	0.25	0.19[b]	0.8	0.9 [b]

[a]*Only bags installed January 2006 are included, all bags had 34,606 hours of operation*
[b]*Average drag for bags in Row F only. Bag removed for weighing from Row F*
[c]*Bag had to be cut off the cage*

Discussion

A comparison of drag and dust cake weight measurements in February 2007 and May 2008 is presented in Table 6. Only bags installed for the January 2006 startup were included in this comparison.

The drag of the dual density and OEM bags were measurably less in May 2008 than February 2007. The dust cake of the dual density bags was also lower, while the dust cake of the OEM bag was about the same. These lower drag and dust cake values may be due to the optimized control logic for cleaning the bags that pulses the bags more frequently than necessary based upon pressure drop. The frequent cleaning is performed to assure that mercury-laden activated carbon is removed and replaced with fresh activated carbon. Another reason for the lower values is that the baghouse was operating with less than three units in service for most of the past several months. Fewer units results in lower flow (air-to-cloth ratio) which is much easier on dust cake formation and filtration.

The drag and dust cake weight of the Toray test bags were higher than previous measurements. Even so, the values are within an acceptable range which indicates that this bag type should be considered a viable option for installation in this baghouse. However, the results show that the standard PPS, dual density and P84 bags would be preferred.

There is no measurable performance benefit from the membrane on the GE/BHA fabric that offsets the cost premium for these bags.

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 is no indication that performance should deteriorate soon.

After over 34,000 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 July.

Baghouse Operations

DARCO® Hg-LH, a brominated carbon, was injected starting in January 2008 and continued throughout the second quarter. Figure 3 shows TOXECON™ data for April 2008. Mercury removal was over 90% for the majority of the month using 1.0-1.2 lb/MMacf PAC. The baghouse cleaning frequency was steady at 0.18 p/b/hr. The tube sheet pressure drop was around 1.0 inches of water with two units at full load.

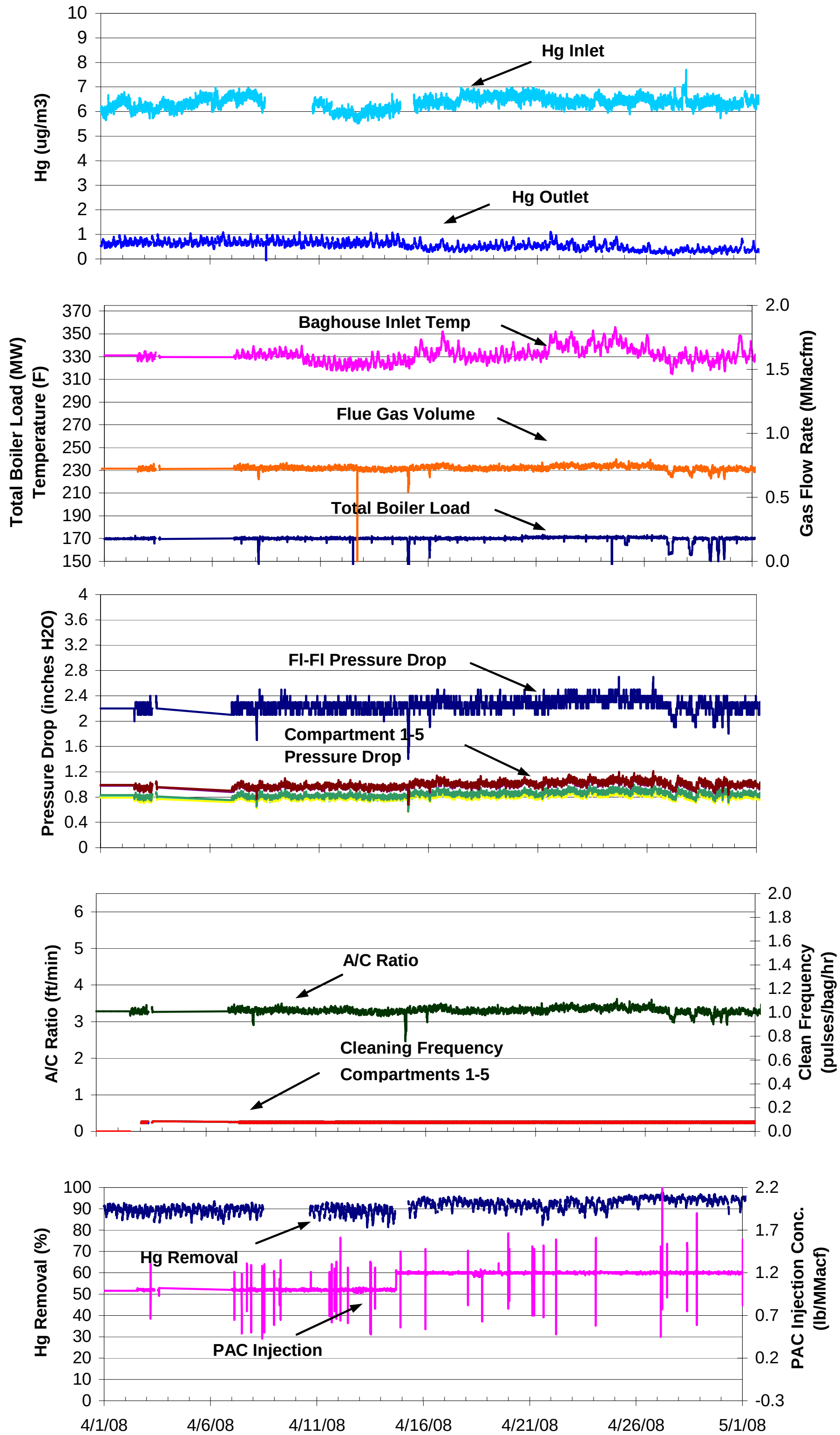

Figure 3. TOXECON™ Performance Data for April 2008.

Figure 4 shows TOXECON™ data for May 2008. Mercury removal was over 90% at a PAC injection rate of 1.0-1.2 lb/MMacf. The baghouse cleaning frequency was steady at 0.18 p/b/hr. The tube sheet pressure drop was around 1.0 inches of water even when all units were at full load.

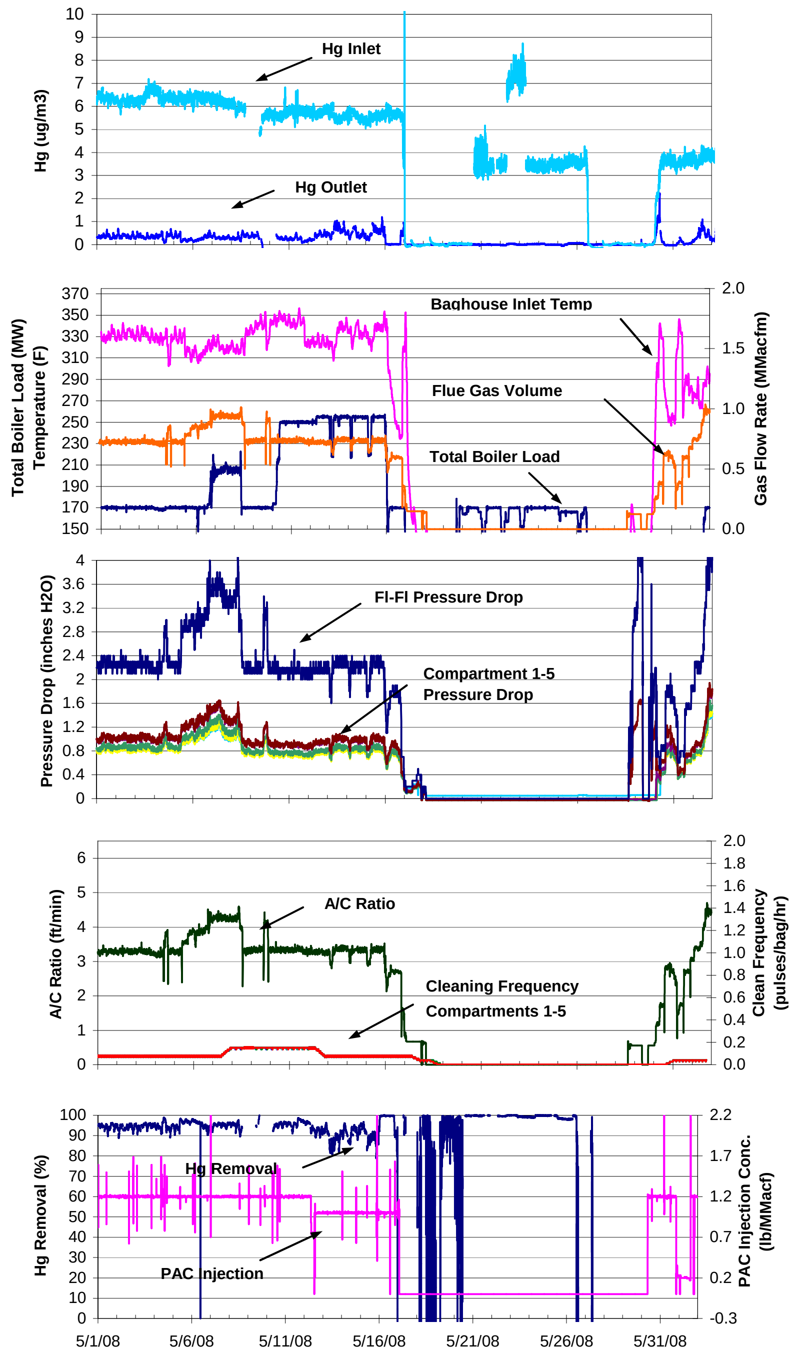

Figure 4. TOXECON™ Performance Data for May 2008.

Figure 5 shows TOXECON™ data for June 2008. Mercury removal was over 90% for most of the month with a PAC injection rate of 1.2-1.3 lb/MMacf. The baghouse cleaning frequency was steady at 0.18 p/b/hr. The tube sheet pressure drop was around 2.0 inches of water when all units were at full load.

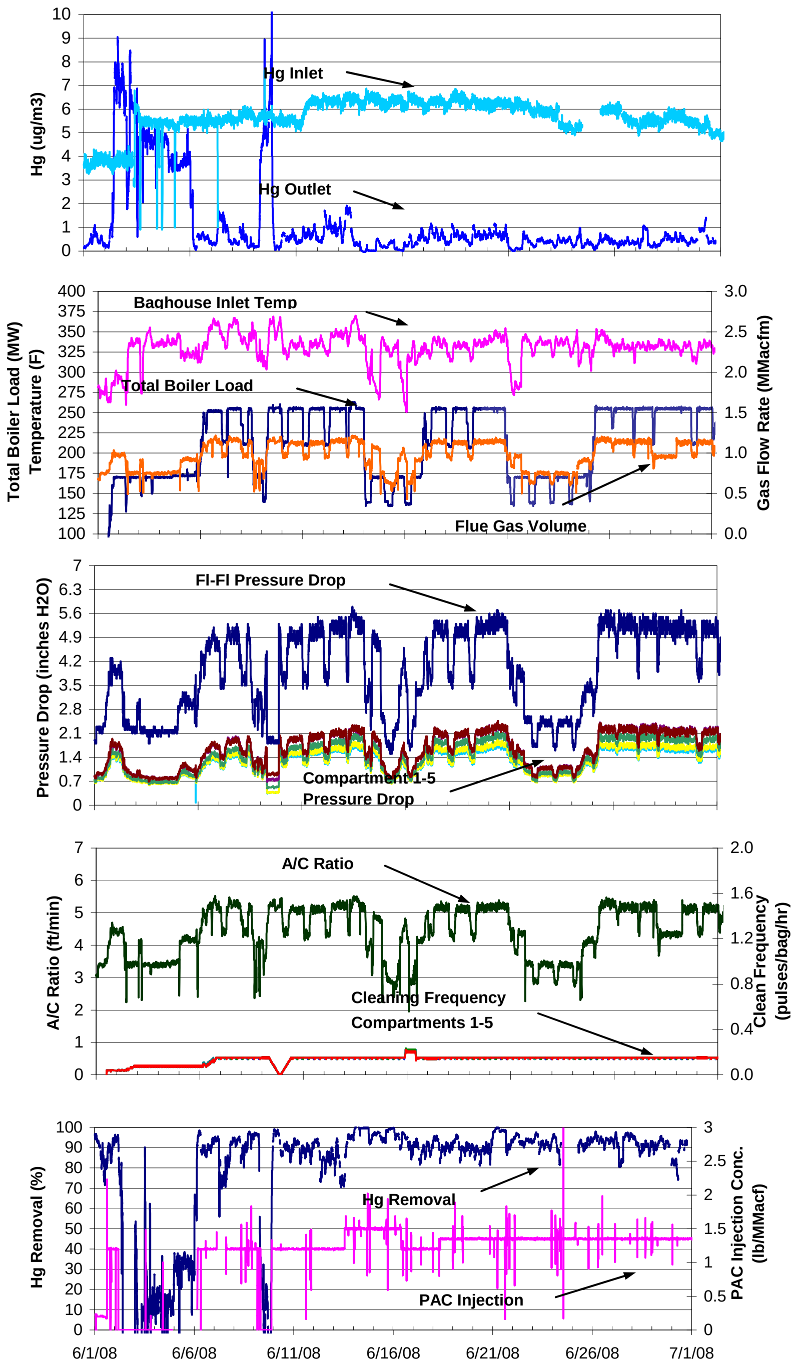

Figure 5. TOXECON™ Performance Data for June 2008.

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

This test effort was designed to support the overall objectives of the TOXECON™ retrofit at Presque Isle as well as to further the technical understanding of the TOXECON™ technology for both We Energies and the greater industry. Parametric tests were performed in August, 2007 to assess the capability of trona (sodium sesquicarbonate) injection upstream of the TOXECON™ baghouse to control SO_2 and NO_x. Injection equipment and measurement instrumentation were installed specifically for these tests. The following were the objectives of the testing program:

- Quantify the trona injection rate versus SO_2/NO_x removal.
- Record baghouse performance over the test period, showing how pressure drop, cleaning frequency and mercury removal change.
- Determine if there is any negative effect of trona injection on emissions (NO_2).
- Evaluate the technical and economic performance of trona.

Data and results from the testing in August were presented in the 3Q07 quarterly report. A draft topical report including technical results and economic assessment was submitted in late 1Q08. Conclusions from the report were described in the previous quarterly report (1Q08). The draft document was sent out for review and will be submitted in final form when complete.

Task 17 – Carbon/Ash Management System

During 4Q07 a review on current technologies concerning mercury removal from high carbon ash was completed. Several thermal treatment technologies were identified as having potential for a pilot scale test in 2008. During 1Q08 two thermal technologies were identified as having the potential to treat the TOXECON™ baghouse ash. One process uses microwave energy while the other uses natural gas as the heating source. Several 55-gallon drums of baghouse ash were shipped out to be tested using both technologies.

An alternative use for the PAC/ash mixture from the TOXECON™ baghouse was identified in 4Q07. High carbon fly ash has been used successfully as an additive to create electrically conductive concrete. This could potentially create a demand for the untreated PAC/ash mixture. During 1Q08 a patent search identified We Energies as holding two patents regarding this technology. A task outline and draft test plan were developed regarding this effort and distributed to the project team. During 2Q08 a document search was completed and a detailed overview of conductive concrete technologies was prepared and sent to the project team. The final test plan for the initial phase of “laboratory” testing was submitted this quarter.

The objective of this work is to develop a concrete formulation that can pass an electrical current through a concrete slab. The goal of this project sub-task is to design and construct a conductive concrete pad at the Presque Isle site this autumn. Once in place, the pad will be monitored for temperature, energy usage and durability. Other field demonstrations may be initiated concurrently or sequentially depending on the outcome of the initial test pad demonstration.

ADA-ES has begun preparing a number of concrete formulations varying the amount of fly ash and carbon fiber content. Fly ash material used in the formulations will be characterized for mercury content using U.S. EPA Method 7473 "Mercury in Solids and Solutions by Thermal Decomposition, Amalgamation, and Atomic Absorption Spectrophotometry" and analyzed for carbon content using ASTM D7348-07 "Standard Test Methods for Loss on Ignition (LOI) of Solid Combustion Residues".

Initially, batches of concrete will be tested at an independent laboratory for compressive strength. CTL Thompson, Inc. is a Denver-based laboratory that has worked with ADA-ES in the past and is known for their expertise in analyzing concrete. Results from their testing efforts will aid in further formulation development.

When formulations with suitable compressive strength and workability factors are developed, additional samples will be tested for conductive properties as well as freeze-thaw durability. Further laboratory testing, analysis, and preparation for a field demonstration of this technology are scheduled for 3Q08.

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

Work continued this quarter to finalize a detailed training program and supplement to the Thermo Manual for the CEMs. This work was performed by ADA-ES and involved detailing background, startup, and operation of the CEMs. In May 2008 ADA-ES presented a two-day training overview at the plant for technicians and engineers. The supporting presentation was sent to the plant as a supplement to the on-site training.

In 2Q08 further work was performed on developing a troubleshooting and maintenance guide. When complete, this will also be presented to the plant. This is scheduled to be complete in 3Q08.

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

- Presented during a McIlvaine webcast in April
- Presented at the AWMA in June 2008
- Attended the Concrete Technology Forum in May 2008
- Submitted three abstracts for the EUEC in January 2009
- Technical papers and presentations for future meetings include:
    - MEGA Symposium (August 2008)
    - EUEC (January 2009)

CONCLUSION

This is the seventeenth 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. Operational issues that were addressed included modifying the ash silo wet unloading system to prevent dusting, connectivity problems with the EDS and on-site CEM computer, duct insulation and lagging corrosion, PAC injection eductor wear, and PAC blower leakage. The carbon monoxide detector was still not operational during this quarter and was removed and shipped back to the manufacturer.

The baghouse had a scheduled outage in May. During that time, an internal inspection of the supply and return ducts was performed. External inspection and removal of sections of insulation and lagging was also performed. The probable source of the leak was determined and plans are underway to repair the ductwork. During the outage, a second series of drag tests and test bag inspections was performed. The first series was in February 2007. Results from the drag tests showed good performance in the remaining test bags as well as the OEM bags installed in the remainder of the baghouse.

Work began on the ash management task this quarter. Two companies will be testing their thermal treatment on ash samples from the baghouse in 3Q08. ADA-ES began developing formulations for using high LOI fly ash in the preparation of conductive concrete. A Test Plan and overall outline for this sub-task was distributed.

Several software and operational maintenance efforts were performed this quarter. CEM availability was impacted in April by a computer failure. This computer allows ADA-ES to communicate remotely with the CEMs on site.

The project team is actively involved in a number of reporting and technology transfer activities.