Pilot Testing of Mercury Oxidation Catalysts for Upstream of Wet FGD Systems

Quarterly Technical Progress Report

January 1, 2006 – March 31, 2006

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ABSTRACT

This document summarizes progress on Cooperative Agreement DE-FC26-04NT41992, "Pilot Testing of Mercury Oxidation Catalysts for Upstream of Wet FGD Systems," during the time-period January 1 through March 31, 2006. The objective of this project is to demonstrate at pilot scale the use of solid honeycomb catalysts to promote the oxidation of elemental mercury in flue gas from coal combustion, and the use of a wet flue gas desulfurization (FGD) system downstream to remove the oxidized mercury at high efficiency. The project is being co-funded by the U.S. DOE National Energy Technology Laboratory, EPRI, Great River Energy (GRE), TXU Generation Company LP, the Southern Company, and Duke Energy. URS Group is the prime contractor.

The mercury control process under development uses honeycomb catalysts to promote the oxidation of elemental mercury in the flue gas from coal-fired power plants that have wet lime or limestone FGD systems. Oxidized mercury is removed in the wet FGD absorbers and leaves with the byproducts from the FGD system. The current project is testing previously identified catalyst materials at pilot scale and in a commercial form to provide engineering data for future full-scale designs. The pilot-scale tests will continue for approximately 14 months or longer at each of two sites to provide longer-term catalyst life data. Pilot-scale wet FGD tests are being conducted periodically at each site to confirm the ability to scrub the catalytically oxidized mercury at high efficiency.

This is the ninth reporting period for the subject Cooperative Agreement. During this period, project efforts primarily consisted of operating the catalyst pilot units at the TXU Generation Company LP's Monticello Steam Electric Station and at Georgia Power's Plant Yates. Two catalyst activity measurement trips were made to Plant Yates during the quarter. This Technical Progress Report presents catalyst activity results from the oxidation catalyst pilot unit at Plant Yates and discusses the status of the pilot unit at Monticello.

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INTRODUCTION

This document is the quarterly Technical Progress Report for the project "Pilot Testing of Mercury Oxidation Catalysts for Upstream of Wet FGD Systems," for the time-period January 1 through March 31, 2006. The objective of this project is to demonstrate at pilot scale the use of solid honeycomb catalysts to promote the oxidation of elemental mercury in flue gas from coal combustion, and a wet flue gas desulfurization (FGD) system downstream of the catalysts to remove the oxidized mercury at high efficiency. The project is co-funded by the U.S. DOE National Energy Technology Laboratory (NETL), EPRI, Great River Energy (GRE), TXU Generation Company LP (TXU Generation), Southern Company, and Duke Energy. URS Group is the prime contractor.

The mercury control process under development uses honeycomb catalysts to promote the oxidation of elemental mercury in the flue gas from coal-fired power plants that have wet lime or limestone FGD systems. Oxidized mercury is removed in the wet FGD absorbers and leaves with the byproducts from the FGD system. The current project is testing previously identified catalyst materials at pilot scale and in a commercial form, to provide engineering data for future full-scale designs. The pilot-scale tests will continue for approximately 14 months or longer at each of two sites to provide catalyst life data.

Pilot-scale wet FGD tests are being conducted periodically at each site to confirm the ability to scrub the catalytically oxidized mercury at high efficiency. The pilot wet FGD system has also been used downstream of catalysts tested as part of another cooperative agreement (DE-FC26-01NT41185).

Four utility team members have provided project host sites for mercury oxidation catalyst testing. GRE provided a test site at their Coal Creek Station (CCS), which fires North Dakota lignite, and CPS Energy of San Antonio (CPS) provided a test site at their J.K. Spruce Plant, which fires Powder River Basin (PRB) subbituminous coal. Both the CCS and Spruce mercury oxidation catalyst pilot tests were conducted as part of project 41185, and both hosted pilot FGD tests downstream of the catalysts as part of the current, 41992 project.

In the current project, TXU Generation is hosting pilot catalyst tests and intermittent wet FGD pilot tests at their Monticello Steam Electric Station, Unit 3, which fires a Texas lignite/Powder River Basin (PRB) coal blend. The TXU Generation test program began in mid-January 2005.

Duke Energy was also to host oxidation catalyst pilot and wet FGD pilot tests at one of their sites firing low-sulfur Eastern bituminous coal. However, both of their candidate sites (that are having wet FGD retrofitted but not selective catalytic reduction [SCR]) were measured to have low elemental mercury concentrations in the flue gas downstream of the particulate control device. Consequently, Duke Energy decided not to host oxidation catalyst pilot tests. However, they did host pilot wet FGD tests to determine the ability to scrub the highly oxidized mercury content of the particulate control outlet flue gas at their Marshall Station.

Southern Company has a number of generating units that fire low-sulfur Eastern bituminous coal. They agreed to host oxidation catalyst tests at their Georgia Power Plant Yates, Unit 1, and to provide project co-funding. Oxidation catalyst pilot tests commenced there during the previous quarter, on December 16, 2005.

The remainder of this report presents results from this project for the first quarter of calendar year 2006. The remaining report is divided into five sections: an Executive Summary followed by a section that describes Experimental procedures, then sections for Results and Discussion, Conclusions, and References.

EXECUTIVE SUMMARY

Summary of Progress

The current reporting period, January 1 through March 31, 2006, is the ninth technical progress report period for this project. During the current period, the oxidation catalyst pilot units continued in operation both at Monticello Unit 3 and at Georgia Power's Plant Yates, Unit 1. One trip was made to the Monticello site to verify sonic horn operation, but otherwise access to the pilot unit was restricted due to construction activity overhead. At Plant Yates, two catalyst activity measurement trips were made. Three of the four catalysts planned for long-term testing at Plant Yates have been installed; the fourth catalyst will be installed later.

Problems Encountered

The most significant problem during the current period was that overhead construction activity in the vicinity of the oxidation catalyst pilot unit at Monticello severely limited project team access to the unit. As a result, no catalyst activity measurements were made at that site during the quarter. There were no other significant problems encountered during the current reporting period other than technical issues that are discussed later in this report.

Plans for Next Reporting Period

During the next reporting period (April 1 through June 30, 2006), catalysts will be evaluated for elemental mercury oxidation activity at Monticello and at Plant Yates through routine (~bimonthly) evaluation trips. Ontario Hydro relative accuracy tests and final wet FGD pilot testing will occur at Monticello near the end of the quarter. The 14-month pilot unit operation period at Monticello was to end in March. However, because of unscheduled pilot unit outage time in late December through mid-January, and due to very limited access to the pilot unit during the current quarter due to overhead construction, the shutdown has been delayed until late in the next quarter.

Prospects for Future Progress

During the subsequent reporting period (July 1 through September 30, 2006), the oxidation catalyst pilot unit at Monticello should be shut down. At Plant Yates, oxidation catalysts will be evaluated for elemental mercury oxidation activity through routine (~bimonthly) evaluation trips. The fourth oxidation catalyst will likely be installed in the pilot unit, and intensive gas characterization efforts and initial wet FGD pilot testing will likely occur at Plant Yates. Pilot unit operation will continue at Plant Yates until the first quarter of calendar year 2007.

EXPERIMENTAL

The work being conducted as part of this project will use three different experimental apparatus types. One is an elemental mercury catalyst oxidation pilot unit (8000 acfm of flue gas treated), the first of which was recently installed at TXU Generation's Monticello Steam Electric Station. A second, nearly identical pilot unit was previously located at CPS' Spruce Plant. During the course of this project, this second pilot unit has been relocated and installed at Georgia Power's Plant Yates.

Each pilot unit has four separate compartments that allow four different catalysts to treat flue gas from downstream of the host plant's particulate control device. Details of the pilot unit design, construction, catalyst preparation and pilot unit operation have been discussed in previous quarterly technical progress reports for the 41185 project[1, 2, 3, 4].

The second pilot unit, which has now been installed and placed in service at Plant Yates, did not have sonic horns installed on it while it was in operation at CPS' Spruce Plant. Spruce has a fabric filter for particulate control and sonic horns were not needed to keep the catalyst clean. In anticipation of operating downstream of a small-SCA ESP at Plant Yates, new sonic horns were installed prior to shipping the pilot unit. The first pilot unit, at Monticello, has 17-inch horns that were supplied by Analytec Corporation. Since those horns were procured, Analytec was purchased by BHA, who markets a similar horn of their own design. Consequently, the second pilot unit had BHA rather than Analytec horns installed.

The activity of the catalysts is determined by measuring the change in elemental mercury concentration across each catalyst while ensuring that the total mercury concentrations do not change significantly across the catalyst. These measurements are primarily conducted using a mercury semi-continuous emissions monitor (SCEM) developed with funding from EPRI. The analyzer has been described in a previous report[5]. Periodically, the analyzer results are verified by conducting manual flue gas sampling efforts in parallel across each catalyst chamber by the Ontario Hydro method.

The flue gas sampling system for the second pilot unit was modified prior to shipping to Plant Yates to allow the possibility of using two SCEMs to simultaneously sample catalyst inlet and outlet flue gas. Originally, both pilot units were equipped with a sampling manifold and solenoid valves that selected flue gas from the catalyst inlet or the outlet of any of the four catalyst chambers. One analyzer could be cycled to analyze flue gas from any of these five locations. The selected flue gas sample was then drawn through an inertial gas separator (IGS) filter by a centrifugal blower, and the gas sample to the SCEM was withdrawn radially from the IGS filter. With the modification to the second pilot unit, it now has two IGS filters and two blowers, one dedicated to pilot unit inlet flue gas and the second connected via manifold and solenoid valves to the outlets of the four catalyst chambers. This allows the use of two analyzers to simultaneously analyze catalyst inlet and outlet flue gas. If only one analyzer is used, the flue gas sample line will have to be physically moved from the inlet to the outlet sampling loops to quantify catalyst performance.

The second experimental apparatus used as part of this project is a bench-scale test unit that is used to evaluate the activity of candidate catalyst samples under simulated flue gas conditions. The bench-scale catalyst oxidation test apparatus was previously described in quarterly technical progress reports for the 41185 project[3, 4].

The third experimental apparatus is a pilot-scale wet FGD unit that was designed and fabricated as part of the current project to allow the measurement of how effectively catalytically oxidized mercury can be scrubbed. The pilot unit was designed to scrub the flue gas from one of four catalyst chambers on either of the mercury oxidation catalyst pilot units. The design basis and a simplified piping and instrumentation diagram (P&ID) for the pilot wet FGD system were included in a previous technical progress report for this project.[6]

RESULTS AND DISCUSSION

This section provides details of technical results available from the current reporting period, January 1 through March 31, 2006. Pressure drop data are presented for the catalysts installed in the catalyst pilot unit at Monticello. No catalyst activity results are available for the Monticello pilot unit because of limited access to the site during overhead construction activities. Catalyst activity and pressure drop results are available from the pilot unit that was started up at Plant Yates during the previous quarter. The available results from each pilot unit are presented and discussed in separate subsections below.

Catalyst Pilot Unit Operation at Monticello

The catalyst pilot unit was started up in flue gas service at Monticello Steam Electric Station, near Mount Pleasant, Texas, on January 14, 2005. It has operated continuously since then other than during short, unscheduled host unit outages and an unscheduled pilot unit outage as described below. The physical characteristics of the four catalysts currently installed are summarized in Table 1.

Table 1. Characteristics of Catalysts Installed in Pilot Unit at Monticello

Catalyst Box Number	Catalyst	Cross Section, in x in (m x m)	Catalyst Depth	Cell Pitch, mm	Cells per Sq. In. (CPSI)	Area Velocity, std. ft/hr
1	Pd #1 (Johnson Matthey)	29.5 x 29.5 (0.75 x 0.75)	9 in. (0.23 m)	3.2	64	52
2	SCR (Cormetech/MHI)	35.4 x 36.2 (0.90 x 0.92)	29.5 in. (0.75 m)	3.3	58	11
3	Gold (Sud-Chemie Prototech)	29.5 x 29.5 (0.75 x 0.75)	3 x 3 in. (3 x 0.08 m)	3.2	64	52
4	Pd #1 (regenerated from CCS)	29.5 x 29.5 (0.75 x 0.75)	3 x 3 in. (3 x 0.08 m)	3.2	64	52

Catalyst Pressure Drop Performance

In previous catalyst testing at CCS, fly ash was observed to build up in the horizontal-gas-flow catalyst cells, resulting in increased catalyst pressure drop and decreased catalyst mercury oxidation performance. Subsequently, sonic horns were installed and were generally effective in preventing fly ash buildup. Since Monticello, like CCS, has an ESP for particulate control (Spruce has a reverse-gas fabric filter), it was expected that the sonic horns would be necessary to prevent fly ash buildup there.

Figure 1 shows the "full load" pressure drop data for all four catalysts from start up through the current quarter, to the extent data are available. Midway through the current quarter, telephone communications with the pilot unit data logger were lost, and communications have not been restored due to the restricted access to the pilot unit during overhead construction activities. In the figure, "full load" is defined as periods where the flue gas flow rate through the highest-flowing catalyst (gold) was at least 1900 acfm. The desired flow rate is 2000 acfm for all four catalysts, but cannot always be achieved due to limited ID fan draft at lower load and the relatively high pressure drop across some of the catalysts.

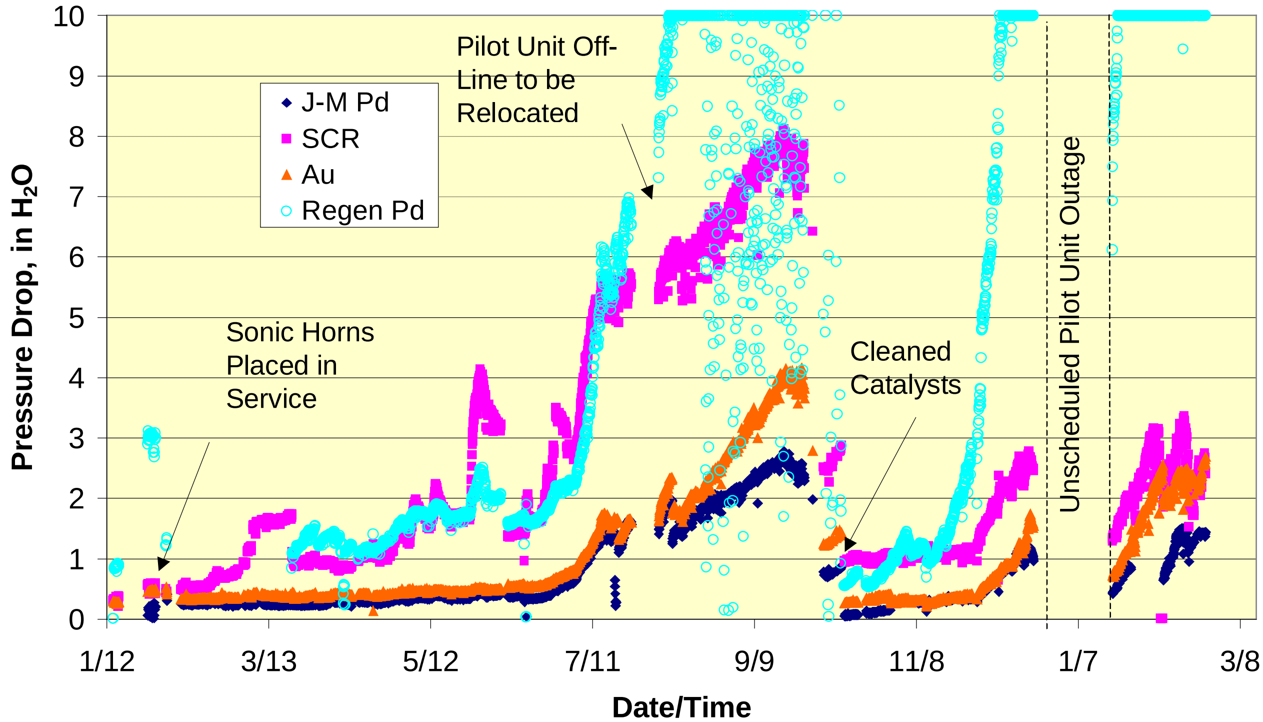

Figure 1. Full-load Catalyst Pressure Drop Data from Monticello Pilot Unit

The sonic horns were placed in service on the Monticello catalyst pilot unit two weeks after initial pilot unit startup on January 14, 2005. However, the sonic horns did not operate properly through the remainder of that quarter. During that period, a failed compressed air pipe nipple was replaced, the horn timer was replaced, the solenoid valves controlling air flow to the horns were replaced, the horns were disassembled and cleaned, and an air pressure regulator was installed to ensure that the optimum air pressure of 70 psig was supplied to the horns. While these efforts corrected a number of operational issues, it still remained that the solenoid valves controlling air flow to the horns did not turn off properly at the end of their cycle (each horn is intended to sound 10 seconds every half hour).

In April 2005, one solenoid valve that had been particularly problematic was replaced with a larger valve (3/4-inch vs. ¼-inch). This change, along with minor wiring and tubing changes, resulted in all four valves cycling properly beginning in late April. The four horns appear to have cycled properly through approximately mid-June 2005.

The pressure drop across all four catalysts increased significantly starting in mid-June, again apparently caused by sonic horn malfunction. Although the air line to the sonic horns has a regulator and filter to control the air pressure and to remove impurities from the compressed air, the air line upstream of the regulator is rusty on the inside. During continued horn operation, exfoliated rust particles from the line tend to build up in the regulator inlet, eventually plugging air flow to the regulator. The regulator was found plugged and was cleaned twice over the summer of 2005.

The pressure drop across all four catalysts dropped somewhat at the beginning of October, due to the effects of a short unit outage. However, in early October it became apparent that although proper sonic horn operation was restored, the fly ash buildup in the catalyst cells would not be removed and the pressure drop across the catalysts would not be restored to clean conditions solely through sonic horn operation. Consequently, the pilot unit was shut down on October 11 and all four chambers were cleaned of fly ash buildup with compressed air and a shop-type vacuum. Considerable fly ash buildup was removed from all four catalysts. Catalyst chamber 1 (Johnson Matthey Pd) had a buildup of hardened fly ash on the chamber floor just upstream of the catalyst, which was evidence of moisture having entered that chamber. While the catalyst chambers were open, the lines to the pressure drop transducers were cleaned out, and the transducers were "zeroed." Plugged, or partially plugged pressure drop tubing connections were found at the inlets to several of the catalyst boxes, and may have contributed to erroneous pressure drop readings. Also during the quarter, a basket strainer was installed on the air line upstream of the regulator in an effort to prevent future plugging of the regulator.

At startup on October 12, after the catalysts were cleaned, the pressure drop across all four catalysts was markedly reduced. The pressure drop values across the gold and Johnson Matthey Pd were between 0.1 and 0.2 in. H_2O, and the pressure drop across the regenerated Pd from CCS was 0.55 in. H_2O. The highest pressure drop was across the SCR catalyst, at 0.9 in. H_2O. This is not surprising considering its longer, 29.5-in. catalyst length (the others are at 9-inches of total catalyst length).

In late November, the pressure drop across the regenerated Pd catalyst was observed to increase. URS personnel were on site conducting another project, and observed sonic horn operation on the catalyst pilot unit on November 30th. All four horns appeared to be cycling and sounding properly, and the compressed air pressure to each was at least 70 psig, the design value, during horn operation. It was decided to continue operation of the pilot unit with no changes and observe the pressure drop values.

On December 2nd, the pressure drop across the other four catalysts began to rise, while the pressure drop across the regenerated Pd catalyst continued to increase towards 10 in. H_2O, the maximum transducer reading. URS personnel were again on site and observed sonic horn operation during the week of December 12th. The solenoid valve for the horn on the gold catalyst chamber was found to not fully close at the end of its cycle, causing that horn to blow continuously. However, even with that horn blowing continuously, the air pressure to the other horns when they operated was observed to be 68 psig, which is near the ideal pressure of 70 psig.

The air pressure regulator setting was increased to produce 70 psig at the horns with two in operation, and the horn on the gold catalyst chamber was left blowing all of the time.

On December 21 flue gas flow to the pilot skid was stopped for then unknown reasons. As a result of holiday and vacation schedules, this unplanned shutdown of the pilot unit was not diagnosed and corrected until early in the current quarter. The cause was traced to damage to the instrument air line to the pilot unit caused by debris falling from overhead construction, which in turn caused the air-operated flow control valves to fail closed. The line was repaired and the pilot unit came back on line on January 19, 2006.

Further troubleshooting was conducted in mid-February to diagnose the pressure drop increases observed. This trip showed no outward signs of a problem – the sonic horns were observed to cycle properly, all pressure drop tubing was clear, and the transducers zeroed properly. Due to the construction activity in the vicinity of the pilot unit, it was not possible to shut down and open any of the catalyst chambers to observe the fly ash buildup.

From mid-February through March 7, the last day for which pressure drop data are currently available, the pressure drop across the regenerated Pd catalyst remained off scale at greater than 10 in. H_2O, while the pressure drops across the other three catalysts remained elevated, in the range of 1.5 to 3 in. H_2O. After March 7, telephone communications with the pilot unit was lost for unknown reasons, so it is not known if the pressure drop values remained relatively steady or increased further. It will not be possible to retrieve the pressure drop data for the remainder of the quarter until the overhead construction activity at Monticello is completed and access to the pilot unit is regained.

Elemental Mercury Oxidation Activity Performance

Because of the restricted access to the Monticello oxidation catalyst pilot unit, the elemental mercury oxidation activity of these four catalysts was not measured during the quarter.

Catalyst Pilot Unit Operation at Plant Yates

The catalyst pilot unit that was previously in service at Spruce Plant as part of project DE-FC26-01NT41185 was shipped to Plant Yates in September 2005 and station personnel installed it downstream of the ID fan on Unit 1. The unit had an extended outage from October 1 through November 20, so startup was delayed until December 2005.

The unit was shipped with two of the regenerated catalysts from the Spruce Plant testing (gold and SCR) still in place. Two new catalyst charges from Sud-Chemie Prototech (gold and Pd) were installed in the pilot unit the week of December 12. The physical characteristics of the four catalysts currently installed are summarized in Table 2.

Table 2. Characteristics of Catalysts Installed in Pilot Unit at Plant Yates

Catalyst Box Number	Catalyst	Cross Section, in x in (m x m)	Catalyst Depth	Cell Pitch, mm	Cells per Sq. In. (CPSI)	Area Velocity, std. ft/hr
1	Pd #1 (Sud-Chemie Prototech)	29.5 x 29.5 (0.75 x 0.75)	3 x 3 in. (3 x 0.08 m)	3.2	64	52
2	Gold (Sud-Chemie Prototech)	29.5 x 29.5 (0.75 x 0.75)	3 x 3 in. (3 x 0.08 m)	3.2	64	52
3	Gold (regenerated from Spruce Plant)	29.5 x 29.5 (0.75 x 0.75)	3 x 3 in. (3 x 0.08 m)	3.2	64	52
4	Argillon SCR (regenerated from Spruce Plant)	35.4 x 35.4 (0.90 x 0.90)	29.5 in. (0.75 m)	3.7	46	13

The SCR catalyst is intended to be replaced with a second Pd catalyst from an alternate vendor (Johnson Matthey). The manufacture of the Johnson Matthey catalyst is being delayed until more information is known about the activity of their catalyst as installed at Monticello. As discussed in previous technical progress reports, some data indicate the Johnson Matthey Pd is less active than the gold or regenerated Sud-Chemie Prototech Pd from Coal Creek Station. However, also discussed previously, this lower apparent activity may be the result of a measurement bias rather than a real difference in performance.[7] This discrepancy still needs to be resolved.

The catalysts were installed the week of December 12, and flue gas flow was established on December 16. Because of the upcoming Christmas and New Year's holidays, the pilot unit was left in operation, including operation of sonic horns on each compartment, and initial catalyst activity measurements were delayed until January 2006. The results of these measurements are discussed later in this subsection.

Catalyst Pressure Drop Data

The catalyst pilot unit at Plant Yates is equipped with a data logger, but no phone line is available nearby. Although it would be possible to convert to a cellular modem to download data, the approach for tracking pilot unit conditions has so far been to download data to a flash drive whenever team personnel are on site. Data from pilot unit startup through the first catalyst activity measurement trip were downloaded on January 15, 2006. Although a second activity measurement trip was conducted in February, that measurement team did not download the pilot unit data. Therefore the only catalyst pressure drop data available are for the first month of operation, from December 16, 2005 through January 15, 2006. Those data are plotted in Figure 2, and show no significant increase in pressure drop across any of the four catalysts. Although the measurement team that made the catalyst activity trip in February did not download the data files, they did observe that the pressure drop across all four catalysts remained below 1 in. H_2O.

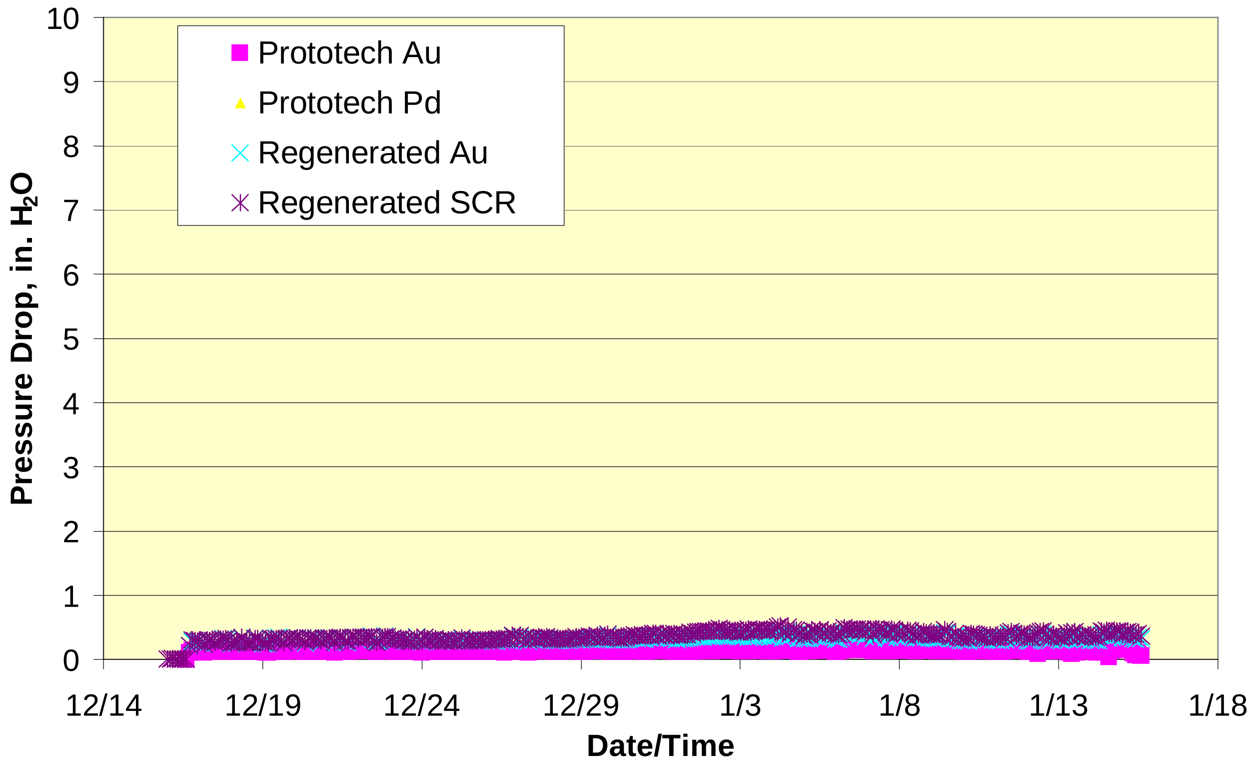

Figure 2. Pressure Drop Data for the Catalyst Pilot Unit at Plant Yates

Elemental Mercury Oxidation Activity Performance

The first catalyst activity measurement trip at Plant Yates was conducted in mid-January 2006. The results of those measurements are summarized in Table 3.

Table 3. Results of Catalyst Activity Measurements at Plant Yates, January 12-15, 2006

Catalyst Type	Catalyst Inlet Total Hg* ($\mu g/Nm^3$)	Catalyst Inlet Elemental Hg* ($\mu g/Nm^3$)	Catalyst Inlet Oxidation (%)	Catalyst Outlet Total Hg* ($\mu g/Nm^3$)	Catalyst Outlet Elemental Hg* ($\mu g/Nm^3$)	% Hg Adsorption Across Catalyst	Oxidation Across Catalyst (%)	Catalyst Outlet Oxidation (%)
New Pd/Al (1/13)	5.04	2.66	47	3.76	0.07	25	97	98
New Au (1/13)	4.85	3.05	37	5.51	0.07	-13	98	99
Regenerated Au (1/14)	3.51	2.20	37	4.07	0.06	-16	97	99
Regenerated SCR (1/15)	3.09	0.98	68	2.93	-0.04	5	100	100

*1 $\mu g/Nm^3$ @ 3% O_2 = 0.66 lb Hg/10^{12} Btu heat input

The results in Table 3 show that all four catalysts were near adsorption equilibrium, and were achieving very high elemental mercury oxidation percentages. These percentages are higher than have typically been measured at previous pilot testing sites, which is likely an effect of the bituminous coal fired at Yates having significantly higher chloride content than the low-rank Western coals fired at all of the previous sites. Chlorine in coal is primarily converted to HCl in the flue gas; HCl is believed to be a reactant in the heterogeneous oxidation of elemental mercury in flue gas. Although the catalyst inlet flue gas HCl concentration at Plant Yates has not yet been measured as part of this project, previous measurements as part of other projects have shown ESP outlet flue gas HCl concentrations in the range of 10 to 20 ppmv. In comparison, the previous mercury oxidation catalyst test sites have had approximately 1 ppmv of HCl in the catalyst inlet flue gas.

A second catalyst activity measurement trip was made to Plant Yates approximately one month later. These results are shown in Table 4. Note that for the regenerated gold, the catalyst outlet elemental mercury concentration was measured one day, while the outlet total mercury concentration was measured the following day. Thus, there are two line entries for this catalyst, with the elemental mercury oxidation across the catalyst calculated with one day's data and the mercury adsorption data calculated with the following day's data.

Table 4. Results of Catalyst Activity Measurements at Plant Yates, February 20-23, 2006

Catalyst Type	Catalyst Inlet Total Hg* (mg/Nm^3)	Catalyst Inlet Elemental Hg* (mg/Nm^3)	Catalyst Inlet Oxidation (%)	Catalyst Outlet Total Hg* (mg/Nm^3)	Catalyst Outlet Elemental Hg* (mg/Nm^3)	% Hg Adsorption Across Catalyst	Oxidation Across Catalyst (%)	Catalyst Outlet Oxidation (%)
New Pd/Al (2/21)	3.98	1.93	52	3.38	0.15	15	92	96
New Au (2/22)	5.17	2.73	47	4.54	0.04	12	99	99
Regenerated Au (2/22)	5.17	2.73	47	-	0.11	-	96	-
Regenerated Au (2/23)	3.95	2.05	48	3.46	-	12	-	-
Regenerated SCR (2/23)	3.95	2.05	48	3.12	0.03	21	99	99

*1 µg/Nm^3 @ 3% O_2 = 0.66 lb Hg/10^{12} Btu heat input

The results in Table 4 show slightly lower mercury oxidation percentages across some of the catalysts than the previous data from January 2006. However, all of the percentages are quite high (>90%) and the measured catalyst outlet elemental mercury concentrations are quite low (<0.2 µg/Nm^3). Measurements planned for mid-April will determine whether the February data represent a small loss of activity for these catalysts or merely represent measurement anomalies when quantifying such low catalyst outlet elemental mercury concentrations.

CONCLUSION

Results to date from Monticello show that reliable sonic horn operation will be required to prevent fly ash buildup in the horizontal-gas-flow catalysts, particularly the SCR catalyst and the regenerated palladium catalyst. Results from this quarter suggest that the horns installed and operating for 10 seconds every 30 minutes are not adequate to prevent fly ash buildup within the catalysts. It is possible that more powerful horns and/or more frequent sounding of the horns is required to maintain clean catalysts at this site. Due to limited access to the catalyst pilot unit at Monticello while overhead construction is underway, it was not possible to determine the effects of the apparent fly ash buildup since the catalysts were physically cleaned last October on mercury oxidation performance.

At Plant Yates, the first month of data show that the sonic horns installed there have been adequate to prevent pressure drop increases. That pilot unit has new horns from another vendor, whereas the Monticello pilot unit uses horns that remained with the pilot unit from previous Coal Creek testing. It is not apparent whether the difference in sonic horn effectiveness seen so far at these two sites is due to differences in fly ash characteristics, or represents a difference in sonic horn performance.

Catalyst activity test results from Plant Yates show all four catalyst to be achieving over 90% oxidation of elemental mercury after two months of operation. This high performance is likely due to higher flue gas HCl concentrations at Plant Yates than at Monticello. The apparent effectiveness of the sonic horns in preventing fly ash buildup at Plant Yates also likely helps.

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