Results Of Activated Carbon Injection For Mercury Control Upstream Of A COHPAC Fabric

Paper No.

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ABSTRACT

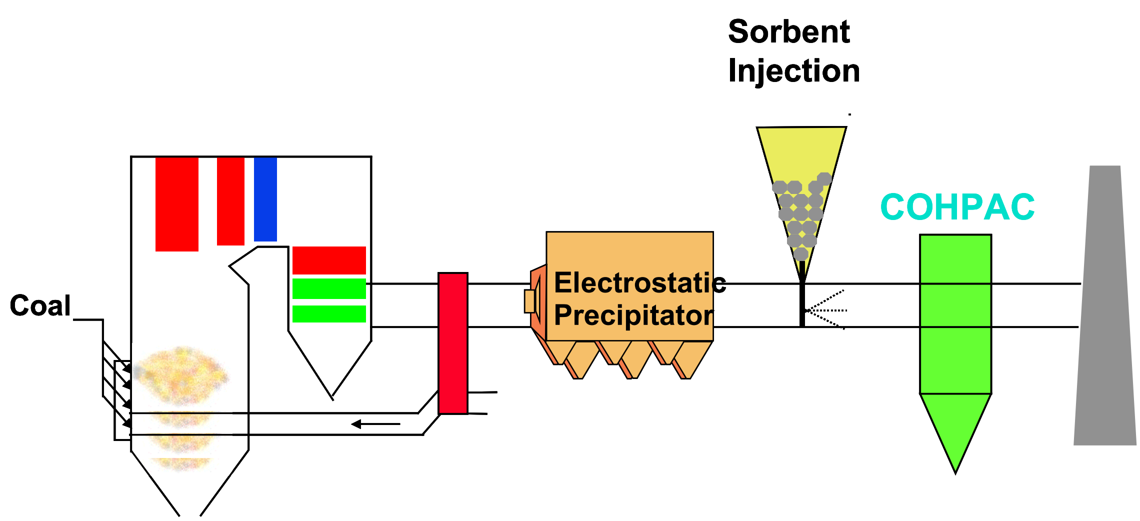
Injecting activated carbon upstream of a COHPAC fabric filter represents one of the most cost-effective approaches of reducing mercury emissions from coal-fired boilers. This configuration is referred to as TOXECON, and it can produce high levels of mercury reduction, up to 90%, at relatively low carbon feed rates, 2-3 lb/Macf, without contaminating the bulk of the ash. This paper will provide results from short-term tests conducted on coal-fired boiler flue gas and the most recent results from a year-long test that began in March 2003. This new long-term program is being conducted by ADA-ES working in partnership with the Department of Energy National Technology Laboratory (NETL), EPRI and a number of power generators and vendors. These tests are being conducted on ½ of Alabama Power's E.C. Gaston Unit 3 COHPAC fabric filter. Results from a short-term test program at this site in 2001 showed high mercury removal efficiencies were possible, but operational restraints prevented running these conditions for extended periods and could not provide information on long-term impact on fabric filter performance. The current program will evaluate the long-term (~1 year) performance of activated carbon for mercury control and its affect on bag life, pressure drop and balance-of-plant equipment. The paper will also present progress on a new $50M five-year demonstration program of TOXECON that will take place at the We Energies Presque Isle Power Plant. This project was recently awarded under the Clean Coal Power Initiative.

INTRODUCTION

Injecting a sorbent such as powdered activated carbon into the flue gas represents one of the simplest and most mature approaches to controlling mercury emissions from coal-fired boilers. 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 the existing particle control device, either an electrostatic precipitator (ESP) or fabric filter (FF). The most commonly used sorbent for mercury control has been activated carbon. For the past two decades, powdered activated carbon injection upstream of a baghouse has been successfully used for removing mercury from flue gases from municipal and hazardous waste combustors.

One of the disadvantages of injecting activated carbon is its impact on the salability or reuse of ash. Test have shown that the activated carbon interferes with chemicals used in making concrete. One straightforward cost effective approach to reducing mercury emissions without contaminating the fly ash is the use of the EPRI COHPAC and TOXECON processes that are currently commercially available. COHPAC is an EPRI patented concept that places a high air-to-cloth ratio baghouse downstream of an existing ESP to improve overall particulate collection efficiency. The process becomes TOXECON when a sorbent such as activated carbon is injected upstream of the COHPAC baghouse located downstream an ESP (Figure 1). With this configuration, the ash is collected upstream of the carbon injection and remains acceptable for sale. The downstream baghouse provides an effective contract device for the PAC resulting in high levels of mercury control at relatively low sorbent injection rates.

Figure 1. Configuration Combining ACI and a Secondary Fabric Filter



The advantages of the TOXECON configuration are:

- Sorbents are mixed with a small fraction of the ash (nominally 1%), which reduces the impact on ash reuse and waste disposal.
- Full-scale field tests have confirmed that fabric filters require only 10-20% of the sorbent required by ESPs to achieve similar removal efficiencies.
- Capital costs for COHPAC are less than other options such as replacing the ESP with a full-sized baghouse or larger ESP.
- COHPAC requires much less physical space than either a larger ESP or full-size baghouse system
- Outage time can be significantly reduced with COHPAC systems in comparison to major ESP rebuilds/upgrades.

This paper will present results on short-term testing of the TOXECON process. Two long-term programs will also be described to address issues uncovered during the earlier tests. Initial long-term results from tests being conducted at the Alabama Power Gaston plant will be presented at the conference.

BACKGROUND

Advantages of a Fabric Filter for Mercury Control

The type of particulate control equipment is a key parameter defining both the amount of sorbent that is required and provides the ultimate limitation of the amount of mercury that can be removed. When the sorbent is injected into the flue gas it mixes with the gas and flows downstream. This provides an opportunity for the mercury in the gas to contact the sorbent where it is removed. This is called "in flight" capture. The sorbent is then collected in the particulate control device where there is a second opportunity for sorbent to contact the mercury in the gas.

The difference in gas phase diffusional contact between in-flight sorption and fabric filter cake contact can be evaluated using the following simplified technical consideration: In a typical ESP injection case, the gas spends 2 sec in contact with the PAC in the inlet duct and nozzle with a carbon injection rate of 10 lbs/Macf. Carbon mass median particle size is 15 µm giving a carbon particle-particle distance in suspension of approximately $d_{pp} =$ 2 mm. Diffusion during time t typically extends over a distance of :

$$X_D = \sqrt{(D\ t)}$$

where D is the gas-phase diffusion constant. In suspension, the ratio of the diffusion distance to the particle-particle distance is then:

$$X_D / d_{pp} = \sqrt{(D \times t)} / d_{pp} = \sqrt{(1xD)}/2mm = 0.5\sqrt{(D)}$$

In a filter cake with an air to cloth ratio of 4 f.p.m., a typical cake thickness of 4 mm, and a gas void fraction of 0.6, the flue resides in the filter cake proper during approximately 0.3 secs. In the cake, the particle-particle distance is much shorter, of the order of 30 μm, and the corresponding ratio for the filter cake case is:

$$X_D / d_{pp} = \sqrt{(D \times t)} / d_{pp} = \sqrt{(0.3 \mathrm{x} D)}/0.03 \text{ mm} = 18 \sqrt{(D)}$$

Based on this calculation, the diffusional mass transfer from the gas-phase to the particle is then more efficient in a fabric filter cake than during the "in-flight" period dominating in the ESP case. This explains why there is a factor of ten difference in carbon feed rates required for ESPs as compared to fabric filters.

NETL Test Program

Under a cooperative agreement from the Department of Energy National Energy Technology Laboratory (DOE/NETL), ADA-ES worked in partnership with PG&E National Energy Group (NEG), Wisconsin Energy Corp., Alabama Power Company, Ontario Power, TVA, First Energy, Hamon Research Cottrell and EPRI on a field test program of sorbent injection technology for mercury control. The test program, which took place at four different sites during 2001 and 2002, is described in detail elsewhere (Durham et al., 2001).

Four full-scale demonstrations were conducted during 2001 and 2002. The first program was completed in the spring of 2001 at the Alabama Power E.C. Gaston Station (Bustard et al. 2002). This unit burns a low-sulfur bituminous coal and uses a HSESP followed by a COHPAC baghouse as secondary collector for remaining fly ash and injected carbon. The second program was conducted during the fall of 2001 at the WEC Pleasant Prairie Power Plant (PPPP) (Starns et al., 2002). This unit burns a subbituminous Powder River Basin (PRB) coal and uses an electrostatic precipitator to collect the carbon and fly ash. The third program was completed in the summer of 2002 at PG&E National Energy Group's Brayton Point Station (Durham et al., 2002). This unit burns low-sulfur bituminous coals and use electrostatic precipitators for particulate control. The fourth program was completed in the fall of 2002 at PG&E National Energy Group's Salem Harbor Station. Salem Harbor fires bituminous coals with an ESP for particulate control and a SNCR system for NO_x control.

Figure 2 presents results from the NETL full-scale tests. For the two ESP tests, one bituminous coal and the other a Powder River Basin (PRB) coal, mercury removal increases with increased rates of carbon injection. For the PRB coal, mercury removal was limited to 70% across the ESP. This limitation is most likely due to the trace amounts (<1 ppm) of HCl available in the gas stream. For the bituminous coal, mercury removal exceeded 90% at the highest carbon injection rate. This coal has a high-chloride content that resulted in approximately 150 ppm of HCl.

One key component of the test program was to determine the impact of the activated carbon on fly ash. Initial testing with a PRB ash determined that the presence of even trace amounts of activated carbon in the ash rendered the material unacceptable for use in concrete. Even though the Pleasant Prairie (PRB) ash conformed to the ASTM C-618 standard for Class C fly ash, it did not pass the Foam Index test that is also required for sale of this ash for use in concrete formulation. These are field tests used to determine the amount of Air Entrainment Additives needed to meet freeze thaw requirements. This means that with PAC injection, the plant would not only loose revenues from ash sales, it would incur additional expenses to land fill the material.

Fabric Filter Field Tests

Figure 2 also shows performance of activated carbon injection upstream of a fabric filter. This plot includes full-scale data from Plant Gaston on a bituminous, and reduced-scale tests conducted by EPRI on a PRB coal (Sjostrom, 2002a). The data from both fabric filter test programs show that ACI can produce 90% removal of mercury for both bituminous and subbituminous coals. Comparing the data from the fabric filter results with the ESP results, it can be seen that the increased contact between the flue gas and the sorbent in the dust cake reduces the carbon feed requirements by nearly a factor to ten.

Figure 2. Mercury Removal with Activated Carbon Injected Upstream of a Fabric Filter

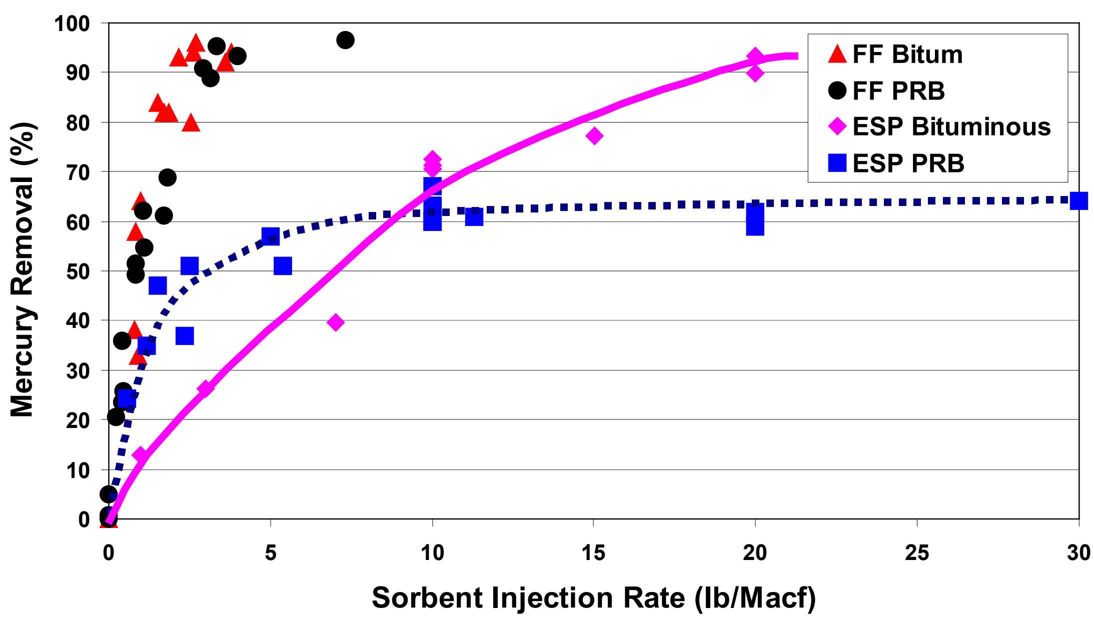
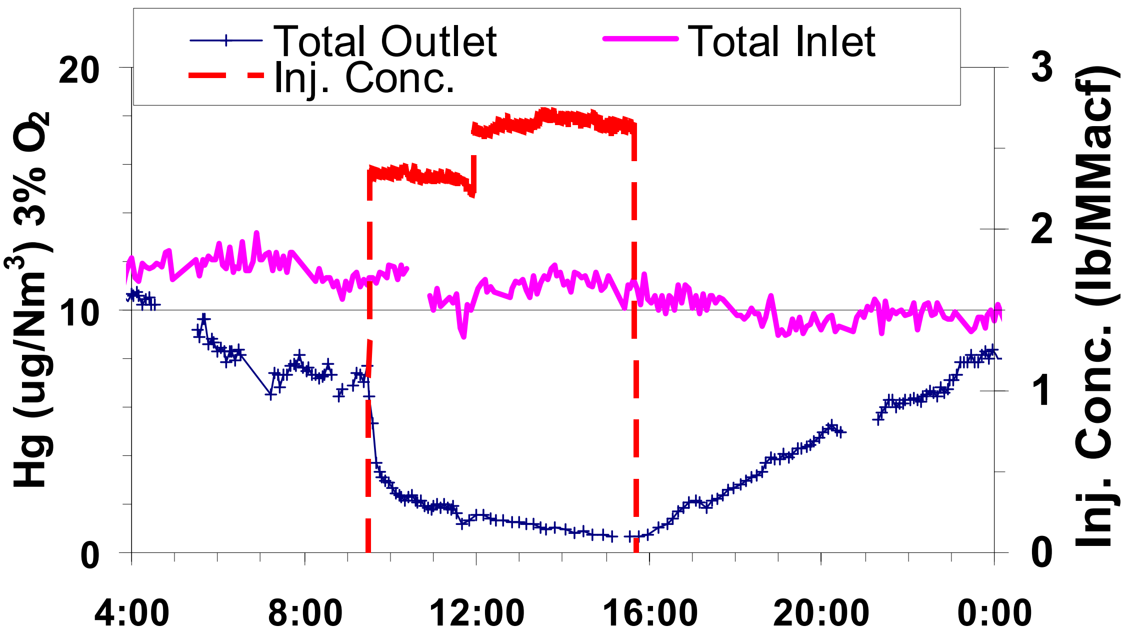


Figure 3 shows continuous mercury measurements made during carbon injection across COHPAC at Plant Gaston. As can be seen the mercury levels downstream of the fabric filter begin to decrease almost immediately in response to the injection of the sorbent. The mercury removal level increases as the carbon builds up on a fabric filter. After injection is stopped, mercury removal continues for a while as the carbon on the bags continues to capture mercury until all the carbon is cleaned from bags.

Figure 3. Mercury Reduction with across ACI Upstream of COHPAC



Ontario Hydro measurements of ACI performance as a function of mercury speciation are presented in Table 1. As can be seen, the activated carbon is effective for both species, even the more difficult to capture elemental mercury.

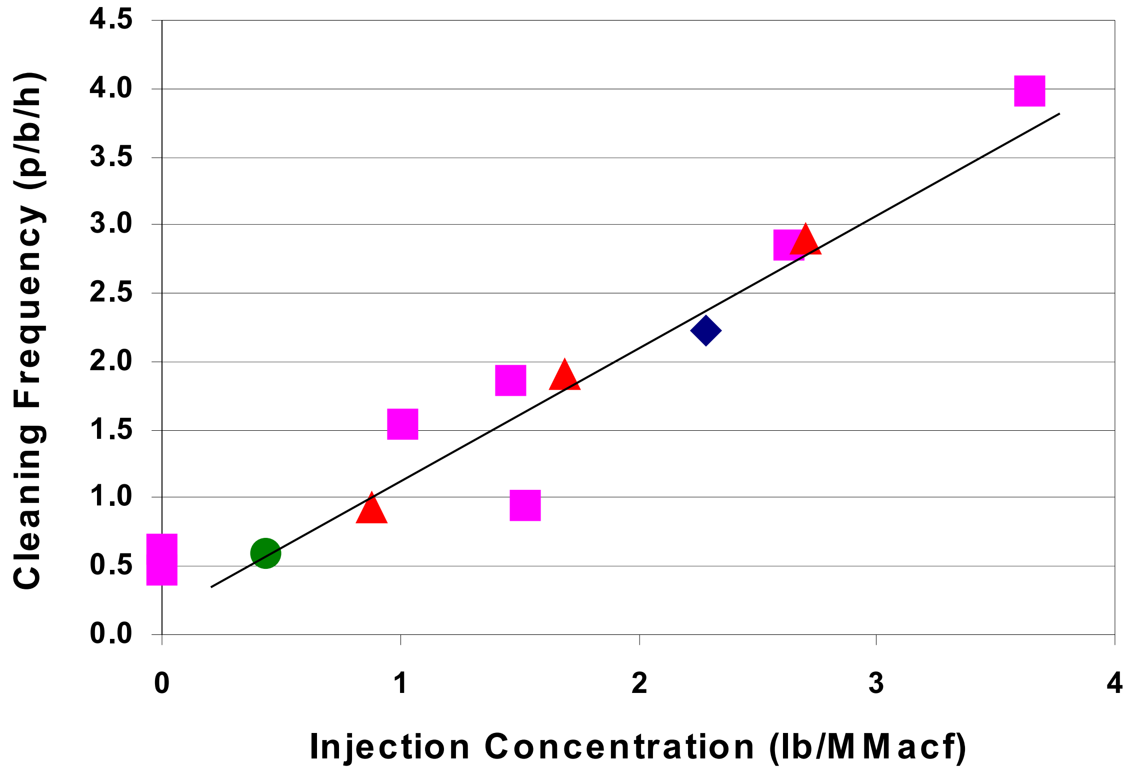
Table 1. Average Mercury Removal Efficiencies Across COHPAC as Measured with Ontario Hydro Method

Sampling Location	**Particulate (µg/dncm[1])**	**Oxidized (µg/dncm[1])**	**Elemental (µg/dncm[1])**	**Total (µg/dncm[1])**
COHPAC Inlet	0.2	6.4	4.6	11.2
COHPAC Outlet	0.1	0.9	0.0	1.1
Removal Efficiency (%)	50	86	99	90

Normal: T = 32°F

One important consideration in the TOXECON process is the integration of the sorbent injection system with the fabric filter. This is important in the COHPAC configuration because the carbon represents a significant increase in the particle loading to the baghouse. Because of the strong relationship between pressure drop and particle loading, carbon injection at Gaston showed a linear increase in pulsing frequency with increased carbon injection rates (Figure 4). A pulse clean frequency of 1.5 pulse/bag/hr at this installation (with a rotating arm pulse jet type of filter) is considered to be the highest acceptable rate without significantly impacting bag life.

Figure 4. COHPAC Cleaning Frequency in Pulses/Bag/Hour as a Function of PAC Injection Concentration (rotating arm pulse jet type of filter)



Therefore, it is important to take the carbon loading into account in the specification of a fabric filter for use in configuration. Bustard et al. (1997) developed an empirical model of COHPAC performance from data from existing COHPAC installation. Based on the model, it is recommended the baghouse be designed with a maximum air to cloth of 6 ft/min.

The data presented in Figures 2 and 4 were the result of a series of six- to eight-hour tests. Longer-term testing at "optimum" plant operating conditions as determined from these short duration tests, was also conducted to document:

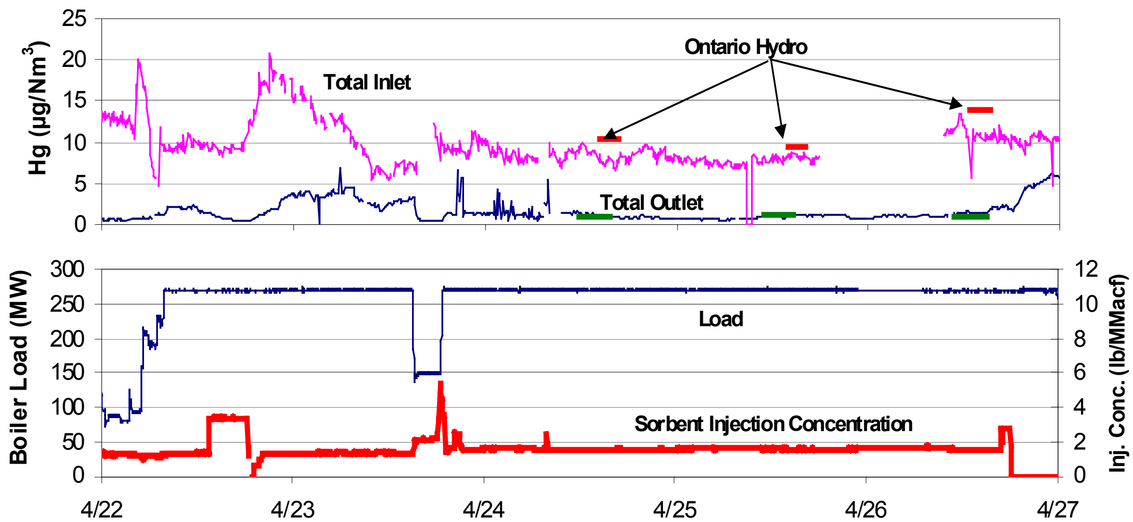
- Mercury removal efficiency over time;
- The effects on COHPAC and balance of plant equipment of sorbent injection; and
- Operation of the injection equipment to determine the viability and economics of the process.

During the longer-term tests, carbon was injected continuously 24 hours per day, for 9 days. Based on results from the parametric tests, injection rate was determined taking into consideration both mercury removal and the projected increase in COHPAC cleaning frequency.

An injection concentration of 1.5 lbs/MMacf was chosen to maintain COHPAC cleaning frequency below 1.5 pulses/bag/hour.

Figure 5 presents inlet and outlet mercury concentrations as measured by the S-CEMs, boiler load, and PAC injection concentration during the last 5 days of the long-term test. Periods when Ontario Hydro measurements were made are also identified. The S-CEMs indicate that mercury removal was nominally 87, 90, and 88% during the Ontario Hydro tests. This correlates well with the manual measurements. However, it is important to note that the S-CEMs showed that the average mercury removal efficiency over the multi-day time period was 78%, with variations between 36% to over 90%. This difference is probably due to varying coal and operating conditions over time. Figure 5 also shows that during this 5-day period inlet mercury concentration varied by nearly a factor of five. Outlet concentrations can be seen to follow the inlet and there are times during these transitional periods when removal efficiencies are fairly low. During the period when the Ontario Hydro tests were run, inlet mercury levels were low and fairly steady. These tests were conducted under ideal conditions and may show the best case condition for mercury control at this injection rate.

Figure 5. Inlet and Outlet COHPAC Mercury Concentrations, Boiler Load and PAC



Preliminary Cost for Activated Carbon Injection at Gaston

The estimated uninstalled cost for a sorbent injection system and storage silo for the 270 MW Unit 3 is $575,000 ± 30%. Sorbent costs were estimated for nominally 80% mercury control based on the long-term PAC injection concentration of 1.5 lbs/MMacf. For Gaston Unit 3, this would require an injection rate of nominally 80 lbs/h. Assuming a unit capacity factor of 80% and a delivered cost of $0.50/lb for PAC, the annual sorbent cost for injecting PAC into the existing COHPAC baghouse would be about $300,000.

LONG-TERM TOXECON FIELD TEST AT E.C. GASTON STATION

The results of the first field test program at Gaston provided a good indication of other capabilities and limitations of the TOXECON technology for controlling mercury. However, the tests were performed for a limited amount of time (< 200 hours of continuous operation) and did not allow for a thorough operational analysis of the use of this technology for mercury control. In the fall of 2002, ADA-ES was selected by the DOE to continue to mature the technology and conduct a long-term test program at the Gaston Station.

The year-long-term mercury control testing will provide data to assess the operational impacts to COHPAC and the ability to effectively control mercury over varying operational and seasonal conditions. Important data in terms of mercury removal, bag life, pressure drop/cleaning frequency and outlet emissions will result from an extended test of this technology. Technical and financial support on this program will be provided to ADA-ES by Southern Company and Alabama Power, the Electric Power Research Institute (EPRI), Allegheny Energy, Arch Coal Inc. (ACI), First Energy, Hamon Research-Cottrell, Ontario Power Generation, Duke Power and TVA.

Description of the Test Site

The E.C. Gaston Electric Generating Plant, located in Wilsonville, Alabama, has four 270 MW balanced draft and one 880 MW forced draft coal fired boilers. All units fire a variety of low-sulfur, washed, Eastern bituminous coals.

The primary particulate control equipment on all units are hot-side ESPs. Units #1 and #2 and Units #3 and #4 share common stacks. In 1996 Alabama Power contracted with Hamon Research-Cottrell to install COHPAC downstream of the hot-side ESP on Unit 3. This COHPAC system was designed to maintain Unit #3 and #4's stack opacity levels below 5% on a 6-minute average.

The COHPAC system is a hybrid pulse-jet type baghouse, designed to treat flue gas volumes of 1,070,000 acfm at 290^{o}F (gross air-to-cloth ratio of 8.5 ft/min with on-line cleaning). The COHPAC baghouse consists of four (4) isolatable compartments, two compartments per air-preheater identified as either A- or B-Side. Each compartment consists of two bag bundles, each having a total of 544, 23-foot long, polyphenylene sulfide (PPS) felt filter bags, 18 oz/yd^2 nominal weight. This results in a total of 1,088 bags per compartment, or 2,176 bags per casing. The evaluation was conducted on one-half of the gas stream, nominally 135 MW. The side chosen for testing was B-side. A-side was monitored as the control unit.

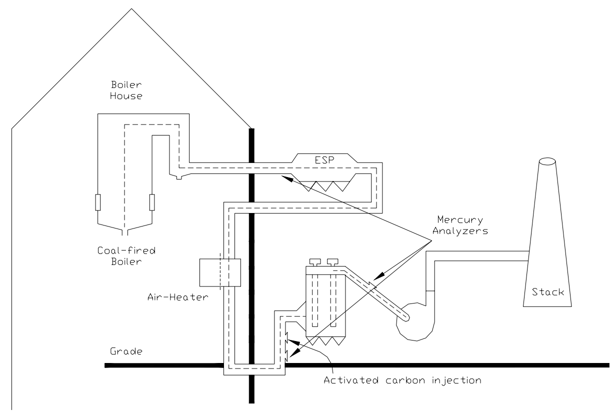
The hot-side ESP is a Research-Cottrell weighted wire design. The specific collection area (SCA) is 274 ft^2/1000 acfm. Depending on the operating condition of the hot-side ESP, nominally 97 to 99+% of the fly ash is collected in the ESP. The remaining fly ash is collected in the COHPAC system. The average inlet particulate mass concentration into COHPAC between 1/97 and 4/99 was 0.0413 gr/acf. Hopper ash from both the ESP and baghouse are sent to a wet ash pond for disposal. A hydrovactor system delivers the fly ash to the pond.

Figure 6 shows a diagram of the location of the various components of the air pollution control train. Design parameters obtained from Alabama Power for Gaston Unit 3 are presented in Table 2. For the mercury control program, carbon-based dry sorbents were injected upstream of COHPAC, downstream of the ESP over an eight week period.

Table 2. Site Description Summary, Gaston Unit 3

Parameter Identification	Description
Boiler Manufacturer	**B&W wall-fired**
Burner Type	B&W XCL
Low NOx Burners	Yes
NOx Control (Post Combustion)	None
Temperature (APH Outlet)	290^{o}F
Coal (Typical – this unit fires a variety of coals)	
1.1.1 Type	Eastern Bituminous
Heating Value (Btu/lb)	13,744
Moisture (%)	6.9
Sulfur (%)	0.9
Ash (%)	13.1
Hg (μg/g)	0.06
Cl (%)	0.03
Control Device	
Type	Hot-Side ESP with COHPAC
ESP Manufacturer	Research Cottrell
Design	Weighted Wire
Specific Collection Area (ft^2/1000afcm)	274
Flue Gas Conditioning	None
Baghouse Manufacturer	Hamon Research-Cottrell
Design	Pulse-Jet, Low Pressure – High Volume
Air-to-Cloth Ratio (acfm/ft^2)	8.5:1 (gross), On-Line Cleaning

Figure 6. Flow Schematic of Gaston Unit 3, Showing Injection and Measurement Locations



Activated Carbon Injection Equipment

The carbon injection system, shown in Figure 7, consists of a bulk-storage silo and twin blower/feeder trains each rated at 750 lb/hr. PAC is delivered in bulk pneumatic trucks and loaded into the silo, which is equipped with a bin vent bag filter. From the two discharge legs of the silo, the reagent is metered by variable speed screw feeders into eductors that provide the motive force to carry the reagent to the injection point. Regenerative blowers provide the conveying air. A PLC system is used to control system operation and adjust injection rates. Hard piping carries the reagent from the feeders to distribution manifolds located on the ESP inlet duct, feeding the injection probes. Each manifold supplied up to six injectors.

Figure 7. Carbon Injection Storage Silo and Feeder Trains for 150 MWs Fabric Selection

A key parameter to be evaluated during the test program is fabric used to make the filter bags. The OEM fabric for the four COHPAC baghouses in the U.S. (Gaston Units 2 and 3 and Big Brown Units 1 and 2) was a 2.7 denier Ryton™ felt. Denier is a measure of the linear density of a fiber and provides an indication of the cross section or thickness of the fibers.

EPRI has invested significant resources to develop a fabric that had inherently higher permeability and therefore lower pressure drop. The most tested high-permeability fabric was a 6 denier instead of 2.7 denier Ryton felt. The test results after a year of operation at another site with COHPAC, Big Brown, showed the residual drag of the 6 denier fabric was half that of the 2.7 denier fabric. This fabric helps reduce pressure drop at Big Brown and the plant had switched to ordering 6 denier fabric for all bag replacements. Last year the producer of Ryton stopped production of this material. With Ryton no longer available, a similar fabric is available from Toray with a brand name of Torcon. The replacement for 6-denier Ryton is 7 denier Torcon.

This fabric is of interest at Gaston because the major impact on COHPAC from earlier short-term sorbent injection testing was an increase in cleaning frequency, or equivalently pressure drop. This high-permeability fabric may reduce the impact of the increased mass loading on pressure drop and allow for either higher injection rates or less performance degradation over time.

Test Program

The first month of operation will be devoted to integrating the injection and mercury measurement systems with COHPAC and normal plant operation. Carbon injection concentration will be optimized taking into consideration how COHPAC pressure drop and performance of the upstream ESP varies. Feedback control may be required in order to vary the injection concentration to maintain the cleaning frequency below 1.5 pulses/bag/hour (practical limit determined by Alabama Power during short-term tests). This will be followed by up to 6 months of continuous injection and mercury removal monitoring. This series of tests will be conducted on the existing 2.7-denier bags.

A second long-term test is planned with a set of the new, high perm (7-denier Torcon) bags. All of the 2.7-denier bags in the B-side baghouse will be replaced the high-perm bags. Carbon injection concentration will again be optimized and carbon will be injection continuously, again for up to 6 months. Hopefully, the new bags will be able to tolerate a high injection concentration than the original design.

Operational trends will be monitored using the existing system supplied by Southern Research Institute. Performance variables that will be monitored continuously include pressure drop, cleaning frequency, inlet grain loading, flow, and outlet opacity. Periodically bags will be removed to measure bag strength.

Coal and ash samples will be collected and select samples will be analyzed. Test will include ultimate and proximate, mercury and chlorine measurements of the coal, and mercury and LOI measurements of the ash.

This long-term test at Gaston provides an opportunity to evaluate other mercury control sorbents that may have advantages in cost and/or performance. The test plan has time set aside at the end of the long-term test to evaluate alternative sorbents.

WE ENERGIES PRESQUE ISLE TOXECON DEMONSTRATION PLAN

We Energies was awarded a program under the DOE Clean Coal Power Initiative to design, install, evaluate and operate an integrated emissions control system for mercury and particulate matter that will treat the flue gases of three 90 MW subbituminous coal-fired units. This will be the nation's first application of TOXECON technology designed for PAC injection and mercury control on a coal-fired utility boiler. It also represents the first COHPAC or TOXECON technology on a unit firing a PRB coal.

This project will provide long-term operating data on a system that is specifically designed for both particulate control and sorbent injection. The proposed project will also investigate the capabilities of the system for SO_2 and NO_x control and advance the development of ancillary processes that are key to mercury control, such as mercury measurement technology and waste minimization. Advanced microprocessor-based controls are also required to integrate these components into a fully-functional multi-pollutant control system.

The project will take place at We Energies' Presque Isle Power Plant located in Marquette, Michigan. Units 7, 8, and 9 are each 90 MW with individual HESPs as the primary particulate control device. The proposed project involves controlling the emissions from the three units using a single, TOXECON baghouse island. This approach is especially appealing for plants with older, smaller units that must balance upgrading pollution control equipment with justifying high capital expenditures. Integrating the three units into one project and structure provides significant cost savings over treating the units separately, and optimizes the use of space.

Equipment

Environmental Elements Corporation (EEC) will provide the baghouse, which is a pulse jet type designed for off-line cleaning with provision for on-line cleaning when one compartment is isolated for service. The baghouse is subdivided into fourteen compartments, each containing 540 bags. The bags are round and are 6-inches in diameter and 20-feet in length. The casing is designed with the provision to increase the height of the filter bags to 24 feet. The operation of the baghouse will be controlled through the plant's DCS system. The baghouse is designed with a gross air-to-cloth ratio of 5.0 ft/min and a net of 5.4 ft/min.

Three new ID fans will boost the flue gas pressure to overcome the additional pressure that the baghouse and bypass ductwork will create. The fans will be radial type with nominal 800 hp motors. Pressure will be controlled via control dampers on the outlet of the fans and by variable inlet vanes on the inlet of the fans. Each fan will be sized to handle the flue gas produced by a single boiler.

A new ash handling system will be installed to collect the fly ash/carbon mixture that is collected in the baghouse. The system will be a pneumatic vacuum type with fly ash vacuum exhausters, silencers, dry ash storage silo, ash hopper isolation valves, fly ash mixer/conditioner, and local PLC controls. The ash/carbon mixture will be loaded into a truck for disposal. The ash handling system will be designed to move one ton per hour.

The powdered activated carbon (PAC) system will deliver the carbon into the flue gas. The total injection rate will be between 130 and 220 lb/hr. The PAC system consists of storage silo, feed hoppers, feeders, blowers, eductors, injection probes and PLC controls. The injection point for the activated carbon will be just after the third flue gas stream enters the flue gas header duct. Sorbents will be loaded into the silo with self-unloading pneumatic trucks.

A water injection spray cooling skid system will be used to ensure that the flue gas temperature stays below 350^{o}F. The capacity of carbon to hold mercury decreases at higher temperatures making the carbon significantly less effective and eventually ineffective in capturing vapor phase mercury. The water injection skids will spray water into the flue duct just downstream of each unit's existing ID fan. The skids consist of pumps, valving, and spray nozzles that insert into the flue gas duct. A substantial (500-1000 cfm) amount of compressed air is required for the spray cooling systems dual fluid atomizer array. A dedicated compressor will provide the air to the spray cooling skid. A local PLC controller with alarm ties to the main plant control system will be provided.

An expansion to the new plant DCS system will be provided to handle the additional I/O required by the addition of the new systems and equipment for this project. The DCS equipment will consist of controllers with appropriate amounts of I/O cards, power supplies, and at least one Human Machine Interface (HMI). The type of DCS will be determined later to ensure that it is compatible with the system that the main plant selects in the future.

CONCLUSIONS

Short-term tests have indicated that injecting activated carbon upstream of a COHPAC fabric filter offers one of the most efficient and cost-effective approaches for reducing mercury emissions from coal-fired boilers. This combination of PAC and COHPAC represents the EPRI patented TOXECON process, has the additional benefit of minimizing the impact on fly ash and its subsequent reuse. Full-scale tests produced mercury removal rates for a bituminous coal as high as 90% at feed rates 10-20% lower than that required for an ESP. Small-scale slipstream tests on a flue gas from PRB coal have duplicated these results and also show high removal levels at low sorbent feed rates.

ADA-ES is currently involved in two programs to further advance this technology. The program being conducted at the Alabama Power Gaston Station will provide one year of operational data on a bituminous coal. The program will document the mercury removal levels that can be achieved at changing load and operating conditions. The CCPI program at We Energies Presque Isle station will demonstrate the technology on a PRB coal. This program will provide several years of operating data and represents a key step it the commercialization process. Results from both of these programs will provide significant benefit to all future potential users of the technology.

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