

ADA-ES Addresses Emission Control Needs of Coal-Fired Power Plants

As concerns over emissions from coal-fired power plants become more critical and enter the mainstream press and agendas of the everyday person, ADA continues to look for solutions: primarily for mercury emissions, but most recently we've also undertaken projects that address CO₂ emissions and new hybrid hydrogen-methane automobile fuels. You can read about ADA's activities in these areas in the following stories:

Solutions

◆ ADA-ES Takes Aggressive Steps to Insure Supply of Activated Carbon

ADA-ES has taken two major steps to position itself to be able to better supply activated carbon to its mercury control customers: developing a new, greenfield AC plant to meet long-term supply needs; and working with Calgon Carbon Corporation to jointly develop products and services to meet near-term AC needs. *(See page 1)*

◆ ADA-ES Announces Its First Contract for CO₂ Research

ADA-ES is a member of a DOE/NETL-funded team working on a sorbent-based process to capture carbon dioxide from coal-fired power plants. ADA is providing engineering services related to the sorbent injection system and assessing the future commercial potential of the technology. *(See page 2)*

◆ SO₂ and SO₃ Interference With Mercury Capture

Both SO₂ and, in particular, SO₃ make it more difficult for ACI systems to remove mercury from flue gas emissions. ADA is looking for utilities that are currently injecting SO₃ for particulate control to test and evaluate the effectiveness of our liquid flue gas conditioning chemical for particulate and mercury control at their sites. *(See page 2)*

◆ ACI System Contracts Recently Awarded to ADA-ES

ADA-ES sells ACI systems for eight power plants. *(See page 2)*

◆ ADA-ES is Working with Hythane Company to Commercialize a Hydrogen-Methane Motor Vehicle Fuel

ADA-ES is consulting to a developer of hydrogen-methane fuel for motor vehicles. *(See page 2)*

◆ ADESORB™ Process Promises to Produce Mercury Sorbents With Lower Costs and Increased Capacity

With an SBIR grant from DOE/NETL, ADA-ES is investigating a process for producing lower-cost, carbon-based sorbents. This process also promises to increase expected product yields. *(See page 3)*

◆ ADA-ES Modifies TOXECON II™ Process and Gets Significant Results

ADA-ES redesigned the PAC injection grid at the TOXECON II™ system at Entergy's Independence power plant and saw significantly improved mercury removal. *(See page 3)*

◆ News from Presque Isle Power Plant

We Entergy's ACI system completed 48 consecutive days of operation with sustained mercury removal of greater than 90%. *(See page 3)*



ADA-ES Takes Aggressive Steps to Insure Supply of Activated Carbon

Recently, ADA-ES took two major steps to position itself to be able to better supply activated carbon (AC) to its mercury control customers.

In mid-February, ADA-ES' Board of Directors committed the necessary resources to pursue the development of a new activated carbon manufacturing facility. This decision will position ADA to provide a significant portion of the activated carbon supply that will be required for this rapidly expanding market.

Previously, the Company announced that in order to stay ahead of an expected billion dollar market, it had undertaken preliminary activities for a new "greenfield" activated carbon manufacturing plant, including plant design, initial permitting, securing key lignite reserves, and third-party market analysis. ADA is currently moving forward with plant design, securing options on plant sites, permitting, and specifying and sourcing of key capital equipment.

The large-scale production facility, which is expected to cost approximately \$200 million to build, is being designed to maximize efficiency and produce the most cost-effective sorbent for the mercury control market. A project of this size will capitalize on the Company's position as the market leader in mercury control and leverage its recently developed

intellectual property related to activated carbon production. *(See page 3 for article on the ADESORB™ process.)* By maintaining an aggressive construction schedule, the Company expects to synchronize its AC production with the expected growth of the market.

"We firmly believe that this vertical integration of our business plan will enable the Company to stay well ahead of the competition and capitalize on the opportunities we have created with our investment in mercury control," said Dr. Michael Durham, President of ADA-ES.

In order to meet the near-term needs for AC prior to start-up of the new plant, ADA will be working with Calgon Carbon Corporation to jointly develop products and services for the control of mercury emissions from coal-fired power plants. Calgon is the leading producer of AC in the U.S. and worldwide.

"We are excited about the unprecedented combination of experience and resources that we have put together in the team of ADA-ES and Calgon Carbon," said Michael Durham. He added, "This relationship should allow us to meet our goal of satisfying both the near-term and long-term mercury control needs of our customers in the power generation market." Having defined our near-term and long-term sources of activated carbon, ADA can now support its sales of activated carbon injection systems by guaranteeing a supply of AC through long-term supply contracts.



ADA-ES Announces Its First Contract for CO₂ Research

Research Triangle Institute International (RTI) invited ADA-ES to be a member of its team to work on a sorbent-based process to capture carbon dioxide from coal-fired power plants. The DOE/NETL awarded the RTI team a \$4 million cooperative agreement to develop and demonstrate this novel process over the next three years.

The development of this sorbent-based technology fits well with ADA's proven business model of providing emission control technologies that involve the continuous injection of sorbents and chemicals into flue gas streams. Unlike many approaches to controlling CO₂, this technology can be applied to existing power plants, creating an extensive potential commercial market. ADA will provide engineering services related to the sorbent injection system and assess the future commercial potential of the technology.

RTI is a world-renowned, non-profit research organization based in Research Triangle Park, North Carolina, with 2,500 employees located in more than 40 countries and engaged in many distinct scientific research and technology development areas.

Dr. Michael Durham, President of ADA-ES, has stated, "We are enthusiastic about becoming involved in this greenhouse gas mitigation project, which represents a new area in emission control for ADA-ES. We believe the corresponding potential marketplace is substantial, and continue to be optimistic about ADA-ES' opportunities related to cleaner energy."

SO₂ and SO₃ Interference With Mercury Capture

ADA-ES has been involved in more than 30 full-scale mercury emissions control demonstrations in the past five years. As more was learned about the control of mercury emissions, it became clear that SO₂ and SO₃ levels in flue gas have a major effect on mercury capture. Both SO₂ and, in particular, SO₃, which is created from burning higher sulfur coals, from adding an SCR, or from injecting SO₃ for particulate control, make it more difficult for activated carbon injection systems to remove mercury from flue gas emissions.

SO₃ appears to interfere with the adsorption of mercury onto the surface of unburned carbon in fly ash as well as onto the surface of injected activated carbon. Although the reaction mechanisms are not fully understood, SO₃, and to some extent SO₂, inhibits mercury from being captured by carbon.

The full-scale research on this phenomenon has led to several potential solutions. Injecting customized blends of activated carbon sorbent with various alkalis has demonstrated limited success on some applications. The alkali material, which is injected upstream of the activated carbon, absorbs SO₃ and allows carbon to more effectively remove mercury.

Another method being tested to improve mercury capture at plants that inject SO₃ for particulate control is to inject the activated carbon sorbent upstream of the air preheater. This has two benefits: allowing the activated carbon to have more residence time in the flue gas prior to it being exposed to SO₃, and enabling it to adsorb the mercury before SO₃ can interfere with its receptive sites. A plant's ductwork configuration would

need to be conducive to this application. This alternative may allow plants to continue using SO₃ injection and successfully control mercury emissions with activated carbon injection.

An alternative for plants injecting SO₃ is to switch to a liquid flue gas conditioning chemical. ADA has been providing liquid flue gas conditioning equipment and chemicals to the utility industry for the past ten years. We are looking for utilities that are interested in using our liquid flue gas conditioning chemical and doing activated carbon injection testing for mercury control to evaluate the effectiveness of carbon injection for particulate and mercury control at their sites. Please contact Jon Barr at (303) 339-8842 to discuss this further.

ADA-ES is Working with Hythane Company to Commercialize a Hydrogen-Methane Motor Vehicle Fuel

Hythane Company, LLC, a Colorado-based, international company focused on the emerging hydrogen energy market, recently selected ADA-ES to provide consulting services associated with the development of blended hydrogen-methane fuels, known as Hythane[®], for motor vehicles. The relationship with Hythane Company builds upon ADA's past track record of working on cooperative projects between the federal government and commercial companies and reflects our past successes with bringing new air pollution control technologies to market.

Tests by Hythane Company show that vehicle emissions are reduced significantly when hydrogen-methane fuels are used, and clean fuels like Hythane[®] are expected to play a greater role in the future global energy mix.

ACI System Contracts Recently Awarded to ADA-ES

Since our last newsletter (Issue 10, May 2006) ADA-ES has been awarded a number of new contracts for the sale of ACI systems to be installed at eight coal-fired power plants. The new customers are located around the country, burn primarily PRB coal, and are a mix of new and existing plants.

Location	Coal	Air Pollution Control	MW	New/Retrofit
South	PRB	SDA/FF	680	New
West	PRB	SDA/FF	220	New
Northeast	Bituminous	Cold-Side ESP	335	Retro
South	PRB	Cold-Side ESP	650	Retro
South	PRB/Lignite	Cold-Side ESP, Wet FGD	855	Retro
South	PRB	Cold-Side ESP	628	Retro
Midwest	PRB	SDA/FF	400	Retro
Southwest	PRB	SDA/FF	400	New

ADESORB™ Process Promises to Produce Mercury Sorbents With Lower Costs and Increased Capacity

Under its program aimed at developing lower-priced mercury sorbents for power generation customers, the DOE/NETL awarded ADA-ES an SBIR grant to investigate the Company's proposed process for producing lower-cost, carbon-based sorbents. This technology may result in a new, simpler manufacturing process that will maximize production capability and product yield.

The ADA-developed process, known as ADESORB™, is similar to the conventional manufacturing process for making activated carbon. However, it has several significant differences that ADA expects to not only lower the production cost of carbon-based sorbents but also increase the expected product yield and make more efficient use of the raw materials.

ADA has made small batches of sorbent in the laboratory using the ADESORB™ process and performed mercury sorption tests on slipstreams of flue gas from a coal-fired plant. When tested and compared with standard, commercially available sorbents, the ADA material was equally as effective in removing mercury from flue gas.

The ADESORB™ process promises to dramatically reduce costs and increase capacity of both existing and new activated carbon production facilities. Existing conventional activated carbon manufacturing equipment could potentially be modified to incorporate the ADESORB™ process changes.

ADA-ES Modifies TOXECON II™ Process And Gets Significant Results

ADA-ES has been working with EPRI and several utility partners to further develop and demonstrate the TOXECON II™ mercury control process at Entergy's Independence coal-fired power plant in Arkansas. TOXECON II™ is an EPRI-patented process where sorbents are injected in the latter fields of an ESP to collect mercury from flue gas. The front fields of the ESP collect approximately 80% to 90% of the plant's fly ash and since sorbents are injected only in the latter fields, this fly ash contains no sorbents and is suitable for beneficiation, including use as an admixture for concrete. The remaining carbon-laden fly ash, collected from the latter fields, is disposed of separately.

ADA has been testing TOXECON II™ at the Independence plant since August 2005. Earlier, mercury removal rates using this technology at a different plant were promising, but were not as high as had been expected. ADA engineers speculated that the carbon sorbent was not being distributed across the ESP duct uniformly and this was limiting mercury capture. As a result, ADA led an effort funded by ADA, EPRI, and EPRI members to characterize the carbon distribution in the ESP through extensive flow modeling of the ESP and injection grid.

The findings of the flow modeling indicated inadequate distribution of the carbon sorbent inside the ESP as the likely reason mercury capture was not as high as expected. ADA redesigned the injection grid to incorporate the following new design elements:

News From PIPP

ADA-ES manages the technical evaluations of the performance of an ACI system at We Energies' Presque Isle Power Plant. The installation, a TOXECON™ configuration with sorbent injection upstream of a baghouse and downstream of an ESP, was jointly funded through a Clean Coal Power Initiative project by DOE/NETL and the utility. The ACI system was installed at the plant in 2005 and began commercial operation in early 2006 — the first commercial ACI system installed on a U.S. coal-fired power plant.

We Energies reported on January 24th of this year that they were seeing excellent mercury capture with ACI. As part of the parametric and long-term testing, they had just completed 48 consecutive days where greater than 90% mercury removal was sustained. During this time, halogenated carbon was injected at a variety of concentrations as part of the parametric testing program. Carbon was then switched to a non-halogenated form and a steady injection concentration of 2.5 lb/MMacf.

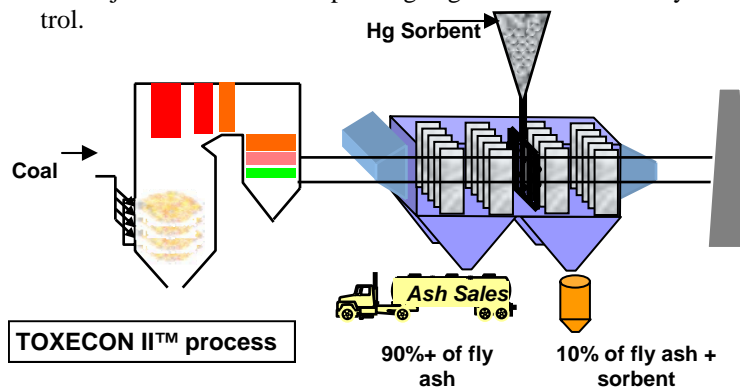
ADA-ES and We Energies plan to continue long-term testing for mercury removal, showing that mercury removal greater than 90% can be achieved at all normal operating modes. The focus of near-term testing will be to optimize mercury removal by addressing baghouse performance and operating parameters, such as:

- ◆ Pressure drop set points
- ◆ Bag cleaning frequency
- ◆ Air-to-cloth ratio

In addition, the team plans to test sorbent injection for SO₂ and NO_x trim control this summer.

- ◆ New lances were designed to more evenly distribute the carbon through multiple nozzles on the lances
- ◆ Carrier air distribution was optimized to improve carbon penetration into gas passages
- ◆ New nozzles were designed on the lances to disperse the carbon better

Another full-scale test was conducted in January 2007 with the new injection grid and lances. The results of this trial were significantly better than the original trial and confirmed the flow modeling study results. The new TOXECON II™ grid was able to reduce mercury emissions by more than 80% at an injection concentration of 5 lb/MMacf of flue gas. These results could be very important to a large number of utilities that have power plants with ESPs, sell their fly ash, and want to use activated carbon injection to meet the pending regulations for mercury control.



Headed Our Way? Let's Get Together!

ADA-ES technical and marketing personnel have committed to present papers and/or have an exhibit booth at the following conferences over the next six months:

- ◆ **June 10–15 (Clearwater, FL)**
International Technical Conference on Coal Utilization & Fuel Systems
Sharon Sjostrom paper
- ◆ **June 26–29 (Pittsburgh, PA)**
A&WMA Annual Meeting
Sharon Sjostrom to chair a panel
- ◆ **July 8–10 (Chattanooga, TN)**
Reinhold's "APC Roundtable"
Sharon Sjostrom to present a workshop; ADA-ES exhibit booth
- ◆ **August 1–3 (Milwaukee, WI)**
PennWell's "COAL-GEN 2007"
Papers probable; ADA-ES exhibit booth

So, mark your calendars, come hear the latest, or stop by and chat.

ABBREVIATIONS USED IN THIS DOCUMENT

AC	activated carbon
ACI	activated carbon injection
ADA	ADA-ES, Inc.
CO ₂	carbon dioxide
DOE	U.S. Department of Energy
DOE/NETL	U.S. Department of Energy's National Energy Technology Laboratory
EPRI	Electric Power Research Institute
ESP	electrostatic precipitator
FF	fabric filter
H-ESP	hot-side ESP
lb/MMacf	pounds per million actual cubic feet
NORIT	NORIT Americas Inc.
NO _x	nitrogen oxide
PAC	powdered activated carbon
PRB	Powder River Basin
RTI	Research Triangle Institute International
SBIR	Small Business Innovative Research
SDA	spray dryer adsorber (i.e., dry scrubber)
SO ₂	sulfur dioxide
SO ₃	sulfur trioxide

ADA-ES Team Additions

Since the last newsletter, ADA has hired the following 13 new professionals, increasing the firm's size to almost 50 folks — most of whom are located in the Littleton, Colorado, offices:

Team Member/Title	Former Business Affiliation
Mike Allen <i>Project Engineer</i>	Hamon Research-Cottrell; and Industrial Accessories Co.
Brian Carlton <i>Instrumentation Technician</i>	Quadna; and active duty in the U.S. Navy
Tyler Derritt <i>Engineer I</i>	Recent graduate of The Colorado School of Mines
Marty Dillon <i>Project Engineer</i>	Olsson Associates; and active duty in the U.S. Navy
Charlene Donnelly <i>Accounting Manager</i>	Purcell Energy Ltd.; and Earth Sciences
CJ Fritzges <i>Document Control Administrator</i>	ISH, Inc.; and Orica USA
Pattie Garcia <i>Eng. & Mktg. Administrator</i>	Option One Mortgage Corp; and eGlobe, Inc.
Paul Johnson <i>Project Engineer I</i>	Recent graduate of The Colorado School of Mines
Tom Lentzner <i>Instrumentation Technician</i>	Air Pollution Testing, Inc.
Justin McNeill <i>Sample Mgmt. Coordinator</i>	SGS Minerals
Araceli Moreno <i>Accounting Assistant</i>	Fleshtone Color Lab; and recent graduate of CSU-Dominguez Hills
Rachel Smith <i>Dir., Financial Plng. & Internal Control</i>	Newmont Mining Corp.; and Ernst and Young
Steve Young <i>Mgr., Sorbent Process Development</i>	NORIT Americas; and ICI Americas

ADA-ES' Stock

Traded on NASDAQ Closed 3/23/07 at **\$13.93**
 Ticker name: **ADES** Average daily volume **12,635**
 (90 days ending 3/23/07)

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