

# ENVIRONMENT & ENERGY REPORTER

*A periodical from Southern Research Institute about environmental challenges and technologies in the electric power, advanced energy, transportation, & GHG areas.*

*Summer 2005*

## **Gulf Power Selects Southern Research Institute to Operate Mercury Research Center**



*Plant Crist Power Station in Florida*

Fueled by existing and pending regulations, public awareness, and strategic business factors, many electric utilities are seeking technologies that can reliably reduce mercury emissions to the environment. Unfortunately, there are more questions than technological solutions. This is producing an increase in technology research, development, verification, and demonstration efforts. An independent and credible "test bed" for mercury control strategies could provide real-world information that is critical to utility decision making. It could also be used to verify mercury control technologies for vendors and developers, and provide a representative power plant simulator for other groups investigating mercury control implementation strategies.

On January 31, 2005, Southern Company announced that its Gulf Power subsidiary will be the first utility in the nation to launch a comprehensive Mercury Research Center (MRC). Atlanta-based Southern Company is a large and high visibility energy company, with more than 4 million customers, 500,000 shareholders, and nearly 39,000 megawatts of generating capacity. The primary mission of the MRC is to study different methods of reducing mercury emissions from power plants. However, mercury monitoring systems, technologies that control other pollutants, balance of plant technology impacts, Hg-speciation chemistry research, and other topics will also be examined.

Gulf Power is building the \$5 million research center at its Plant Crist generation station, located near Pensacola, Florida. The Center's backbone will be a flue gas "slip stream," routed from one of the Plant Crist boilers to a series of scaled-down critical plant systems, environmental systems, and other equipment (see diagram). In all, five environmental technologies will be in place, including an industry-standard selective catalytic reduction (SCR) unit, rotary air pre-heater, baghouse, electrostatic precipitator, and wet limestone scrubber.

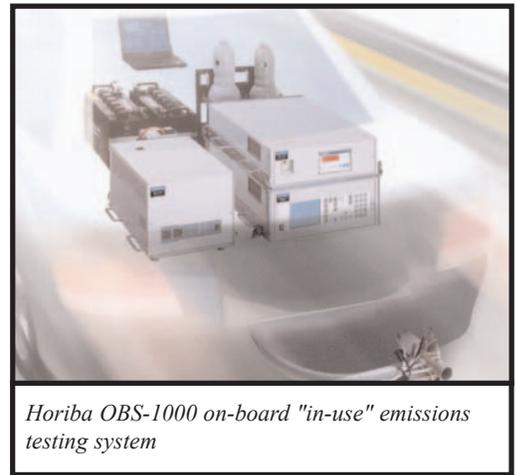
Southern Research was selected by Southern Company and Gulf Power to operate the MRC. According to Scott Hinton, the

*See Mercury page 3*

## **New "In-use" Test Methods Improve Measurement of Vehicle Performance**

In 1997, it was discovered that some heavy duty diesel engine manufacturers were employing electronic engine control strategies that passed Federal laboratory dynamometer tests but produced excessive emissions under real world on-road conditions. That eventually led to the establishment of consent decree settlements between EPA and various heavy duty engine manufacturers. One remedy under the consent decrees is that manufacturers must test engine emissions with portable measurement devices under in-use or actual field conditions.

The field of in-use vehicle emission measurement is in its infancy. Commercial portable measurement devices are



*Horiba OBS-1000 on-board "in-use" emissions testing system*

*See In-use page 2*

# Unexpected "Blue" Plume Effect Complicates Control Requirements For Utilities

The Clean Air Interstate Rule was intended to reduce SO<sub>2</sub> and NO<sub>x</sub> emissions in the Eastern U.S. According to the EPA it will do that - reductions of 70% for SO<sub>2</sub> and 60% for NO<sub>x</sub> are projected to occur. Unfortunately, the Rule may unintentionally increase sulfur trioxide emissions.



*Smoke Stack Shadows. Acid plume after evaporation of water fog. Red color of shadow is due to strong scattering of blue light by sub-micron acid droplets.*

Complying with the Rule at coal-fired power plants will likely involve the widespread use of selective catalytic reduction (SCR) for NO<sub>x</sub> control and flue gas desulfurization (FGD) (typically wet scrubbers) for SO<sub>2</sub> control. Unfortunately, the use of SCR can enhance the formation of sulfur trioxide (SO<sub>3</sub>) which combines with water to form sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) as the flue gas cools. This sulfuric acid is the agent responsible for producing a visible "blue" plume and potentially locally damaging acid aerosols. At elevated

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## In-use (continued from page 1)



*Tim Hansen inspecting Semtech-D in-use testing system at Sensor, Inc.*

just becoming available and are likely to undergo change as the measurement science evolves, especially with regard to particulate emissions. Several different technologies are being evaluated by EPA and others. Current instrument suppliers include Horiba, Sensors, Inc., and Clean Air Technologies International (CATI).

Tim Hansen, Director of Southern's transportation emission testing group, is applying these instruments and specifying field protocols for several clients (See "In-Use Testing Begins at NYSERDA" below). "This is really an exciting new area for us - the testing technology is applicable to a wide range of transportation and other equipment. It will help policy folks make more realistic or achievable plans, and can help vendors and fleet operators develop more effective control strategies. I could see this becoming the preferred test for many, and as things evolve, the fastest and cheapest way to test vehicles for fuel efficiency and emissions performance."

## In-Use Testing Begins at NYSERDA

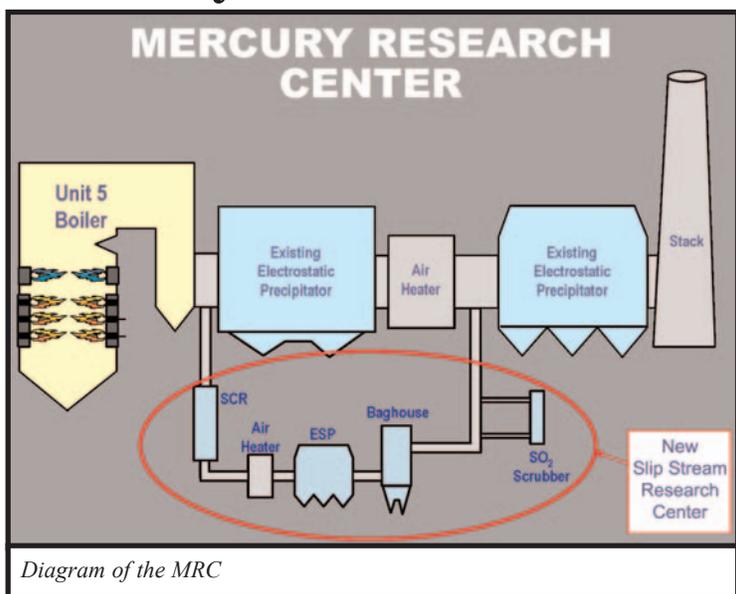
In New York State and across the country, diesel emissions are a significant contributor to PM and NO<sub>x</sub> emissions in non-attainment areas such as the New York City Metropolitan Area. For example, nearly 118,000 tons per year of NO<sub>x</sub> emissions in NYC are from non-road diesel equipment. Because of these significant emission contributions and the long lifespan of existing engines, several concerned groups have become focused on the retrofit of existing diesels with new emission control technologies to help improve air quality.

In April 2005, the New York State Energy Research and Development Authority started a program to evaluate the in-use performance of commercially available diesel emission control technologies. Southern Research, under contract to NYSERDA, is managing the program. The demonstration

and evaluation program consists of three major tasks: (1) completing a non-road equipment and emission inventory and technical, performance and economic feasibility analysis of emission control technologies to help prioritize equipment and control technology combinations for in-use testing; (2) developing generic and specific test protocols for in-use testing; and (3) conducting in-use field tests of off-road equipment and emission control technologies to evaluate control performance and impacts such as fuel consumption and economics.

The information provided by the demonstration/evaluation project from a technical, performance and energy perspective will be helpful in designing future diesel emission control retrofit programs and developing better air quality policy and local equipment usage guidelines.

# Mercury (continued from page 1)



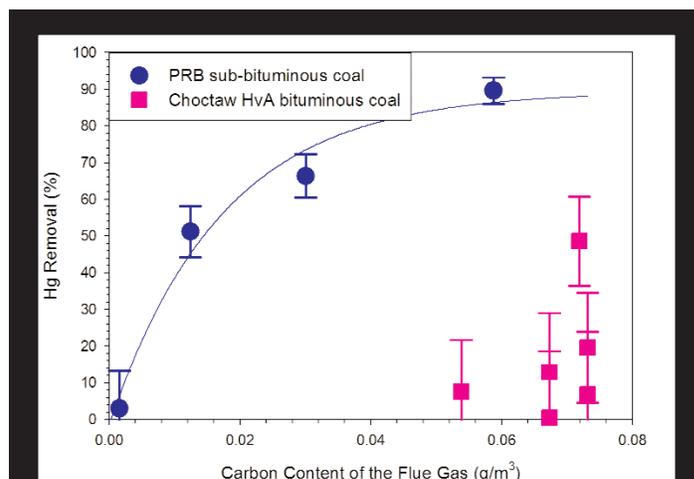
Southern Research Technical Program Director, "The production of affordable energy in an environmentally sound manner is a national priority. In fact, there are very few products or services that compare to the effect energy production has on the economy and the U.S. standard of living. The Mercury Research Center will be a high-profile research laboratory, supporting national efforts to reduce pollution from fossil-energy production. Our operation of the Center represents an exciting opportunity for Southern Research and will provide a real world platform for the Institute to highlight its capabilities."

The Center is scheduled to be in full operation by November 2005 and should begin research projects in early 2006. Future issues of the *Environment and Energy Reporter* will highlight the activities and developments at the Mercury Research Center. The Center's website is located at [www.mercuryresearchcenter.org](http://www.mercuryresearchcenter.org).

## About The Environment & Energy Reporter

The *Environment & Energy Reporter* is published quarterly by the Environment and Energy Department at Southern Research Institute, an independent contract research organization based in Alabama, North Carolina, and Florida. For more information about the projects and capabilities in this newsletter, please contact us by email at [info@sri-rtp.com](mailto:info@sri-rtp.com) or call 919-806-3456.

## Hg Sorbents Evaluations at Southern Research



**Mercury removal graph: Hg removal versus carbon content upstream of an ESP**

The mercury sorbent research efforts at Southern Research have focused on a range of applications, extending from traditional activated-carbon sorbent injection upstream of existing control devices, to development and testing of novel sorbents and reagents. Southern Research has investigated the role of calcium in the removal of mercury by flyash, including Hg-removal enhancement by high-calcium flyash, hydrated lime, limestone, and multiple process mixtures of calcium with carbon, aluminosilicates, and other materials. Sodium tetrasulfide, capable of removing both the oxidized and elemental forms of mercury, has been investigated at pilot-scale stand-alone facilities and slipstream facilities at full-scale power plants. Southern Research is continuing sorbent development research with treated activated carbons, advanced reagent-injection technologies, and advanced-process technologies like TOXECON.

## Small Scale Cogeneration Unit Verified at Hooligans Bar and Grille in Upstate New York

### *Aisin uses small reciprocating engine as prime mover*

Aisin Seiki Ltd. has developed the Aisin Seiki G60 engine-based cogeneration unit for use in small scale applications. Aisin produces components and systems for the automotive industry.



*Aisin CoGen Unit*

A three cylinder lean-burn natural gas-fired engine drives a conventional synchronous generator. According to the manufacturer, the unit produces a maximum of 6.0 kW of electricity (120/240 Vac) and 46,000 Btu/hr of heat at a net efficiency of 86%. The heat is collected from the water cooled engine and exhaust stack and used to provide hot water to residential or small commercial establishments.

According to the Electric Power Research Institute (EPRI), Aisin has deployed over 400 units in Japan, and more recently, additional units in North America. EPRI indicates that initial demonstration units have enjoyed a high degree of customer satisfaction so far. They plan to host one or more new demonstrations of Aisin units after the summer of 2005.

One unit, operating since January of 2004, has been subjected to independent performance verification by Southern Research Institute. The verification, paid for by the New York State Energy Research and Development Authority, the U.S. EPA, and the Association of State Energy Research and Technology Transfer Institutions, will take place at the 498-seat Hooligans Bar and Grille in Liverpool, New York.

The field verification will measure and report electrical performance (e.g., real power, apparent power, reactive power,

power factor, and voltage total harmonic distortion), electrical efficiency and CHP thermal efficiency and thermal utilization performance, emissions performance including NO<sub>x</sub>, CO, CO<sub>2</sub>, CH<sub>4</sub>, and THC, and estimated NO<sub>x</sub> and CO<sub>2</sub> emission offsets.

In areas like New York State, where the spread between electricity and fuel rates is large, and in applications where a relatively steady demand for heat exists, cost savings may justify installing a cogeneration unit like the G60. Generally, the more the unit runs the greater the savings could be.

## Blue Plume

*(continued from page 2)*

concentrations, highly visible plumes can occur. However, visible plumes are also possible with H<sub>2</sub>SO<sub>4</sub> concentrations as low as 4ppm.

In a recent survey, Southern Research estimated the number of units that could experience acid "blue" plume problems in the electric utility industry. As many as 850 individual boiler units in the Mississippi Valley and east could be impacted to the degree that they will require mitigation of H<sub>2</sub>SO<sub>4</sub> emissions to meet opacity requirements. About 25% might require mitigation to alleviate potential problems related to excess ground level concentrations. For utilities considering a return to high sulfur coal after scrubbers are installed, H<sub>2</sub>SO<sub>4</sub> emissions would be expected to increase substantially. For oil-fired units, if SCR is used, H<sub>2</sub>SO<sub>4</sub> problems are also likely to occur.

Increased H<sub>2</sub>SO<sub>4</sub> emissions are of concern because of documented health impacts, the potential for local environmental and crop damage, and the aesthetic impacts from the highly visible plume downwind of power plant stacks.

### Pre-Job Posting Announcement

Southern Research Institute will soon announce new openings for the Birmingham, Alabama and Research Triangle Park, North Carolina Offices.

Get a jump on the competition and send an electronic copy of your resume to Mrs. Kelley Gemma (k.gemma@sri.org).

Due to growth at both locations, experienced *Principal Investigators* are needed to plan and manage performance evaluation testing projects in the mercury control and transportation emissions areas.