NETL 2006 Mercury Conference

Title: TOXECON™ Retrofit for Mercury and Multi-Pollutant Control

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Summary of Presentation:

We Energies and DOE, under a Clean Coal Power Initiative program (CCPI), are working together to design, install, evaluate and demonstrate the EPRI-patented TOXECON™ air pollution control process as an integrated emissions control system for mercury and particulate matter from three 90 MW units at the Presque Isle Power Plant located in Marquette, Michigan. CCPI was initiated in 2002 with a goal of accelerating commercial deployment of advanced technologies to ensure the United States has clean, reliable, and affordable electricity. CCPI builds upon the advancements made by previous and continuing clean coal research and ensures the ongoing development of advanced systems for commercial power production.

This presentation discusses the first commercial full-scale TOXECON™ demonstration with activated carbon injection for mercury removal. The process involves the injection of activated carbon between the existing particulate collector (at Presque Isle, the existing collectors are hot-side electrostatic precipitators) and a fabric filter (baghouse) installed downstream. The sorbent collects mercury that is then removed from the flue gas using the baghouse. The project will also investigate the capabilities of the system to control SO_2 and NO_x emissions.

The specific objectives of this project are to demonstrate the operation of the TOXECON™ multi-pollutant control system and accessories, and

- Achieve 90% mercury removal from flue gas through activated carbon injection
- Evaluate the potential for 70% SO_2 control and trim control of NO_x from flue gas through sodium-based or other novel sorbent injection
- Reduce PM emission through collection by the TOXECON™ baghouse
- Recover 90% of the mercury captured in the sorbent
- Utilize 100% of fly ash collected in the existing electrostatic precipitator
- Demonstrate a reliable, accurate mercury CEM suitable for use in the power plant environment
- Successfully integrate and optimize TOXECON™ system operation for mercury and multi-pollutant control

Mercury CEMs supplied by Thermo Electron have been in continuous service since June 30, 2005. They provide inlet and outlet readings to compute mercury removal during TOXECON™ testing. Both mercury CEMs are calibrated daily and records of the zero checks, span checks, and calibrations are recorded. A summary of the CEM operation is included in the presentation.

Demonstration of TOXECON™ began in February 2006. This presentation will discuss engineering considerations in the design of this system, operational challenges and results from

optimization and reliability testing. It will also provide a summary of the economics of mercury removal using the TOXECON™ system.

Parametric testing was conducted beginning from February to November, 2006. The overall goal of these tests was to establish a correlation between injection of Norit Americas DARCO Hg and Hg-LH activated carbon and mercury removal. Secondary goals included understanding the variables that impact mercury removal performance and to document any changes in baghouse performance. A summary of the results of these tests are covered in the presentation.

One surprising result from the parametric testing is an obvious and instantaneous response in outlet mercury concentration to changes in baghouse inlet temperature. The magnitude of the change was that a 10°F increase in temperature appeared to result in up to a 1 $\mu g/m^3$ increase in mercury. Various theories for this behavior have been proposed and further testing is planned to better understand the phenomenon.

Hot, burning embers were found in the hoppers of the TOXECON™ baghouse in March. After a complete bag inspection, it was determined that 200 bags had been damaged due to overheating. It was determined that the incident was caused by the spontaneous combustion of the activated carbon while stored in the hoppers. Literature searches revealed a model to predict auto-ignition of combustible materials called the Frank-Kamenetskii Model. The presentation describes this model and the testing conducted to further quantify the parameters which can lead to spontaneous combustion of ash/PAC mixtures in an operating baghouse environment. Also covered are the steps taken and recommendations for preventing reoccurrence.

A continuing problem has been the inability to adequately handle the collected ash/PAC mixture after transport and storage in the ash silo. The unloading equipment was designed to use a wet unloader consisting of a pin mixer with water sprays. The original equipment proved incapable of supplying a consistent, dustless product. Despite several redesigns, excessive dusting continued and forced termination of parametric testing for a period of time. The presentation describes the problems and the current plans for solution.