

# Real-Time Mercury Analysis: A Dry Sample Conditioning System

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## Environmental Problem

Vapor-phase mercury emitted from the combustion of coal is recognized as a serious threat to the nation's air quality and public health. Mercury is a toxic, persistent pollutant that accumulates in the food chain. Concentrations of mercury in the air are usually low and of little direct concern; however, mercury in the air falls onto the Earth's surface through rain and snow and enters lakes, streams, and estuaries. Once there, mercury transforms to its most toxic form, methylmercury. Concentrations of methylmercury can build up in fish and animal tissues—people are exposed to mercury primarily by eating fish.

In March 2005, EPA directed coal-fired power plants to reduce mercury emissions by almost 22% in the next 5 years. In addition, several individual states have voiced the possibility of issuing their own mercury regulations. At this point, only two states, Massachusetts and Wisconsin, have issued mercury regulations; however, many other states, including New Jersey and Minnesota, are examining their own mercury regulations.

## SBIR Technology Solution

With support from EPA's SBIR Program and the Electric Power Research Institute, Apogee Scientific, Inc., developed an advanced dry-catalytic gas sample conditioning system for use in the determination of in-duct mercury concentrations in coal-fired utility boilers. The Apogee Dry Sample Conditioning System (DSCS) represents a breakthrough in real-time mercury measurement technology. To date, the measurement of mercury concentrations in the exhaust streams of coal-fired utility boilers has been accomplished using wet-chemical impinger-based conditioning systems that are expensive to run and prone to problems. For real-time mercury monitoring to become a reality in terms of compliance monitoring, a dry-based sample conditioning system is a necessity.

The DSCS uses catalytic material in a reducing environment, created via the combustion of a hydrocarbon fuel, to ensure the complete conversion of all forms (species) of vapor-phase mercury to the elemental state ( $\text{Hg}^0$ ). Current mercury detectors are only capable of measuring elemental mercury, and oxidized forms of mercury are very difficult to transport reliably.

An additional innovation was a modification to allow for operation at facilities where vapor-phase selenium compounds are present. The DSCS removes interference due to selenium compounds without adversely affecting the mercury measurements.

The DSCS takes the needed step towards reliability and automation to enable mercury monitoring for use as a compliance tool. The system removes the need for extensive labor and the costs associated with monitoring and managing a wet-chemical based sample conditioning system. Additionally, the system is inexpensive to operate and has been



Apogee's Dry Sample Conditioning System, pictured above, is a breakthrough in real-time mercury measurement technology.

shown to be very reliable. Apogee Scientific has tested the DSCS technology at a variety of power plants representing a large fraction of the modern coal-generation facilities in the United States. Testing occurred continuously for periods of between 1 to 3 weeks at each of four sites. Data were collected demonstrating the accuracy, stability, and robustness of the system.

### Commercialization Information

The DSCS technology is continuing to be tested and refined by Apogee Scientific as a solution to mercury monitoring needs. Extensive testing is required to assure long-term stability and further refine the ultimate design. Although the system still is considered to be in a “beta” testing form, the promise of the technology already is being recognized. Apogee Scientific recently operated the DSCS at a utility facility for more than 3 months of continuous operation to demonstrate and evaluate the longevity and long-term durability of the system and design. Based on the strong results of this demonstration, Apogee Scientific has started entertaining the first commercial requests for this technology. The company plans to begin selling commercial units, and is actively seeking commercial partners to couple the system with other leading mercury monitoring technologies.

### Company History

Founded in 1993, Apogee Scientific, Inc., is an advanced technology small business located in Englewood, Colorado. Apogee Scientific’s utility

experiences include real-time total, elemental, and oxidized vapor-phase mercury measurement services using state-of-the-art continuous emissions monitors that have been used at more than 30 power generation sites burning bituminous, subbituminous, or lignite coals. Apogee Scientific has developed a

patented flue gas extraction system that couples with a sample conditioning system, such as Apogee’s DSCS, followed by a commercially available elemental mercury monitor. The company has a staff of 10 and annual revenues of approximately \$1.5 million.

## SBIR Impact

- Vapor-phase mercury emitted from coal combustion plants is a serious threat to the nation’s air quality and public health.
- Apogee’s Dry Sample Conditioning System (DSCS) was operated successfully at a utility facility for more than 3 months to demonstrate and evaluate the longevity and durability of the system and design.
- The technology removes the need for extensive labor and the costs associated with monitoring and managing a wet-chemical based sample conditioning system.
- Apogee’s DSCS is a needed step toward reliability and automation to enable mercury monitoring for use as a compliance tool.