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# MERCURY CEMs: TECHNOLOGY UPDATE

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## ABSTRACT

**Continuous emission monitors (CEMs) for mercury (Hg) are receiving increased attention and focus. Their potential use as a compliance assurance tool is of particular interest. While Hg CEMs are currently used in Europe for compliance purposes, use of Hg CEMs in the United States (U.S.) has focused on combustion research and Hg control technology evaluation applications. Hg CEMs are now receiving increased attention as compliance assurance tools. Several programs exist to evaluate Hg CEM measurement performance. It is through these efforts that application-specific measurement issues are investigated. Collectively, these efforts have served to advance the state-of-the-art of the technology as evidenced by the number and types of CEMs now available and the various applications in use.**

## INTRODUCTION AND BACKGROUND

Anthropogenic releases of Hg to the environment have become a serious global and national concern due to the toxicity of Hg in its organic form. Combustion of fossil fuels, municipal and medical waste, as well as hazardous waste collectively represents a significant contribution to the Hg released in the U.S. These combustion processes emit Hg in a number of inorganic forms that can be converted, by naturally occurring biological processes, into the highly toxic methyl Hg species. Understanding combustion source emissions is a necessary step in understanding fate and transport of Hg, and ultimately risk to human health and the environment. Hg CEMs are valuable tools that can aid in understanding the contributions from these sources as well as potentially provide assurance of compliance with established emission limits. In addition, Hg CEMs can provide a number of other potential benefits, including:

- Real-time emission data
- Greater understanding of process variability and operation
- Operational data for system optimization and process control
- Evaluation of Hg control strategies
- Potentially less reliance on waste feed characterization (i.e., for incinerators)
- Greater public assurance

These approaches have largely driven the advancement of the Hg CEM technologies in the U.S., despite the lack of a clear regulatory incentive.

Hg CEMs are currently used in Europe for compliance purposes, primarily in Germany. Hg CEMs are installed at over 100 facilities, including fossil-fuel boilers and municipal waste combustors.[1] The types of pollution control devices associated with combustors have a significant impact on Hg CEM measurement ability. An ordinary German site has eight separate devices to control emissions: two electrostatic precipitators (ESPs), two scrubbers, a spray dryer, a carbon adsorber, a catalytic oxidizer, and a baghouse.[1] The effects of potential interferants such as carbon dioxide ($CO_2$), carbon monoxide (CO), nitrogen oxides ($NO_x$), water vapor, sulfur dioxide ($SO_2$), ammonia ($NH_3$), hydrochloric acid (HCl), chlorine ($Cl_2$), hydrocarbons, and particulate are minimized, if not eliminated. After passing through the control devices, particularly ESPs, baghouses, and wet scrubbers, most, if not all, of the Hg remaining in the flue gas is in the elemental phase.[1] Measuring elemental Hg is much less difficult than measuring the other forms of Hg associated with combustion processes.

Extrapolating European Hg CEM measurement performance to U.S. applications is difficult due to the diversity in combustion sources and pollution control device availability and configuration. As a result, the measurement environment is likely to be much more severe and diverse as well. In order for Hg CEMs to be considered for regulatory compliance assurance, acceptable performance will need to be demonstrated. Hg CEMs are not likely to be required unless sufficient performance data are available to justify the promulgation of a CEM-based standard. It is this lack of demonstrated performance that caused EPA's Office of Solid Waste (OSW) to propose the use of total Hg CEMs for compliance assurance only as an option in the Phase I Maximum Achievable Control Technology (MACT) rule for Hazardous Waste Combustors (HWCs).[2] Without a mandatory requirement for Hg CEMs, Hg CEM vendors and potentially regulated facilities appear to be reluctant to invest in their further development. As a result, few opportunities exist to demonstrate CEM performance, and those demonstrations that have been conducted have not been sufficiently robust to fully support a Hg CEM-based standard. As a result, the developmental progress of mercury CEMs in the U.S. has been hindered.[2]