3.4 Metal Emissions Monitor for DOE Mixed Waste Thermal Treatment

Technology Need

Current effluent measurement techniques are based on extractive samples followed by chemical analyses. In addition to being expensive and subject to human error, these methods provide no real-time data for operational feedback. Availability of a real-time, in situ monitor for metals would allow a waste treatment facility to be operated more efficiently and would provide continuous public assurance of environmental compliance.

Technology Description

This project is developing an instrument using Laser-Spark-Spectroscopy (LASS) as a continuous monitor to measure metal emissions in the offgas of thermal treatment units. LASS offers the potential for measuring metals continuously, in situ, and in real time. LASS also can measure metals embedded in either particles, fine aerosols, or vapors. Major tasks include performing laboratory evaluation, designing and fabricating a series of prototype field instruments, and demonstrating these instruments at a DOE waste treatment field experiment, at an EPA test site, and at a DOE waste treatment site. Results of prototype measurements are being analyzed, evaluated, and compared to standard EPA measurements.

Benefits

Advances in control and monitoring of metal emissions will benefit DOE-EM operations in several areas. For thermal treatment units, such a monitor will simplify permitting and daily operations, ease public opposition, and improve system efficiency. This monitor will also serve as an important tool to evaluate emissions from new thermal treatment technologies. Since this is a long term development effort, it is difficult to estimate the potential cost savings. However, current EPA methods to measure metal emissions are very costly (upwards of $8,000 per stack per triplicate sample). The lack of continuous emissions measurements also makes ensured compliance more costly due to tighter operational restrictions. All of these costs would be reduced, if not eliminated, with the introduction of this instrument.

Collaboration/Technology Transfer

Sandia has submitted two patent applications for innovations related to the laser-spark technology and the use of this technology for monitoring metal emissions. A license for these technical innovations has been granted to Sky+ (Oakland, CA), a company that was formed recently to commercialize the laser

spark technology. Sandia is cooperating with Sky+ in their effort to commercialize Sandia's prototype metal emissions monitor. Sandia is also cooperating with Laser Diagnostics (Los Alamos, NM) to evaluate Laser Diagnostics' proprietary method for calibration of laser spark measurements.

Accomplishments

- Instrument performance specifications (detection limits, species of interest, etc.) have been defined for effluents typical of DOE waste treatment processes.
- Laboratory experiments have been conducted to demonstrate the feasibility of a continuous metals monitor based on the laser spark technology.
- A prototype portable continuous metal emissions monitor based on LASS has been designed, fabricated, and evaluated both in the laboratory and in field experiments.
- The prototype metal emissions monitor system has been demonstrated at a DOE mixed waste treatment experimental facility, the Clemson University Joule Melter Project, where it measured lead, cadmium, and manganese in the effluent stream.
- An upgraded, remotely operable prototype monitor has been developed and has been demonstrated both at a DOE funded, pilot-scale, plasma-processing facility and at the EPA Incineration Research Facility. This prototype includes capabilities to determine metal concentrations in real time and includes a method for calibrating instrument response in the field.

TTP Information

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Flower, W.L., L.W. Peng, C.K. Woods, N.B. French, K.R. Hencken, H.A. Johnsen, R.F. Renzi, and D. Trujillo. "A Continuous Emissions Monitor for Metals: Field Demonstration of a Prototype Probe," P*roceedings of the* I*nternational* I*ncineration* C*onference*, Bellevue, WA, University of California, Irvine (1995).

Peng, L.W., W.L. Flower, K. R. Hencken, H.A. Johnsen, R.F. Renzi, and N.B. French. "A Laser-Based Technique for Continuously Monitoring Metal Emissions from Thermal Waste Treatment Units," P*rocess Control and* Q*uality* 7, pp. 39-49 (1995).

Bonin, M.P., W.L. Flower, R.F. Renzi, and L.W. Peng. "Size and Concentration Measurements of Particles Produced in Commercial Chromium Plating Processes," J. A*ir and Waste* M*anagement* A*ssociation* 45, pp. 902-907 (1995).

Flower,W.L., L.W. Peng, N.B. French, H.A. Johnsen, and D.K. Ottesen. "A Laser-Based Technique for Continuously Monitoring Metal Emissions from Thermal Waste Treatment Units," P*roceedings of the* I*nternational* I*ncineration* C*onference*, Houston, TX, University of California, Irvine (1994).