THE ENVIRONMENTAL TECHNOLOGY VERIFICATION PROGRAM

U.S. Environmental Protection Agency

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ETV Joint Verification Statement

TECHNOLOGY TYPE:	**Dioxin Emission Monitoring System**		
APPLICATION:	**Monitoring Incinerator Emissions**		
TECHNOLOGY NAME:	**DioxinMonitoringSystem**		
COMPANY:	**Monitoring Systems GmbH**		
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The U.S. Environmental Protection Agency (EPA) has established the Environmental Technology Verification (ETV) Program to facilitate the deployment of innovative or improved environmental technologies through performance verification and dissemination of information. The goal of the ETV Program is to further environmental protection by accelerating the acceptance and use of improved and cost-effective technologies. ETV seeks to achieve this goal by providing high-quality, peer-reviewed data on technology performance to those involved in the design, distribution, financing, permitting, purchase, and use of environmental technologies. Information and ETV documents are available at www.epa.gov/etv.

ETV works in partnership with recognized standards and testing organizations, with stakeholder groups (consisting of buyers, vendor organizations, and permitters), and with individual technology developers. The program evaluates the performance of innovative technologies by developing test plans that are responsive to the needs of stakeholders, conducting field or laboratory tests (as appropriate), collecting and analyzing data, and preparing peer-reviewed reports. All evaluations are conducted in accordance with rigorous quality assurance (QA) protocols to ensure that data of known and adequate quality are generated and that the results are defensible.

The Advanced Monitoring Systems (AMS) Center, one of six technology areas under ETV, is operated by Battelle in cooperation with EPA's National Exposure Research Laboratory. The AMS Center evaluated the performance of the Monitoring Systems GmbH DioxinMonitoringSystem in monitoring emissions of polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF). This verification statement provides a summary of the test results.

VERIFICATION TEST DESCRIPTION

The performance of the DioxinMonitoringSystem was evaluated in terms of relative accuracy (RA), range, data completeness, and operational factors (ease of use, maintenance, and consumables/waste generated). RA and range were determined by comparing DioxinMonitoringSystem results to those from Method 23 reference samples collected simultaneously. Range was determined from measurements over a variety of defined operating conditions that produced differing levels of dioxins. Data completeness was assessed as the percentage of maximum data return achieved by the DioxinMonitoringSystem over the test period. Operational factors were evaluated by means of operator observations and records of needed maintenance, vendor activities, and expendables used.

A 2.94 thousand British thermal unit per hour, 3-Pass Wetback Scotch Marine Package Boiler (SMPB), manufactured by Superior Boiler Works, Inc., and located at the EPA Research Triangle Park facility, was used for the verification test. During this verification test, the SMPB was fully instrumented with continuous emission monitors for a variety of species including oxygen, carbon monoxide, carbon dioxide, water, and hydrogen chloride. Reference samples were collected and analyzed for dioxins using Method 23 with several modifications.

QA oversight of verification testing was provided by Battelle and EPA. Battelle QA staff conducted a technical systems audit, a performance evaluation audit, and a data quality audit of 10% of the test data. Additionally, EPA QA staff conducted an independent technical systems audit.

This verification statement, the full report on which it is based, and the test/QA plan for this verification test are all available at www.epa.gov/etv/centers/center1.html.

TECHNOLOGY DESCRIPTION

The following description of the DioxinMonitoringSystem is based on information provided by the vendor. This technology description was not verified in this test.

The DioxinMonitoringSystem is a long-term sampling device for measuring the concentrations of PCDDs in gas streams. It is an automatic isokinetic sampler for measurement of PCDDs, PCDFs, and other persistent organic pollutants. The system comprises (1) a stack-mounted dual probe system including automatic probe switching, blowback, and cleaning, with particle filter and polyurethane foam (PUF) cartridge housing attached and (2) a remote control unit for isokinetic sampling enabling automatic measurement control, remote control and data download, standby/restart, and calibration. The control unit includes both menu-driven software and a process computer. The computer monitors the function of all aggregates and registers all data required for the subsequent evaluation of the samples taken. At regular intervals, data are stored on a static random access memory (SRAM) card. The data on the SRAM card are later interrogated together with the analysis results to ascertain the mass concentration.

The gas is sampled isokinetically from the gas stream by alternating the use of one of two titanium probes. The collected gas is transferred to a titanium mixing chamber where it is diluted with dried and cooled air. Thus, the sampled gas is cooled by keeping the dew point below the gas mixture temperature, which avoids any condensation. The dry gas mixture then passes through a filter stack where the PCDDs are collected. The filters are designed to collect the dust fraction and the gas (or more exactly, the material passing through the filter) fraction separately. The DioxinMonitoringSystem allows most of the sampling to be conducted in an unattended fashion after an initial run configuration by the operator. This device is configured specific to the sampling location on installation, partially by the sampling institution or laboratory preparing and analyzing the cartridges and partially by the operator.

The system can also be configured as a single probe device. Both configurations can handle high dust loadings (up to 150 milligrams per cubic meter) without change in performance, and flue gas velocities up to

30 meters per second can be accommodated within the isokinetic control range of the overall system. The system can also be configured to collect samples for determining heavy metals.

VERIFICATION RESULTS

Parameter Evaluated	Method of Evaluation	Results			
Accuracy	Comparison to Method 23 reference samples		PCDDs	PCDFs	PCDD/Fs
		RA (RA)[a] Intermethod RSD (Intermethod RSD)[b] Intramethod RSD	• 106% • (16.8%) • 85.4% • (16.3%) • 10.0%	• 18.4% • (17.8%) • 10.3% • (10.4%) • 8.4%	• 22.6% • (17.5%) • 9.7% • (10.4%) • 8.4%
Range	Comparison to Method 23 reference samples by concentration and sample collection time	• No dependence of accuracy on PCDD/F toxic equivalent (TEQ) over range of approximately 1 to 6 nanograms TEQ/dry standard cubic meter • No dependence of accuracy on sample duration over range of 4 to 16 hours.			
Data completeness	Ratio of number of samples successfully collected to number of potential samples that could have been collected	100% completeness in number of samples collected.			
Ease of use	Operator observations	• Installation of the DioxinMonitoringSystem was completed by a representative of MonitoringSystems, GmbH, within 48 hours • Effectively operated after 1-2 hours of training in basic operation • Installation of sampling media and removal of sampling media completed in approximately 5-15 minutes each • Less than 1% downtime			
Maintenance	Operator observations	No maintenance was required during the verification test.			
Consumables/waste generated	Operator observations	PUF cartridges were used in the sampling cartridges for sample collection.			

[a] RA calculated using only congeners detected in both the DioxinMonitoringSystem and Method 23 samples.

[b] Intermethod relative standard deviation (RSD) calculated using only congeners detected in both the DioxinMonitoringSystem and Method 23 samples.

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