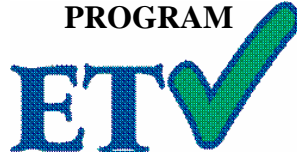


THE ENVIRONMENTAL TECHNOLOGY VERIFICATION  
PROGRAM



## ETV Joint Verification Statement

**TECHNOLOGY TYPE:** Dioxin Emission Monitoring System

**APPLICATION:** Monitoring Incinerator Emissions

**TECHNOLOGY  
NAME:** Adsorption Method for Sampling Dioxins and Furans

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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](http://www.epa.gov/etv).

ETV works in partnership with recognized standards and testing organizations, with stakeholder groups (consisting of buyers, vendor organizations, and permittees), 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 bm becker messtechnik gmbh AMESA (Adsorption Method for Sampling Dioxins and Furans) 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 AMESA 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 AMESA results to those from reference samples collected simultaneously using Method 23 sampling trains. Range was determined from measurements over a variety of defined operating conditions that produced differing levels of PCDD/PCDFs. Data completeness was assessed as the percentage of maximum data return achieved by the AMESA 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 dioxide, carbon monoxide, carbon dioxide, water, and hydrogen chloride. Reference samples were collected and analyzed for PCDD/PCDFs using Method 23 with several documented 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.

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](http://www.epa.gov/etv/centers/center1.html).

## **TECHNOLOGY DESCRIPTION**

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

The AMESA long-term sampling apparatus is based on the isokinetic sampling of flue gas and the adsorption of PCDD, PCDF, and other persistent organic pollutants on an exchangeable adsorption-resin-filled cartridge. The AMESA system consists of a titanium sampling probe with probe shaft and heat exchanger, a cartridge unit as a collection point, and a control cabinet. The titanium probe is used for both the isokinetic sampling and cooling of the hot flue gas to less than 50°C. The cooled flue gas, together with any accumulated condensate, is fed into the cartridge filled with adsorption resin (XAD-2) via an upstream quartz wool filter. Flue gas conditions are monitored using sensors in the probe and are used by the control unit to adjust sampling rates to maintain isokineticity. The PCDD/Fs can be collected over a period of up to one month and then analyzed in a laboratory. All data required for the subsequent determination of the mass concentration are gathered automatically and stored on a static random access memory card.

## VERIFICATION RESULTS

Parameter	Method of Evaluation	Results			
			PCDDs	PCDFs	PCDD/Fs
Accuracy	Comparison to Method 23 reference samples	RA	• 48.2%	• 49.0%	• 48.2%
		Intermethod RSD	• 37.4%	• 20.9%	• 21.9%
		Intramethod RSD	• 10.0%	• 8.4%	• 8.4%
Range	Percent difference comparison to Method 23 reference samples	<ul style="list-style-type: none"> <li>• No dependence of accuracy on PCDD/F toxic equivalent (TEQ) over range of approximately 1 to 6 nanograms TEQ per dry standard cubic meter</li> <li>• No dependence of accuracy on sample duration over range of 4 to 16 hours</li> </ul>			
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	<ul style="list-style-type: none"> <li>• Installation of the AMESA system was completed by a representative of becker messtechnik within 48 hours</li> <li>• Effectively operated after 2 hours of training in basic operation</li> <li>• Installation of sampling media and removal of sampling media completed in approximately 15 minutes each<sup>(a)</sup></li> <li>• Approximately 3% down time</li> </ul>			
Maintenance		No maintenance was required.			
Consumables/waste generated		XAD-2 and glass wool were used in the sampling cartridges for sample collection. Methylene chloride, acetone, and toluene were used to rinse the probe liner and sampling tube. <sup>(a)</sup>			

<sup>(a)</sup> Installation and removal of sampling media were not typical of normal installation. The small duct diameter on the boiler required a special installation and included routine removal and rinsing of the probe liner and sampling line, which is not typically performed after each sampling period.

RSD = relative standard deviation

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