THE ENVIRONMENTAL TECHNOLOGY VERIFICATION PROGRAM

U.S. Environmental Protection Agency

Illinois Clean Coal Institute

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# ETV Joint Verification Statement

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| **TECHNOLOGY TYPE:** | **Mercury Emissions Monitor** | |
| **APPLICATION:** | **Sorbent Trap Monitoring of Flue Gas Mercury** | |
| **TECHNOLOGY NAME:** | **HG-324K System** | |
| **COMPANY:** | **Environmental Supply Company** | |
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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. In collaboration with the Illinois Clean Coal Institute, and with assistance from the Northern Indiana Public Service Company, the AMS Center evaluated the performance of the Environmental Supply Company's HG-324K sorbent-based mercury sampling system for determining mercury in stack gas at a coal-fired power plant. This verification statement provides a summary of the test results.

## VERIFICATION TEST DESCRIPTION

The performance of the HG-324K was evaluated in terms of relative accuracy (RA), data completeness, and operational factors (ease of use, maintenance and data output needs, power and other consumables use, reliability, and operational costs). RA was determined according to Equation A-10 of Chapter 40 of the Code of Federal Regulations Part 75 (40 CFR Part 75) Appendix A, by comparing HG-324K vapor-phase total mercury ($Hg_T$) results to simultaneous results from American Society for Testing and Materials (ASTM) D 6784-02, the "Ontario Hydro" (OH) method. Data completeness was assessed as the percentage of maximum data return achieved by the HG-324K over its test period. Operational factors were evaluated by means of observations during use and records of needed maintenance, vendor activities, and expendables use.

The HG-324K was verified at Unit 17 of the R.M. Schahfer Generating Station, located near Wheatfield, Indiana, between June 12 and 15, 2006. Unit 17 burns pulverized Illinois sub-bituminous coal and has an electrostatic precipitator and a wet flue gas desulfurization unit. During this period, twelve successive OH method runs, each of 2 hours duration, were conducted on the Unit 17 stack using paired OH trains. Those reference samples were collected and analyzed to determine elemental mercury and oxidized mercury, the sum of which is $Hg_T$.

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.

## TECHNOLOGY DESCRIPTION

The following description of the HG-324K is based on information provided by the vendor. The information provided below was not verified in this test.

The HG-324K system was designed to sample mercury emissions from coal-fired sources as specified in Appendix K in 40 CFR Part 75. The system consists of a dual heated probe, knockout and drying impingers to remove moisture, a connecting umbilical, and the HG-324K automated sampler. An integrated sample of vapor phase mercury is captured on two parallel and independent sorbent traps that are placed in the stack on the front of the sampling probe. Stack gas is drawn through each of the traps at a constant flow rate of approximately 500 cubic centimeters per minute. The traps and probe are heated to prevent condensation of moisture from the sample gas. After exiting the probe, the sample gas passes through the knockout and drying impingers to remove moisture and then is drawn into the HG-324K sampler for measurement of the sample volume. The HG-324K provides proportional, integral, derivative flow control of the dual samples; records all temperatures including the stack, probe, and condenser; controls the probe temperature; and measures the dry standard volume of sample gas.

The HG-324K is controlled using an industrial data acquisition and control system with a removable CompactFlash™ memory card for storing data files. The HG-324K may be connected to a plant network through wireless or direct connection to allow program control and remote data access. It comes in a watertight, corrosion proof case with 2-inch hard rubber transport wheels and a retractable extension handle. The outside dimensions are 24-5/8 inches long by 19-1/2 inches wide by 14 inches deep.

The sorbent traps used with the HG-324K were prepared and analyzed for $Hg_T$ by Frontier Geosciences. Consistent with Appendix K, each trap incorporated a breakthrough section and a pre-spiked section to assess mercury spike recovery.

**VERIFICATION RESULTS**

The RA of the HG-324K for determining $Hg_T$ was 29.5%, based on 11 OH runs, when the comparison was based on HG-324K results corrected for trap blanks but not corrected for mercury spike recovery. For those 11 runs, the overall average $Hg_T$ value from the OH reference method was 0.821 microgram per dry standard cubic meter (µg/dscm), whereas that from the HG-324K was 1.004 µg/dscm, a difference of 0.183 µg/dscm. When comparing HG-324K results corrected for mercury spike recovery, the RA for 11 OH runs was 37.0%, and the OH and HG-324K average values were 0.821 µg/dscm and 1.064 µg/dscm, respectively, a difference of 0.243 µg/dscm.

The HG-324K sampled during all 12 OH runs conducted over four days with no delays, breakdowns, broken traps, or sampling interruptions. The only problem encountered was that after Run 8 the post-test leak check failed. As a result, only 11 of the 12 sampling runs (91.7% data completeness) were suitable for comparison to the OH reference results.

The HG-324K was installed quickly and was operated by a vendor representative without serious problems. A failed post-test leak check in one sampling run was the only difficulty encountered. The sorbent traps were rugged and uniform in construction, so that no breakage occurred; no problems were encountered in placing the traps into the end of the sampling probe or recovering them after sampling. The sampling probe used with the HG-324K was simple and relatively light in weight, and was handled by a single operator in all sampling. The HG-324K sorbent sampling system incorporated data acquisition and transfer capabilities, including magnetic card recording media and wireless communication.

The cost of the HG-324K system as tested is $18,750. As used in this test, the cost per sorbent trap sample was about $500, including preparation of the trap, pre-spiking the trap with mercury, and analyzing the four-section trap after sampling.

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