THE ENVIRONMENTAL TECHNOLOGY VERIFICATION PROGRAM

ETV

U.S. Environmental Protection Agency

Oak Ridge National Laboratory

Verification Statement

TECHNOLOGY TYPE:	**ANODIC STRIPPING VOLTAMMETRY**	
APPLICATION:	**MEASUREMENT OF LEAD IN DUST WIPES**	
TECHNOLOGY NAME:	**PDV 5000 Trace Element Analyzer**	
COMPANY:	**Monitoring Technologies International**	
ADDRESS:	**78 Collingwood Street** **Osborne Park 6017** **Perth, Western Australia**	**PHONE: +61 8 9204 3600** **FAX: +61 8 9204 2602**
WEB SITE:	**www.mti.com.au**	
E-MAIL:	**cgreen@colingreen.idps.co.uk**	

The U.S. Environmental Protection Agency (EPA) has created the Environmental Technology Verification Program (ETV) 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 substantially 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.

ETV works in partnership with recognized standards and testing organizations and stakeholder groups consisting of regulators, buyers, and vendor organizations, with the full participation of 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 protocols to ensure that data of known and adequate quality are generated and that the results are defensible.

Oak Ridge National Laboratory (ORNL) is one of the verification organizations operating under the Advanced Monitoring Technology (AMT) Center. AMT, which is administered by EPA's National Exposure Research Laboratory (NERL), is one of six technology areas under ETV. In this verification test, ORNL evaluated the performance of lead in dust wipe measurement technologies. This verification statement provides a summary of the test results for Monitoring Technologies International's (MTI) PDV5000 trace metal analyzer.

VERIFICATION TEST DESCRIPTION

This verification test was designed to evaluate technologies that detect and measure lead in dust wipes. The test was conducted at the Capitol Community Technical College in Hartford, CT, from November 5 through November 9, 2001. The vendors of commercially-available, field portable technologies blindly analyzed 160 dust wipe samples containing known amounts of lead, ranging in concentration from ≤ 2 to 1,500 µg/wipe. The experimental design was particularly focused on important clearance standards, such as those identified in 40 CFR Part 745.227(e)(8)(viii) of 40 µg/ft^2 for floors, 250 µg/ft^2 for window sills, and 400 µg/ft^2 for window troughs. The samples included wipes newly-prepared and archived from the Environmental Lead Proficiency Analytical Testing Program (ELPAT). These samples were prepared from dust collected in households in North Carolina and Wisconsin. Also, newly-prepared samples were acquired from the University of Cincinnati (UC). The UC dust wipe samples were prepared from National Institute of Standards and Technology (NIST) Standard Reference Materials (SRMs). The results of the lead analyses generated by the technology were compared with results from analyses of similar samples by conventional laboratory methodology in a laboratory that was recognized as proficient by the National Lead Laboratory Accreditation Program (NLLAP) for dust testing. Details of the test, including a data summary and discussion of results, may be found in the report entitled *Environmental Technology Verification Report: Lead in Dust Wipe Detection Technology— Monitoring Technologies International, PDV 5000 Trace Metal Analyzer,* EPA/600/R-02/060.

TECHNOLOGY DESCRIPTION

MTI's PDV 5000, a field portable instrument, is a self-contained anodic stripping analyzer. Anodic Stripping Voltammetry (ASV) works by electroplating metals in solution onto an electrode. This concentrates the metal. The metals on the electrode are then sequentially stripped off, which generates a current that can be measured. The current (milliamps) is proportional to the amount of metal being stripped off. The potential (voltage in millivolts) at which the metal is stripped off is characteristic for each metal. This means the metal can be identified as well as quantified.

VERIFICATION OF PERFORMANCE

The following performance characteristics of the PDV 5000 were observed:

Precision: Precision—based on the average percent relative standard deviation— 22% for the ELPAT samples and 21% for the UC samples, excluding two outlier values.

Accuracy: Accuracy was assessed using the estimated concentrations of the ELPAT and UC samples. The average percent recovery value for all samples reported above 30 µg/wipe was 88% for the UC samples and 93% for the ELPAT samples. The range of percent recoveries values was from 35% to 137%. This negative bias is statistically significant, but the average value is within the acceptable bias range of 100% ± 25%. For the NLLAP laboratory results, the average percent recovery values were 98% and 91%, respectively, for the ELPAT and UC samples. The negative bias for both the ELPAT and UC samples was statistically significant.

Comparability: A comparison of the PDV 5000 results and the NLLAP-recognized laboratory results was performed for all samples (ELPAT and UC) that were reported above 30 µg/wipe. The correlation coefficient (r) for the comparison to NLLAP lab results for the UC samples was 0.999 [slope (m) = 1.074, intercept = -14.345], and for the ELPAT samples was 0.988 [m = 0.885, intercept = 15.633]. While the slopes for both the ELPAT and UC samples were statistically different than 1.00, the correlation coefficients show a strong linear agreement with the NLLAP laboratory data.

Detectable blanks: All twenty samples, prepared at concentrations around 1 µg/wipe, were reported

correctly as < 20 µg/wipe by the PDV 5000. The instrument reported the eight samples near 17 µg/wipe as < 20 µg/wipe, but the four samples around 30 µg/wipe were reported as < 20, < 20, 24, and 25.

False positive results: A false positive result is one in which the technology reports a result that is above the clearance level when the true (or estimated) concentration is actually below. For the UC samples, the PDV 5000 reported four of a possible 29 results as false positives, while the NLLAP laboratory did not report any false positives. For the ELPAT samples, the PDV 5000 reported three of a possible 12 fp results and the NLLAP laboratory reported two of 12.

False negative results: A false negative result is one in which the technology reports a result that is below the clearance level when the true (or estimated) concentration is actually above. For the UC samples, the PDV 5000 reported 17 of 29 possible fn results, while the NLLAP laboratory reported 23 of 30 fn results. For the ELPAT samples, the PDV 5000 reported 12 of a possible 28 fn results, while the NLLAP laboratory reported seven of 12.

Completeness: The PDV 5000 generated results for all160 dust wipe samples. However, two results for UC samples were reported as non-detects for sample concentrations of 40 and 250 µg/wipe. These were considered outliers and excluded from the data analysis. Therefore, completeness was 99%.

Sample Throughput: With two analysts each operating their own instrument, the MTI team (one expert and one notice analyst) accomplished a sample throughput rate of approximately eighty samples per 12-hour day.

Overall Evaluation: The overall performance was characterized as having an acceptable amount of negative bias, larger than acceptable precision, but in linear agreement with an NLLAP-recognized laboratory's data. The verification team found that the PDV 5000 was relatively simple for the trained analyst to operate in the field, requiring less than an hour for initial setup. As with any technology selection, the user must determine if this technology is appropriate for the application and the project data quality objectives. Additionally, ORNL and ETV remind the reader that, while the ETV test provides valuable information in the form of a snapshot of performance, state, tribal, or federal requirements regarding the use of the technologies (such as NLLAP recognition where required) need to be followed. For more information on this and other verified technologies, visit the ETV web site at http://www.epa.gov/etv.

Gary J. Foley, Ph.D.
Director
National Exposure Research Laboratory
Office of Research and Development

W. Frank Harris, Ph.D.
Associate Laboratory Director
Biological and Environmental Sciences
Oak Ridge National Laboratory