THE ENVIRONMENTAL TECHNOLOGY VERIFICATION PROGRAM

ETV

EPA
U.S. Environmental Protection Agency

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Oak Ridge National Laboratory

Verification Statement

TECHNOLOGY TYPE:	**ANODIC STRIPPING VOLTAMMETRY**	
APPLICATION:	**MEASUREMENT OF LEAD IN DUST WIPES**	
TECHNOLOGY NAME:	**Scanning Analyzer SA-5000 System**	
COMPANY:	**Palintest**	
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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 Palintest's Scanning Analyzer SA-5000 system.

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 levels, such as those identified in the Code of Federal Regulations of 40, 250, and 400 $\mu g/ft^2$. 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 clearance 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— Palintest, Scanning Analyzer SA-5000 System*, EPA/600/R-02/057.

TECHNOLOGY DESCRIPTION

The Scanning Analyzer SA-5000 system uses the electrochemical technique of stripping analysis to specifically determine the concentration of lead in a solution. Anodic stripping analysis is a two step process. The first step is called the deposition step and involves the electro-deposition of lead into a disposable mercury-film electrode. The deposition is achieved by cathodic deposition at a fixed potential and time. Following the fixed deposition time, the system enters the second step, the stripping or measurement step. The stripping step involves scanning the potential anodically using a potential-time waveform. During this anodic scan the deposited lead is reoxidized and stripped out of the electrode. The current and potential are measured during the anodic scan and the resulting voltammogram contains a peak whose potential is specific to lead and whose height is proportional to the concentration of lead in the solution. The peak height is converted from a current to a concentration using one of many calibration curves stored in the instrument. No user calibration is required because each batch of electrodes is checked during manufacture and assigned an eight figure calibration code. The calibration code is used to select the calibration curve which matches the electrode batch. Reporting limits during this verification test were 25 µg/wipe.

VERIFICATION OF PERFORMANCE

The following performance characteristics of the SA-5000 were observed:

Precision: Precision—based on the average percent relative standard deviation—was 6%.

Accuracy: Accuracy was assessed using the estimated concentrations of the ELPAT and UC samples. The average percent recovery value for all samples reported above 25 µg/wipe was 86%. This negative bias is statistically significant, but within the acceptable bias range of 100% ± 25%.

Comparability: A comparison of the SA-5000 results and the NLLAP-recognized laboratory results was performed for all samples (ELPAT and UC) that were reported above 25 µg/wipe. The correlation coefficient (r) for the comparison of the entire dust wipe data set was 0.995 [slope (m) = 0.93, intercept = 3.74], indicating good agreement with the NLLAP laboratory data.

Detectable blanks: All twenty samples, prepared at concentrations around 1 µg/wipe, were reported correctly as < 25 µg/wipe by the SA-5000.

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. The SA-5000 did not produce any out of a possible 38 fp results. For comparison, the NLLAP laboratory also did not report any fp results.

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. The SA-5000 reported 22 out of a possible 22 fn results. (For comparison, the NLLAP laboratory reported 16 out of a possible 19 fn results.) This is due to the SA-5000's slight negative bias that was observed for the UC samples.

Completeness: The SA-5000 generated results for all 160 dust wipe samples, for a completeness of 100%.

Sample Throughput: A single analyst was able to prepare and analyze 80 samples per 10-hour day. Each sample was analyzed in duplicate, for a total of 160 measurements per day.

Overall Evaluation: The overall performance was characterized as having an acceptable amount of negative bias, precise, and in good agreement with an NLLAP-recognized laboratory's results. The verification team found that the SA-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.

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