

THE ENVIRONMENTAL TECHNOLOGY VERIFICATION  
PROGRAM



## Verification Statement

<b>TECHNOLOGY TYPE:</b>	<b>ION SPECIFIC ELECTRODE</b>	
<b>APPLICATION:</b>	<b>MEASUREMENT OF PCBs IN TRANSFORMER OIL</b>	
<b>TECHNOLOGY NAME:</b>	<b>L2000DX Analyzer</b>	
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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 Site Characterization and Monitoring Technologies (SCMT) program. SCMT, 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 polychlorinated biphenyl (PCB) detection technologies. This verification statement provides a summary of the test results for Dexsil's L2000DX instrument.

## VERIFICATION TEST DESCRIPTION

This verification test was designed to evaluate technologies that detect and measure PCBs in transformer oil. The test was conducted at ORNL in Oak Ridge, Tennessee, from August 21 through August 23, 2000. Spiked samples of known concentration were used to assess the accuracy of the technology. Environmentally contaminated oil samples, collected from ORNL transformers and ranging in concentration from 0 to approximately 300 parts per million (ppm), were used to assess several performance characteristics. Tests were conducted outdoors, with naturally fluctuating temperatures and relative humidity conditions. The results of the oil analyses conducted by the technology were compared with results from analyses of homogeneous replicate samples conducted by conventional EPA methodology in an approved reference laboratory. Details of the test, including a data summary and discussion of results, may be found in the report entitled *Environmental Technology Verification Report: PCB Detection Technology—Dexsil Corporation, L2000DX*, EPA/600/R-01/049.

## TECHNOLOGY DESCRIPTION

The L2000DX Analyzer (dimensions: 9 × 9.5 × 4.25 in.) is a field-portable ion-specific electrode instrument, weighing approximately 5 lb 12 oz, designed to quantify concentrations of PCBs, chlorinated solvents, and pesticides in soils, water, transformer oils, and surface wipes. The L2000DX can be operated in the field powered by a rechargeable 8-V gel cell, or in the laboratory using 120-V AC power. To prepare a sample for analysis, 5 mL of the oil is collected in a polyethylene reaction tube. Two glass ampules contained in the reaction tube are broken to introduce metallic sodium to the oil. The mixture is then shaken for 10 s and allowed to react for a total of 1 min. The sodium strips the covalently bonded chlorine atoms off the PCB molecule. An aqueous extraction solution is added to the reaction tube to adjust the pH, destroy the excess sodium, and extract and isolate the newly formed chloride ions in a buffered aqueous solution. The aqueous layer is decanted, filtered, and collected in an analysis vial. The ion-specific electrode is put into this aqueous solution to measure the millivolt potential. The potential is then converted to the equivalent PCB concentration. The lowest concentration reported by the L2000DX is typically 3 ppm. The performance of a previous version of this instrument (the L2000 PCB/Chloride Analyzer) was verified by ETV for soil and solvent extracts in 1998.

## VERIFICATION OF PERFORMANCE

The following performance characteristics of the L2000DX were observed:

**Precision:** Precision—based on the mean percent relative standard deviation—was 11%.

**Accuracy:** Accuracy was assessed using the nominal concentrations of the spiked oils. The mean percent recovery value for the spiked samples was 112%. The L2000DX results were unbiased for both single - Aroclor and multi-Aroclor mixtures.

**False positive/false negative results:** Of the 20 blank samples, Dexsil reported PCBs in 5 samples (25% false positives). In addition, false positive and false negative results were determined by comparing the L2000DX results with the reference laboratory results for the environmental and spiked samples. One of the results was reported as a false positive (13% of total), and none were false negatives.

**Completeness:** The L2000DX generated results for all 152 oil samples, for a completeness of 100%.

**Comparability:** A one-to-one sample comparison of the L2000DX results and the reference laboratory results was performed for all samples (spiked and environmental) that were reported as detections. The correlation coefficient ( $r$ ) for the comparison of the entire oil data set was 0.92 [slope ( $m$ ) = 0.89]. The reference laboratory's method was biased high for samples that contained mixtures of overlapping Aroclors (such as a mixture of 1254 and 1260). If the samples containing mixtures of Aroclors are removed from the data set, the  $r$  value is 0.95 and the  $m$  value is 1.1.

**Sample Throughput:** Operating in the field, the Dexsil team accomplished a sample throughput rate of approximately eight samples per hour for the oil analyses. One operator prepared the samples, while the other performed the analyses. The instrument can be operated by a single trained analyst.

**Overall Evaluation:** The overall performance was characterized as unbiased and precise. The verification team found that the L2000DX 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. For more information on this and other verified technologies, visit the ETV web site at <http://www.epa.gov/etv>.

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**NOTICE:** EPA verifications are based on evaluations of technology performance under specific, predetermined criteria and appropriate quality assurance procedures. EPA and ORNL make no expressed or implied warranties as to the performance of the technology and do not certify that a technology will always operate as verified. The end user is solely responsible for complying with any and all applicable federal, state, and local requirements. Mention of commercial product names does not imply endorsement or recommendation.