

## ALTERNATIVE METHODS OF PCB ANALYSIS

By Stephen Finch

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Several methods are currently used to analyze oil and soil samples for PCB (polychlorinated biphenyl) content. However, alternative methods are being field tested which are faster and more economical than those presently in use.

The majority of PCB contamination is found in and around electrical equipment, where EPA requirements specify that under most circumstances, insulating oil must contain fewer than 50 ppm PCB to be considered non-contaminated. Spill sites generally must be cleaned up to lower levels, specifically 25 ppm, while some states require cleanup to 5 or even 1 ppm.

Since being outlawed by Congress under the Toxic Substances Control Act, PCB production has been eliminated, but their use in electrical equipment has continued. However, over the past 15 years faster, easier and more accurate methods of analysis have been developed to test the millions of samples generated yearly.

Types of PCB analysis can be divided into two categories: specific and non-specific methods.

Specific methods include gas chromatography (GC) and mass spectrometry (MS), which test for PCB molecules in particular. Non-specific methods identify classes of compounds, such as chlorinated hydrocarbons, to which PCBs belong.

These non-specific methods include Chlor-N-Oil® PCB screening kits, x-ray fluorescence spectrometry, and microcoulemetric titration. In fact, any total organic halogen (TOX) test could be considered a non-specific test for PCB.

In general, PCB specific methods are more accurate than non-specific methods, but they are also more expensive, more lengthy to run, and less portable.

EPA methods utilizing gas chromatography and electron capture detectors (ECD) are the most common type run in laboratories today. Using gas chromatog-

raphy to separate the components of the mixture, an electron capture detector is able to detect any compounds containing chlorine, including PCBs.

Combined with their unique retention time, PCBs can usually be singled out from other chlorinated compounds using this technique. If closely related chlorinated compounds are present in the sample, then a mass selective detector can "fingerprint" the PCBs and confirm their identity.

This technique is much more expensive than the standard GC-ECD method, but it can be a lifesaver if the possibility of false-positive results exists.

Non-specific methods test for the presence of chlorine in the sample being examined. As a result, other chlorinated compounds will cause false positive results because the analysis method reads all chlorinated compounds as PCB. False negative results should not occur, however, because if no chlorine is present, PCBs cannot be present.

Although false positives can cause unnecessary secondary testing, these non-specific methods can be very economical when used on samples such as transformer oil, which contains few sources of chlorine other than PCB. Used crank case and cutting oils, however, always contain some chlorinated paraffins and almost always give false positive results with non-specific tests. More expensive gas chromatographic analysis is required when testing for 50 ppm of PCB in these chlorine containing oils.

A new type of non-specific PCB analyzer is currently being tested which utilizes a chloride-specific electrode to determine the amount of chlorine in a sample, then electronically converts the chloride content to PCB levels to give a direct read out in parts per million.

The instrument, called the L2000 PCB Analyzer, can be used on transformer oil, soil samples, and for testing of total chlorine levels in waste oils. It is a

portable unit which can be used in the field or a laboratory, its effective range is from 5 to 5000 parts per million PCB, and samples take only five to six minutes to run.



The PCB Analyzer can be used on transformer oil, soil samples, and for testing of total chlorine levels in waste oils.

The instrument operates in the following manner: A one-point calibration is run before any analysis can be initiated. After attaching the electrode to the instrument, the analysis mode selector is set to “calibration” and the specific ion electrode is placed in a solution containing 50 ppm chloride.

The “start” button is pressed and after a 45-second equilibration time has elapsed, the LCD read out is adjusted to read exactly 50 ppm. This sets the slope of the analysis curve for the particular electrode being used and for the temperature of the sample being tested.

Sample preparation involves converting the covalently bonded chlorine on the PCB molecules to its ionic form so it can be measured using the ion-specific electrode.

Five milliliters of oil (or 10 grams of soil) are placed in a polyethylene test tube which contains two glass ampules. By breaking the ampules in sequence, a metallic sodium reagent is introduced into the sample.

The mixture is shaken well to mix the sample and reactants and the sodium strips the chlorine atoms off of the PCB backbone. An aqueous extraction mixture is added to the mixture to destroy the excess sodium, to extract the newly-formed chloride ions from the oil, and to stabilize the pH for the upcoming analysis. The aqueous mixture is then decanted off through a filter into an analysis vial, where it can be analyzed with the ion specific electrode.

This sample preparation step takes about five minutes to complete, and several tests can be run concurrently.

To analyze the sample, the analysis mode selector is set to the desired PCB setting. The analyst can choose between Aroclor 1242, Aroclor 1260, or Askarel A (60% Aroclor 1260 plus 40% trichlorobenzene).

This choice is made based on the expected source of contamination. If the source of contamination is completely unknown, the analyzer should be set to 1242, which yields the most conservative results.

After choosing an analysis mode, the electrode is placed in the extracted solution and the “start” button is pressed. After 45 seconds, the sample concentration in ppm PCB is displayed on the LCD read out, and the user can make a decision as to how the sample is to be treated.

The process classifies the sample as either non-PCB or PCB-contaminated. At an excavation site where soil analysis is being performed, the decision can be made immediately if more soil needs to be removed or if the excavation has been carried far enough.

The L2000 system can analyze to fewer than 10 ppm PCB in oil and soil, can be used in the field by non-technical personnel, and requires less than 10 minutes to run an analysis. These attributes make the L2000 an excellent alternative to gas chromatographic analysis.

While this new technique does not replace gas chromatography, it can significantly reduce the number of samples requiring GC analysis, and therefore allow a greater number of samples to be run at a lower cost.

## Dexsil's New L-2000 PCB Analyzer

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For more information contact:

**DEXSIL CORPORATION**  
**1 Hamden Park Dr.**  
**Hamden, CT 06517**  
**(203) 288-3509 • FAX (203) 248-6523**