CASE STUDY OF A NEW FIELD SCREENING TOOL FOR DELINEATING SOIL PCB CONTAMINATION

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INTRODUCTION

To completely delineate PCB contamination in soil, repeated mobilizations to the study site may be necessary when relying solely on laboratory gas chromatograph (GC) analysis. Preliminary field screening of soil samples has been used by Dames & Moore when assisting Wisconsin Power and Light Company to more accurately locate and define PCB contamination during site investigations. Field screening has also been used to direct soil excavation efforts to limit the amount of soil requiring disposal and to improve the potential that subsequent verification sampling will show the site to be remediated. Finally, preliminary field screening can be used to limit the number of investigative samples submitted for confirmatory GC laboratory analysis.

This paper addresses two case studies where a portable chloride analyzer (Dexsil L2000 PCB/Chloride Analyzer) was used to field screen soil for PCB contamination. On behalf of Wisconsin Power and Light Company, Dames & Moore has used field screening of soil samples to determine PCB content during a preacquisition environmental site assessment of an electric substation and to direct the excavation of a historic spill site which has less than 50 parts per million PCB contamination.

The Dexsil L2000 PCB/Chloride Analyzer system was used for these projects because it met the following criteria:

- Analyzed PCB content of soil samples;
- On-site field method;
- Immediate results;
- Simple operation; and
- Capable of detecting PCB in soil to as low as 5 ppm.

We found the Dexsil L2000 PCB/Chloride Analyzer provided a quick assessment of PCB contamination in soil reduced costly remobilizations, and reduced the number of soil samples requiring laboratory GC analysis for PCB content. We also found, however, that there were use limitations of this system in cold weather and in soils with low levels of PCBs.

This paper will:

- Review the Dexsil L2000 PCB/Chloride Analyzer System;
- Discuss case studies where Dames & Moore and Wisconsin Power and Light Company used this field screening method;
- Describe advantages of using this system; and
- Describe limitations we encountered using the system.

PCB/CHLORIDE ANALYZER SYSTEM

Field analysis for PCBs using the Dexsil system involves a series of chemical reactions which extracts organic chloride from the soil and fixes the chloride as an inorganic salt. The Dexsil L2000 PCB/Chloride Analyzer uses a chloride specific electrode to measure the total organic chloride content in soil samples. Inorganic chlorides which may be present in the soil are not extracted by the chemistry and thus do not bias the test results.

The Dexsil instrument provides a direct readout, in parts per million (ppm), of total chloride. A selector dial on the instrument also provides a direct readout of total chloride as equivalent PCB. The "1242" setting is used when Aroclor 1242 is suspected in the sample. This is the most conservative setting in that it may result in inaccurate high readings for samples containing Aroclor 1260. The "1260" setting is used when a sample is suspected of containing Aroclor 1260. The "Askarel" setting should be used for samples which contain Askarel transformer fluids. The Askarel setting on the Dexsil analyzer assumes a ratio of Aroclor 1260 to trichlorobenzene of 60:40 in the Askarel. The last setting reads total chloride in the sample.

The different settings provide direct readout as equivalent PCB in ppm based on the total chloride measured. Aroclor 1242 contains 42% chloride and Aroclor 1260 contains 60% chloride. Therefore, the relative amounts of chloride in a 1242 sample would be higher than in a 1260 sample. For example, for a 10 gram sample, if the total chloride concentration is 10 ppm, the PCB concentration as equivalent Aroclor 1260 concentration will be 10/0.60 or 16.7 ppm and the equivalent Aroclor 1242 concentration will be 10/0.42 or 23.8 ppm. By knowing the relationship between the chloride concentration of the various PCBs, it is possible to calculate the Aroclor 1254 or other PCB concentrations based on the readout for total chloride.

Because the "1242" reading is the most conservative, this setting was used for our test cases.

CASE STUDIES

1) Pe-Acquisition Environmental Assessment of an Electrical Substation.

Wisconsin Power and Light Company routinely performs pre-transaction environmental assessments of real estate consisting of a review of historic uses and a regulatory search. When the first phase of these investigations indicate a potential for PCB contamination and acquisition of the property is still desired, environmental sampling of the property is performed.

Wisconsin Power and Light Company recently purchased an electric substation where pre-transaction environmental soil sampling of the site for PCB contamination was performed. Because of a short turnaround time, soil samples were field screened for PCBs using the Dexsil PCB/total chloride analyzer. In this case study, field screening was advantageous because it provided a complete assessment in less than one week, only a yes/no answer regarding PCB contamination was desired, and other chlorinated solvents were not suspected to be present at the site.

The soil sampling grid for evaluating areas around existing oil-filled electrical equipment was developed using MRI guidelines; additional soil samples were also taken along fencing and in other open areas. A total of 176 discrete samples were collected. These were composited to form 56 samples which were field screened for PCBs. Total time to screen the site was 3 days. Finally, seven samples were sent to an analytical laboratory for GC confirmation analysis.

2) Directing Soil Excavation in the Field

Prior to the divestiture of a retired electric substation, WPS performed an evaluation of the site for PCB contamination using laboratory GC analysis. PCB in concentrations less than 50 ppm were found in soil samples collected in an area where transformers had historically been stored and maintained. Field screening using the Dexsil system were used to delineate the area of PCB contamination and to direct the excavation of the contaminated soil. In this case study, field screening was advantageous because it allowed rapid delineation of contaminated soil for removal, minimized the volume of soil excavated and needing disposal, limited remobilization to the site, reduced total project time for the excavation and verification to less than two weeks, and reduced the number of cleanup verification samples which required GC analysis.

ADVANTAGES USING PRELIMINARY PCB FIELD SCREENING

The advantages of field screening of soil samples for PCB content during field investigations and remediations include:

- Flexibility for changing sampling design in the field depending on results;
- Ability to direct excavation efforts in the field to minimize waste generated;
- Fewer investigative soil samples requiring laboratory GC analysis;
- Mobilizations to a site can be reduced due to the ability to accurately delineate contamina tion in the field; and
- Quicker project completion

LIMITATIONS OF PCB FIELD SCREENING

Our experiences in conducting the two case studies discussed indicate the following limitations to using the Dexsil system for field screening soil sample for PCB contamination:

- Limited usefulness when PCB concentrations in the soil are less than 10 ppm PCB (correlation between field results and GC analysis was not good when PCB concentration was less than 10 ppm);
- Outdoor use in cold weather may reduce the reliability of the results;
- Chloride electrode and Dexsil L2000 analyzer sensitivity to changes in temperature require frequent recalibration of the instrument;
- Wet soil samples, if not properly handled, will yield unreliable results;
- Inability to distinguish PCB contamination from other chlorinated organic compounds;
- Dexsil L2000 analyzer requires 110 volt AC source; and
- Wastes generated during analysis (packaging, reaction vials, and sampling materials) must be properly managed.

CONCLUSION

The use of field screening of soil samples for PCB content has been used by Dames & Moore and Wisconsin Power and Light to reduce time and costs associated with investigating, delineating and remediating PCB contamination in soils. However, field screening must be combined with confirmatory laboratory GC analysis to document accuracy and clean-up verification. We believe the Dexsil L2000 will be most useful as a soil PCB field screening tool where PCB concentrations in soil are greater than 10 ppm.