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Innovative Technology Verification Report

Field Analytical Screening Program PCB Method

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Executive Summary

This innovative technology evaluation report (ITER) presents information on the demonstration and evaluation of a field screening method for determining polychlorinated biphenyl (PCB) contamination in soil. PRC Environmental Management, Inc. (PRC), conducted the demonstration under contract with the U.S. Environmental Protection Agency (EPA) Superfund Innovative Technology Evaluation (SITE) Program. Specifically, this demonstration was conducted under the Monitoring and Measurement Technologies Program (MMTP) of the SITE Program, which is administered by the EPA National Exposure Research Laboratory, Las Vegas (NERL-LV).

The method selected for this demonstration and evaluation was a modified version of the Field Analytical Screening Program (FASP) method developed for the Field Investigation Team contract, which is part of the Superfund program. The method uses a field gas chromatograph (GC) and an extraction process that is similar to that of a conventional fixed laboratory. In August 1992, the method was demonstrated and evaluated at a site in Kansas City, Missouri. It was demonstrated in conjunction with the demonstrations and evaluations of three other field screening technologies for PCBs in soil: the Clor-N-Soil PCB Test Kit and L2000 PCB/Chloride Analyzer, both of which are manufactured by the Dexsil Corporation; and the EnviroGard PCB Test, which is manufactured by Millipore, Inc. Separate ITERs have been prepared on the evaluations of these technologies and are available. These ITERs are entitled "Innovative Technology Evaluation Report on the Dexsil Corporation's Demonstration of the Clor-N-Soil PCB Test Kit and L2000 PCB/Chloride Analyzer" and "Innovative Technology Evaluation Report on the Demonstration of the Millipore, Inc., EnviroGard PCB Test. "

The FASP PCB Method is designed to quickly provide quantitative results for PCB concentrations in soil samples. It uses gas chromatography, which is an EPA-approved method for determining PCB concentrations in soil samples. In fact, the FASP PCB Method is a modified version of EPA SW-846 Manual Method 8000. The method determines results for PCB concentrations, in the micrograms per kilogram @g/kg) range, by using a GC equipped with an electron capture detector (ECD). Chromatograrns produced by the GC and ECD for each sample are compared to the chromatograms from Aroclor standards.

The instrumentation and equipment required for the FASP PCB Method are not highly portable. However, when they are mounted in a mobile laboratory trailer, the method can be operated on or near most sites relatively easily. Use of this method requires electricity, and Aroclor standards require refrigeration. An exhaust hood and carrier gases are also needed. For the method to produce reliable results, it must be operated by a trained and experienced operator.

The initial purchase cost of the instrumentation and equipment is relatively high. The three major pieces of equipment used in this demonstration cost $23,214. Similar equipment can be rented for $1,500 to $2,500 per month. Additional accessory equipment, reagents, and glassware needed to extract, prepare, and analyze soil samples during the demonstration cost an additional $5,000. This cost includes nondisposable glassware and laboratory equipment, in addition todisposable items. During this demonstration, 400 Sam-ple extractions and injections were conducted.

The detection limit for the method is reported to be 400 ,ug/kg. During the demonstration, however, PRC found that the method can often achieve a detection limit as low as 100 pg/kg. The highest number of samples analyzed in an g-hour day was 21; the average number analyzed per g-hour day was 15.

The method is susceptible to interferences from some compounds, other than PCBs, that are sometimes found in soil samples. Common interferants include phthalates, sulfur, halogenated solvents, and halogenated pesticides. In some cases in which these interferants are present, higher detection limits must be used for PCBs. It is also difficult, at times, for the operator to correctly identify and quantify mixtures of more than one Aroclor. Correct identification of Aroclors depends largely on the judgment
and experience of the operator.

To assess this method's precision, PRC evaluated its performance on the analysis of field and laboratory duplicate samples. PRC used the data from the duplicate analyses to establish precision control limits. The FASP PCB Method analysis showed 34 sample pairs in which both a sample and its duplicate had positive results. The data from these 34 pairs had a mean relative percent difference (RPD) of 34 percent and a standard deviation of 29. During this evaluation, precision control limits were established by adding two times the standard deviation to the mean for the upper control limit and using zero for the lower control limit. Therefore, the control limits were set at 0 and 92 percent. All of the RPDs for the duplicate sample pairs fell within the control limits. Therefore, the precision of the method (100 percent) was considered acceptable.

PRC used a regression analysis approach to evaluate the accuracy of the FASP PCB Method. The regression analysis was based on 76 matched pairs of positive sample results, and it defined a coefficient of determination (?) factor of 0.86, indicating that there was a strong relationship between the two sets of data. It defined a regression line with a y-intercept of 3.57 milligrams per kilogram (mg/kg) and a slope of 1.09. This indicates that the method is accurate. No correction is needed for the FASP PCB Method data, as it is not statistically different from the confirmatory data. The Wilcoxon Signed Ranks Test was used to verify these results. It indicated, at a 95 percent confidence level, that k data from the FASP PCB Method was not significantly different from those of the conlirmatory laboratory. The accuracy of the FASP PCB Method data was verified.

PRC also used the Dunnett's Test to evaluate the precision of the FASP PCB Method. This test indicated that the FASP PCB Method and the confirmatory laboratory may not have achieved identical precision.