

CASE STUDY ABSTRACT

**Wenatchee Tree Fruit Research and Extension Center (WTFREC) Test Plot
Wenatchee, Washington**

<p>Site Name and Location: Wenatchee Tree Fruit Research and Extension Center (WTFREC) Test Plot Wenatchee, Washington</p>	<p>Sampling & Analytical Technologies:</p> <ol style="list-style-type: none"> 1. Systematic planning process 2. Dynamic workplan 3. Direct push soil sampling 4. Field measurement immunoassay analysis (IA) technologies combined with limited fixed laboratory analyses 	<p>CERCLIS #: None</p>
<p>Period of Operation: 1966-early 1980s</p> <p>Operable Unit: A 2,100-square foot test plot area used for pesticide disposal testing</p>		<p>Current Site Activities: Washington State University test and laboratory facilities; local residential development.</p>
<p>Point of Contact: Greg Gervais Quality Assurance Representative U.S. Army Corps of Engineers-Seattle District 4735 East Marginal Way South Seattle, WA 98134</p>	<p>Media and Contaminants: Soil contaminated with organochlorine pesticides, organophosphorus pesticides, carbamate pesticides, and paraquat</p>	<p>Technology Demonstrator: Garry Struthers Associates, Inc. 3150 Richards Road, Suite 100 Bellevue, WA 98005-4446 (425) 519-0300</p>
<p>Number of Samples Analyzed during Investigation: A total of 271 samples were analyzed for the focused removal, characterization, final confirmation, waste profile, and wastewater analysis phases of this project. Roughly two-thirds of analyses were performed in the field by IA kits. Field and laboratory QC samples were also analyzed during this project.</p>		
<p>Cost Savings: The site characterization and cleanup approach used in this project resulted in savings of about 50% (over \$500,000) over traditional site characterization and remediation methods, which rely on fixed-base laboratory analysis with multiple rounds of mobilization/demobilization to accomplish site cleanup.</p>		
<p>Results: Project was completed successfully and cost-effectively. The WTFREC test plot area was remediated, and shown to a high degree of certainty that regulatory cleanup standards were achieved. The regulator, the client, and local stakeholders were very satisfied with the project's outcome.</p>		
<p>Description: This case study describes an approach to site cleanup that includes the use of systematic planning, on-site measurement technologies combined with limited fixed laboratory analyses, and rapid decision-making (using a dynamic work plan) to facilitate quick cleanup. Site characterization information, obtained in the field through the use of IA kits, was used to guide removal activities by means of an adaptive sampling strategy. This approach permitted a cost-effective cleanup of the contaminated site.</p>		

TECHNOLOGY QUICK REFERENCE SHEET EnviroGard[®] DDT Immunoassay Test Kit

Case Study: Cleanup of the Wenatchee Tree Fruit Test Plot Site Using a Dynamic Work Plan

Technology Name EnviroGard[®] DDT Immunoassay Test Kit			
Summary of Case Study's Performance Information			
Project Role: Supporting in-field decisions regarding further characterization, removal, waste segregation, and disposal of soils contaminated with DDT and other pesticides.		Analytical Information Provided: Semiquantitative concentration data for DDT and other organochlorine pesticides in soil with sensitivity down to 0.2 mg/kg (ppm). The results are reported as the concentration of DDT, but represent the sum of the responses from the 2,4'- and 4,4'-isomers of DDT, DDD, and DDE. During the case study, the test kit results were compared to fixed laboratory analyses for individual pesticide compounds and site-specific action levels were developed for the various decisions to be made (e.g., characterization, removal, waste segregation, and disposal) using the test kit results.	
Total Contract Cost: \$13,036 for 230 samples (includes project samples, PE samples, and blind field duplicates)		Total Cost Per Sample: approx. \$57 per sample (includes QC costs)	
Project Cost Breakdown			
Spectrometer Cost: \$2000 for purchase, or rentals available at \$175/day to \$800/month	Consumables Cost: \$515 for a 20-test kit	Labor Cost: approx. \$20 per sample (includes QC costs)	Waste Disposal Cost: Methanol extract waste: \$470 per lab pack (bulk) disposal
Site-Specific Accuracy/Precision Achieved: The test kit is intentionally biased 100% high by the manufacturer in order to reduce the occurrence of false negative results. Based on a pilot study of the test kits and fixed laboratory data for the individual organochlorine pesticides in soil samples from the site, the project team determined that a DDT test kit result of 5 mg/kg (ppm) could indicate that the site-specific cleanup level for an individual compound (e.g., DDT, DDE, or DDD) had been exceeded. An important aspect of this project was that this initial determination was reviewed and revised as needed during the latter phases of the project. For example, in the deeper soils from the area of the site where bags of concentrated pesticides were buried, the action level for DDT test kit results was raised to 10 mg/kg. Each 12-sample batch contained a reagent blank, 3-point calibration & CCV, purchased performance evaluation (PE) samples as an LCS, a matrix duplicate (intra-laboratory sample split). The precision achieved by the test kit was assessed by the analysis of a pair of duplicate samples with each of 16 batches of field samples. The relative percent difference of the duplicates ranged from 0% to 113% for these 16 batches, with a mean RPD value of 38% and a median RPD of 28%. Split sample analysis (by fixed lab) was performed for samples representing critical decision points (excavation boundaries and regulatory clean closure data).			Throughput Achieved: A batch of 12 field samples could be extracted and analyzed in a half day by one person.

General Commercial Information (Information valid as of August 2000)

<p>Vendor Contact:</p> <p>Not available</p>	<p>Vendor Information:</p> <p>Strategic Diagnostics, Inc. 111 Pencader Drive Newark, DE 19702 1-800-544-8881 www.sdix.com</p>	<p>Limitations on Performance:</p> <p>This test kit is not specific for just DDT. It also responds to the DDT daughter products DDE and DDD, as well as some other organochlorine pesticides.</p>
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<p>Principle of Analytical Operation:</p> <p>This test is based on a competitive enzyme-linked immunosorbent assay (ELISA) reaction between DDT and related compounds extracted from the sample with methanol and an antibody coated on a test tube containing the extract.</p> <p>The antibodies bound to the target analytes cannot bind to an enzyme conjugate added to the tube. When a color-developing reagent is added, the enzyme conjugate forms a colored product. The color density is read with a spectrometer and is proportional to the amount of conjugate reagent present. Darker color means less of the target analyte is present. The DDT results are determined by comparison to 3-point calibration.</p>	<p>Availability/Rates:</p> <p>Test kits are commercially available as off-the-shelf products. Associated test equipment, including hand-held spectrometer, is available for purchase or rental from manufacturer.</p>
	<p>Power Requirements:</p> <p>110 or 220 volt power is needed to charge the hand-held spectrometer, which may then be used in the field without additional power.</p>
	<p>Instrument Weight and/or Footprint:</p> <p>Approximately 5 square feet of space is required for sample processing and analysis.</p>

General Performance Information

Known or Potential Interferences: Other organochlorine pesticides can react with the antibodies to varying degrees. The manufacturer provides cross-reactivity data with the test kit.

<p>Applicable Media/Matrices:</p> <p>Soil and Water</p>	<p>Analytes Measurable with Expected Detection Limits:</p> <p>DDT 0.2 mg/kg DDD 0.05 mg/ kg DDE 0.6 mg/kg</p>	<p>Other General Accuracy/Precision Information:</p> <p>See SW-846 Method 4042</p>
<p>Wastes Generated Requiring Special Disposal:</p> <p>Small volumes of methanol used for sample extraction, plus the used sample volume.</p>		<p>Rate of Throughput:</p> <p>Up to 17 samples can be assayed at one time, with results available in 30 minutes.</p>

TECHNOLOGY QUICK REFERENCE SHEET RaPID Assay® Cyclodienes Immunoassay Test Kit

Case Study: Cleanup of the Wenatchee Tree Fruit Test Plot Site Using a Dynamic Work Plan

Technology Name RaPID Assay® Cyclodienes Immunoassay Test Kit			
Summary of Case Study's Performance Information			
Project Role: Supporting in-field decisions regarding further characterization, removal, waste segregation, and disposal of soils contaminated with cyclodiene pesticides.		Analytical Information Provided: Semiquantitative concentration data for cyclodiene pesticides in soil with sensitivity down to 0.15 mg/kg (ppm). Greater sensitivity was achieved in this project through method modifications. The results are reported as the concentration of dieldrin, but other cyclodiene pesticides can be used to calibrate the assay as well. During the case study, the test kit results were compared to fixed laboratory analyses for individual pesticide compounds and site-specific action levels were developed for the various decisions to be made (e.g., characterization, removal, waste segregation, and disposal) using the test kit results.	
Total Contract Cost: \$13,036 for 230 samples (includes project samples, PE samples, and blind field duplicates)		Total Cost Per Sample: approx. \$57 per sample (includes QC costs)	
Project Cost Breakdown			
Spectrometer Cost: \$2000 for purchase, or rentals available at \$175/day to \$800/month	Consumables Cost: \$540 for a 20-test kit	Labor Cost: approx. \$20 per sample (includes QC costs)	Waste Disposal Cost: Methanol extract waste: \$470 per lab pack (bulk) disposal
Site-Specific Accuracy/Precision Achieved: The test kit is intentionally biased 100% high by the manufacturer in order to reduce the occurrence of false negative results. Based on a pilot study of the test kits and fixed laboratory data for the individual organochlorine pesticides in soil samples from the site, the project team determined that a cyclodienes test kit result of 0.086 mg/kg (ppm) could indicate that the site-specific cleanup level for an individual compound (e.g., dieldrin or endrin) had been exceeded. An important aspect of this project was that this initial determination was reviewed and revised as needed during the latter phases of the project. Each 12-sample batch contained a reagent blank, 3-point calibration & CCV, purchased performance evaluation (PE) samples as an LCS, a matrix duplicate (intra-laboratory sample split). The precision achieved by the test kit was assessed by the analysis of a pair of duplicate samples with each of 14 batches of field samples. The relative percent difference of the duplicates ranged from 0% to 110% for these 14 batches, with a mean RPD value of 35% and a median RPD of 7%. Split sample analysis (by fixed lab) was performed for samples representing critical decision points (excavation boundaries and regulatory clean closure data).		Throughput Achieved: A batch of 12 field samples could be extracted and analyzed in a half day by one person.	

General Commercial Information (Information valid as of August 2000)**Vendor Contact:**

Not available

Vendor Information:

Strategic Diagnostics, Inc.
111 Pencader Drive
Newark, DE 19702
1-800-544-8881
www.sdix.com

Limitations on Performance:

This test kit is not specific for just a single cyclodiene pesticide. It responds to: dieldrin, aldrin, endrin, heptachlor, heptachlor epoxide, chlordane, endosulfan (I and II), α -BHC, γ -BHC (lindane), δ -BHC, and several other organochlorine pesticides.

Principle of Analytical Operation:

This test is based on a competitive enzyme-linked immunosorbent assay (ELISA) reaction between cyclodiene compounds extracted from the sample with methanol and an antibody bound to a magnetic particle and added to a tube containing the extract.

The antibodies bound to the target analytes are separated from the extract using by retaining the magnetic particles with a magnetic field and decanting off the extract. When a color-developing reagent is added, the enzyme conjugate forms a colored product. The color density is read with a spectrometer and is proportional to the amount of conjugate reagent present. Darker color means less of the target analyte is present. The cyclodiene results are determined by comparison to 3-point calibration.

Availability/Rates:

Test kits are commercially available as a special order products. Associated test equipment, including hand-held spectrometer, is available for purchase or rental from manufacturer.

Power Requirements:

110 or 220 volt power is needed to charge the hand-held spectrometer, which may then be used in the field without additional power.

Instrument Weight and/or Footprint:

Approximately 5 square feet of space is required for sample processing and analysis.

General Performance Information

Known or Potential Interferences: Other organochlorine pesticides can react with the antibodies to varying degrees. The manufacturer provides cross-reactivity data with the test kit.

Applicable Media/Matrices:

Soil and Water

Analytes Measurable with Expected Detection Limits:

From manufacturer:
Cyclodienes, as dieldrin:
0.15 mg/kg in soil and 0.6
 μ g/kg in water

As employed for the case
study:
18 μ g/kg (ppb) in soil.

Other General Accuracy/Precision Information:

See SW-846 Method 4041

Wastes Generated Requiring Special Disposal:

Small volumes of methanol
used for sample extraction,
plus the used sample
volume.

Rate of Throughput:

Up to 50 samples can be assayed at one time, with
results available in 60 minutes.