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July 11, 1997

U.S. Army Corps of Engineers
Baltimore District
Attn: Mr. Sanjib Chaki
City Crescent Building
10 South Howard Street
Baltimore, MD 21210

W.O. No.: 03886-076-038

Subject: Contract DACA31-92-D-0018, Delivery Order 0041.
PCB Investigation at Building 2000, Fort Monmouth.

Dear Mr. Chaki:

Attached is a copy of the revised report on the investigation of PCB contaminated soil at Building 2000, Charles Wood Area, Fort Monmouth, NJ. If you have any questions, please call me at (610) 701-3107.

Very truly yours,

ROY F. WESTON, INC.

Richard G. Shimko, P.E., C.H.P.
Project Manager

RGS/dcl

cc: Joe Fallon (Ft. Monmouth)
J. Hackett
File 19.0

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DELINEATION OF PCB SOIL CONTAMINATION AT BUILDING 2000

1.0 INTRODUCTION AND OBJECTIVES

PCBs were detected in soils on the Charles Wood area of Fort Monmouth, New Jersey during the Site Investigation (WESTON, 1995). Soil samples collected downgradient from the former location of transformer CW035, an exterior pad transformer northeast of Building 2000, contained concentrations of PCBs ranging from 2.6 mg/kg to 100 mg/kg. These concentrations of PCBs exceeded the applicable remediation standard, the residential direct contact soil cleanup criteria of 0.49 mg/kg, and, in some cases, the impact to groundwater soil cleanup criteria of 50 mg/kg (NJDEP, 1995).

The objectives of the current investigation were:

- To delineate the horizontal and vertical extent of PCB contamination from this source in accordance with the technical requirements for site remediation, N.J.A.C 7:26E (NJDEPE, 1993),
- To determine the volume of soil with PCB concentrations between 0.5 and 50 mg/kg, and
- To determine the volume of soil with PCB concentrations greater than 50 mg/kg.

2.0 METHODS

2.1 Sampling Locations

The Site Investigation data showed that PCB concentrations decreased as distance from the source (the former transformer pad) increased. Nevertheless, PCB concentrations remained above criteria in all four samples collected downgradient from the former transformer pad. To delineate the entire contaminated area, a grid was established surrounding the four previously sampled locations and the former pad location. This grid extended north and east from the foundation of Building 2000 to paved roads, and was formed by six transects running south to north. Sampling points were placed at intervals of between 6 and 13 feet along each transect. (See Figure 1 for indications of sampling locations determined according to the grid layout).

2.2 General Procedures

Initial samples were collected from the top 12 inches of soil on May 28-30, 1996. Samples were analyzed (screened) in the field by the PCB RISc Soil Test System (produced by ENSYS Inc.) in accordance with New Jersey Department of Environmental Protection guidance (NJDEP, 1994). Screening analysis allowed samples to be separated into three categories of

PCB concentrations: samples with concentrations less than 0.5 mg/kg; samples with concentrations between 0.5 and 50 mg/kg; and samples with concentrations greater than 50 mg/kg.

The plan for conducting the delineation was as follows: in locations where PCBs were detected at concentrations of 0.5 mg/kg or higher, another sample was to be collected one foot deeper at that location.. This process was to continue until screening concentrations less than 0.5 mg/kg were detected, or until the deepest penetration possible with the available equipment was reached. Furthermore, when concentrations in the surface sample exceeded 0.5 mg/kg, a surface sample was to be collected at the next location farther north along that transect away from Building 2000. Sampling was to be extended farther north along each transect until the concentrations of PCBs detected in surface samples was less than 0.5 mg/kg.

This plan was not followed in some areas because of limitations of available time, number of test kits, and problems with going to sufficient depth, as will be explained later. Therefore, although the lateral extent of surface contamination was adequately delineated, the bottom of contamination was not reached in the most contaminated zone.

A total of 67 soil samples were screened (Appendix A). Duplicate analysis was conducted on five of these screened samples, representing more than five percent of the total. Eight samples, or more than 10%, were selected for laboratory confirmation of concentrations detected by field screening (Appendix B).

2.3 Sample Collection Procedures

All samples were collected with 2.5-inch diameter hand augers. The entire one-foot soil interval was removed and placed in a stainless steel bowl. Soil samples were categorized with respect to color (hue, value and chroma), texture, apparent moisture content, extraneous material, and whether the soil was parent material or fill. In general, the soil was categorized as sandy loam. Any changes in these characteristics with depth across the sample were noted. Following categorization, samples were fully mixed and material was put in prelabelled, laboratory-cleaned, glass containers. Filled sample containers were immediately placed on ice. Augers, bowls and trowels were decontaminated prior to sample collection (WESTON, 1994), and surgical or nitrile gloves were worn at all times when handling samples or sampling equipment.

For samples from the zero to one-foot interval, grass or other extraneous material on the soil surface was removed with a decontaminated trowel prior to augering. For deeper samples, a gasoline-powered auger was used to enlarge the overlying 2.5-inch hole to 4 inches. The enlarged hole was emptied of all loose soil that had fallen in during enlargement before a sample was collected at an additional foot of depth with a hand auger. For samples collected from the four to five-foot depth interval, it was not possible to empty the hole manually, so a hand auger was used to empty the hole. This auger was replaced by a freshly decontaminated

auger for sample collection to prevent cross-contamination. At some locations, the soil was too loose to clean the hole with an auger, and sampling had to be suspended at the three to four-foot interval. At some other locations, refusal occurred before reaching the five feet depth.

Following the sampling effort, the excavated holes were filled. Holes which indicated contamination to the bottom were filled with excavated material. Holes which did not indicate contamination to the bottom were filled with clean topsoil.

2.4 Field Chemical Analysis (Screening)

Sample analysis (screening) was conducted in the field within an hour after the samples were collected. Four soil samples were analyzed at a time using the ENSYS RISc Soil Test System. The test is a rapid immunoassay screening test that is reported by the manufacturer to correctly identify 95% of samples that are PCB-free as compared to samples containing PCB concentrations of 1 mg/kg or greater. All tests were run according to the instruction packet provided in each test kit (Appendix C).

The ENSYS test required approximately ten grams of soil from each sample. Each sample was then passed through a series of extraction, filtration, and dilution steps. Each test kit contains the proper dilution ampules to screen for required detection levels. Two dilutions were prepared for each sample; one for detecting PCB concentrations greater than 0.5 mg/kg and one for detecting concentrations greater than 50 mg/kg. The samples were then passed through a colorimetric test and measured against a QC Standard (prepared simultaneously with the samples) in a photometer. Color is produced by a chemical reaction in the standard in the absence of PCBs. The presence of PCBs inhibits the production of color. The color produced by a sample was compared to the color of a standard. Less color, or negative values in the sample as compared to the standard, indicated the detection of PCB's. Different dilutions allowed concentrations of greater than 0.5 mg/kg and greater than 50 mg/kg to be detected for each sample. A subset including more than 10% of the samples analyzed in the field was chosen for laboratory verification of the field results. A member of the field team was trained prior to field work by the test kit manufacturer.

2.5 Laboratory Chemical Analysis

Following field screening, samples were returned to a cooler with ice and retained until the conclusion of screening. After all samples had been collected and screened, eight samples were selected for laboratory analysis (Appendix D). Samples selected for laboratory analysis included:

- Two surface samples collected at zero to one foot below ground level, for which PCB screening concentrations were less than 0.5 mg/kg, and which were adjacent to contaminated surface sample locations, but further removed from the source (location 13 @ 0-1 ft; location 33 @ 0-1 ft).

- Two subsurface samples collected at one to two feet below ground level, for which screening concentrations were less than 0.5 mg/kg, and which were adjacent to contaminated samples collected from one-foot deep or deeper, but were further removed from the source (location 12 @ 1-2 ft; location 32 @ 1-2 ft).

- One surface sample for which the screening was greater than 50 mg/kg, and was believed to probably contain the highest PCB concentration of all samples (location 61 @ 0-1 ft).

- Three subsurface samples, two collected at four to five feet below ground level and one at three to four feet below ground level, for which screening concentrations were greater than 0.5 mg/kg but less than 50 mg/kg, and from locations where samples could not be collected at greater depth (locations 61 and 53 @ 4-5 ft; location 04 @ 3-4 ft).

Laboratory analysis and quality control with respect to matrix spiking followed the Chemical Data Acquisition Plan for the Site Investigation of Fort Monmouth (WESTON, 1994).

3.0 RESULTS

3.1 General Results

The results of the field screening and laboratory analysis are presented in Table 1. Soils north and east of Building 2000 contained PCBs at concentrations exceeding the NJDEP Residential Direct Contact criterion (0.49 mg/kg). Surface samples from an area of approximately 3000 square feet exceeded the criterion, as did samples collected down to 4 to 5 feet below ground level.

Soil contamination was distributed in the area surrounding a spill from the former electrical transformer at Building 2000. Surface soil concentrations near the former location were greater than 50 mg/kg. Proceeding north from the former site and Building 2000, surface soil concentrations were lower (between 0.5 and 50 mg/kg), until, at a distance of approximately 30 feet north of Building 2000, surface soil concentrations were less than 0.5 mg/kg.

Subsurface concentrations followed a similar pattern. Near the former location, subsurface concentrations were less than at the surface, but still exceeded the 0.49 criterion at a depth of 4 to 5 feet below ground level. The depth of contamination gradually decreased further north from the former transformer site.

To some extent, contamination followed the observed drainage swale which skirts the north side of Building 2000. Samples collected from along the swale, as far as 50 feet from the suspected source and from as deep as four feet below ground level, still had concentrations above 0.5 mg/kg.

3.2 Comparisons of Screening, Laboratory and Duplicate Results

Comparisons of field test screening results with laboratory analysis indicated the good correlation between the two methods of contamination measurement In six of eight samples, PCB concentrations from laboratory analysis coincided with screening concentration categories (i.e., < 0.5, 0.5 - 50, > 50 mg/kg) (Table 1). The laboratory detection limit of one sample (13 @ 0-1) was greater than the screening concentration of 0.5 mg/kg, probably because of interference from a non-PCB compound. Nevertheless, PCBs were not detected in this sample in the laboratory and screening predicted the concentration would be less than 0.5 mg/kg. Screening of one sample (12 @ 1-2) indicated that the concentration was less than 0.5 mg/kg, but the laboratory result was 0.52 mg/kg. This discrepancy of 0.02 mg/kg is considered minor. Four of six duplicate screenings agreed. For one sample, the duplicate was greater than the original (61 @ 1-2), and for another sample, the duplicate was less than the original (72 @ 0-1).

3.3 Extent of Contamination

The area of potential contamination is an area north of Building 2000, and bounded by two paved driveways to the east and west (see Figure 2). The proposed depth of excavation is presented on this figure. A brief discussion of the basis of the delineation is presented in the following paragraphs. In general, the delineation lines in Figure 2 were drawn through the first "clean" sample location next to the area of contamination. As discussed in more detail in the following paragraphs, the depth of contamination is an estimate based on the samples at depth and should be supported by additional field tests during remediation. The contaminated zone has been divided into five areas to facilitate discussion.

The northern boundary of the area of contamination is assumed to extend down to a depth of two feet. The line was extended north around the man-hole (Area 5) because the concentration of a surface sample in the vicinity of the man-hole exceeded 0.5 mg/kg. It appeared that the soil at this location had been recently disturbed when electrical lines had been buried in a trench extending from the new transformer to the man-hole, and when the trench was filled, soil from the contaminated area was moved north toward the man-hole.

Two areas of deeper contamination were identified. The first area, which was to the west, (part of Area 3) was delineated to include the lower end of the swale. Deep samples were collected at two locations in this area (04 and 82). The deepest sample at both of these locations (4 ft at 04 and 3 ft at 82) still exceeded 0.5 mg/kg. Nevertheless, laboratory analysis of the four-foot deep sample at location 04 (1.6 mg/kg) was only slightly above the soil criteria. The field screening results suggest that the 3 foot sample at location 82 is also close to 0.5 mg/kg because the test result was only slightly negative.

The second area, which was to the east of Building 2000, near the former PCB transformer pad location, had higher levels of contamination. Portions of this area have PCB contamination greater than 50 mg/kg. Area 1, which extended from the surface to a depth of two feet, had the highest levels of contamination. The field tests indicated that contamination exists to at least a depth of five feet. The deepest extent of the contamination could not be accurately determined in this area because of the difficulty in obtaining deep samples at many of the locations in this area. It is conservatively assumed that contamination extends to at least six feet deep throughout this area. The deeper soil that extends from a depth of two feet to a depth of six feet has been designated Area 2.

PCB concentrations exceeding the criterion of 0.49 mg/kg are almost certainly found deeper than five feet in the area to the east of Building 2000. The maximum depth of contamination was not determined. However, concentrations decrease substantially with depth. At location 61, laboratory analysis showed a concentration of 72 mg/kg at the surface, but only 6.8 mg/kg in the four to five feet deep sample. Location 01 had a concentration of 100 mg/kg at the surface in 1994, but nearby at location 53, the concentration of the four to five feet deep sample was only 1.6 mg /kg.

4.0 REMEDIATION APPROACH

The volumes of soil involved in remediation are divided with respect to PCB concentrations. Soils with concentrations greater than 0.5 mg/kg require remediation under the Residential Direct Contact criterion. TSCA Regulations require that soil with PCB concentrations greater than 50 mg/kg be disposed of as PCB waste. Therefore, the volume of soils where concentrations exceed 50 mg/kg were calculated separately from the volume with concentrations between 0.5 and 50 mg/kg. It is assumed that all of Area 1 soil is contaminated with PCB greater than 50 mg/kg and must be disposed of as PCB waste. All other contaminated soils (Areas 2 through 5) contain PCB contamination of between 0.5 and 50 mg/kg and can be disposed of as solid waste.

The volume of soil to be excavated was calculated using the estimated depths of contamination presented in Figure 2 and are contained in the following table:

Area	Contamination level (mg/kg)	Volume (Cubic yards)	Weight (tons)
1	>50	45	67
2	0.5 to 50	90	134
3	0.5 to 50	178	267
4	0.5 to 50	67	100
5	0.5 to 50	30	45
Total	>50	45	67
Total	0.5 to 50	364	546

REFERENCES

NJDEP, 1993. *Technical Requirements for Site Remediation*, NJAC 7:26E, July 1993.

NJDEP, 1995. *Site Remediation News*, Winter 1995.

NJDEP, 1994. *Field Analysis Manual*, July 1994.

WESTON, 1994. *Chemical Data Acquisition Plan, Site Investigation at Fort Monmouth, NJ*

WESTON, 1995. *Site Investigation, Fort Monmouth, NJ*

Table 1
PCB Sampling Results
Fort Monmouth, New Jersey
28 to 30 May, 1996

Location	Depth (ft.)	Field Sampling Results (mg/kg)			Laboratory Analysis Results (mg/kg)
		0-0.5	0.5-50	>50	
01	0-1	N/A	N/A	N/A	100**
02	0-1	N/A	N/A	N/A	27**
02	1-2	x			
03	0-1	N/A	N/A	N/A	26**
04	0-1	N/A	N/A	N/A	6**
04	1-2		x		NS
04	2-3		x		NS
04	3-4		x		1.6
05	0-1		x		NS
05	1-2	x			NS
06	0-1	x			NS
07	0-1	x			NS
12	0-1		x		NS
12	1-2	x			0.52
13	0-1	x			8.40U
14	0-1	x,x*			NS
15	0-1	x			NS
22	0-1		x		NS
22	1-2	x			NS
23	0-1	x			NS
24	0-1		x,x*		NS
24	1-2	x			NS
25	0-1	x			NS
32	0-1		x		NS
32	1-2	x			0.32
33	0-1	x			0.46
34	0-1	x			NS

* Duplicate Analysis

**Sampled November, 1994; therefore, 1996 results are not applicable (N/A).

NS = Sample not submitted for chemical laboratory analysis

U = Compound was not detected at or above the reporting limit.

Table 1

PCB Sampling Results
Fort Monmouth, New Jersey
28 to 30 May, 1996

Location	Depth (ft.)	Field Sampling Results (mg/kg)			Laboratory Analysis Results (mg/kg)
		0-0.5	0.5-50	>50	
35	0-1	x			NS
42	0-1		x		NS
42	1-2	x			NS
43	0-1	x			NS
44	0-1	x			NS
51	0-1			x	NS
51	1-2			x	NS
51	2-3		x		NS
51	3-4		x		NS
52	0-1			x	NS
53	0-1			x	NS
53	1-2		x		NS
53	2-3		x		NS
53	3-4		x,x*		NS
53	4-5		x		1.6
61	0-1			x	72
61	1-2		x	x*	NS
61	2-3		x		NS
61	3-4		x		NS
61	4-5		x		6.8
62	0-1			x	NS
63	0-1		x		NS
64	0-1		x		NS
64	2-3		x		NS
65	0-1		x		NS
66	0-1		x		NS
66	1-2		x		NS
66	2-3	x			NS
71	0-1		x		NS
72	0-1		x*	x	NS
72	1-2		x		NS
72	2-3		x		NS

* Duplicate Analysis

**Sampled November, 1994; therefore, 1996 results are not applicable (N/A).

NS = Sample not submitted for chemical laboratory analysis

U = Compound was not detected at or above the reporting limit.

Table 1
PCB Sampling Results
Fort Monmouth, New Jersey
28 to 30 May, 1996

Location	Depth (ft.)	Field Sampling Results (mg/kg)			Laboratory Analysis Results (mg/kg)
		0-0.5	0.5-50	>50	
73	0-1		x		NS
73	2-3		x		NS
74	0-1		x		NS
75	0-1		x		NS
75	1-2		x		NS
75	2-3	x			NS
76	0-1	x			NS
81	1-2	x			NS
82	1-2		x		NS
82	2-3		x		NS
83	1-2	x,x*			NS

* Duplicate Analysis

**Sampled November, 1994; therefore, 1996 results are not applicable (N/A).

NS = Sample not submitted for chemical laboratory analysis

U = Compound was not detected at or above the reporting limit.

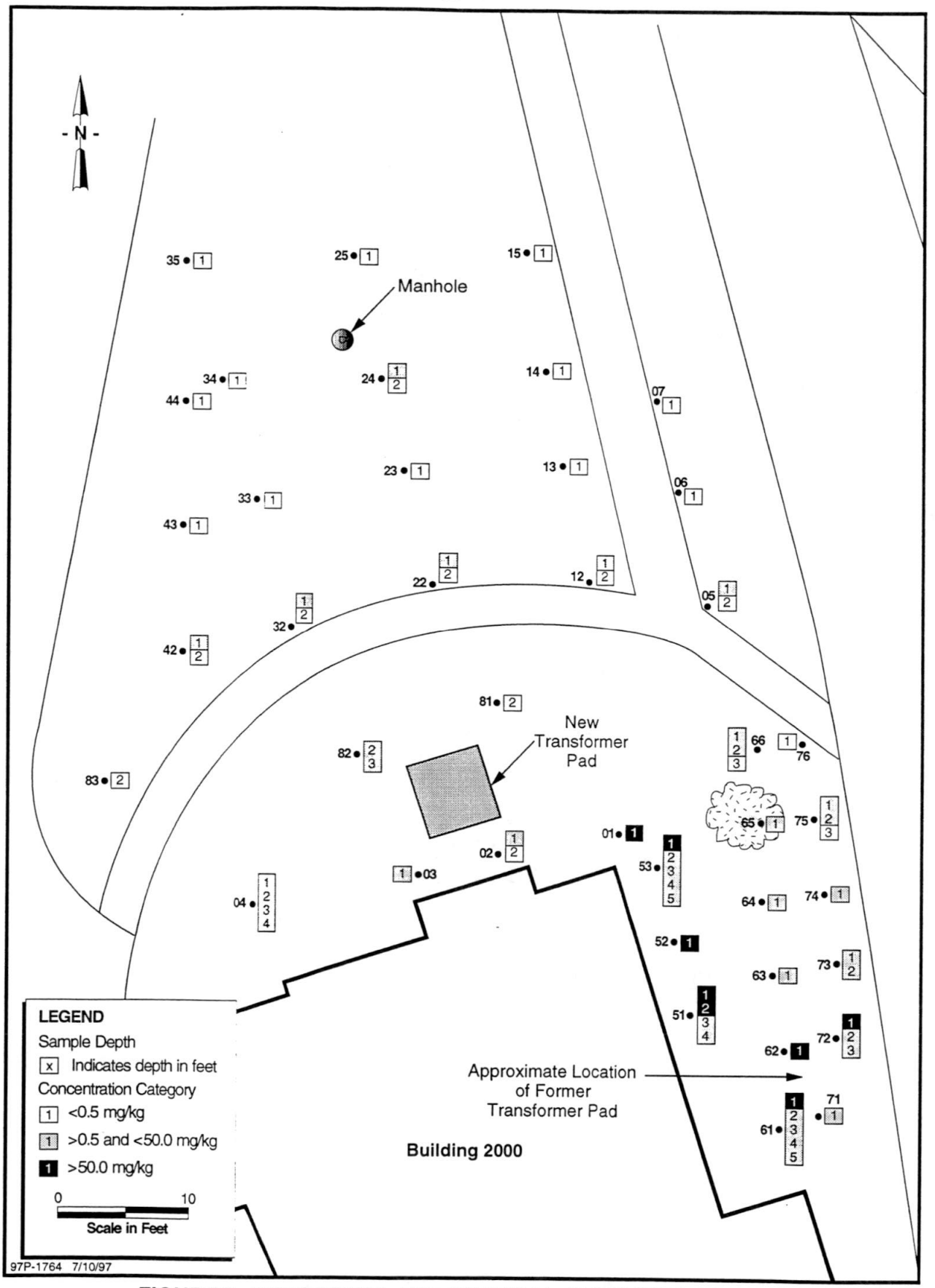


FIGURE 1 HORIZONTAL AND VERTICAL SAMPLING LOCATIONS BUILDING 2000 CHARLES WOOD AREA

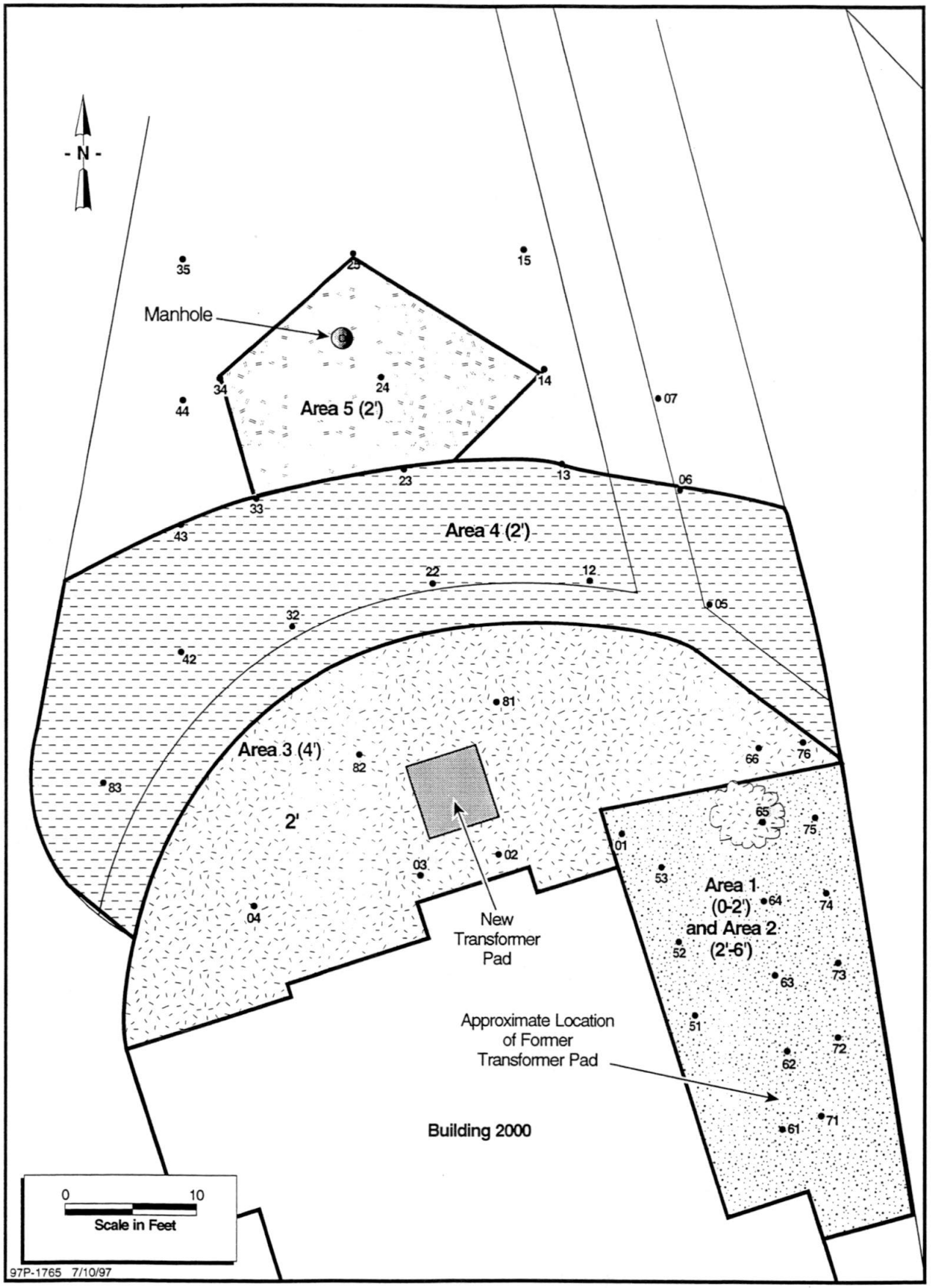


FIGURE 2 ESTIMATED EXTENT OF PCB CONTAMINATION BUILDING 2000 CHARLES WOOD AREA

APPENDIX A

SCREENING FIELD DATA SHEETS

Data for PCB RISC® Soil Test

Operator: R. Semino | Date: 5/28/96 | Location: FT Kendall Bldg. 2000

	Sample ID	ΔOD Standards	OD sample 0.5 ppm	Interpretation	OD sample 50 ppm	Interpretation	Comments
1-1	TR51-A01	-0.06	-0.62	> 0.5	-0.56	> 50	
1-2	TR52-A01	↓	-0.60	> 0.5	-0.12	> 50	
1-3	TR53-A01	↓	-0.60	> 0.5	-0.26	> 50	
1-4	TR61-A01	↓	-0.60	> 0.5	-0.45	> 50	
2-1	TR62-A01	-0.02	-0.51	> 0.5	-0.44	> 50	
2-2	TR63-A01	↓	-0.52	> 0.5	0.20	< 50	
2-3	TR64-A01	↓	-0.53	> 0.5	0.27	< 50	
2-4	TR65-A01	↓	-0.53	> 0.5	0.31	< 50	
3-1	TR66-A01	-0.13	-0.39	> 0.5	0.17	< 50	
3-2	TR71-A01	↓	-0.42	> 0.5	0.12	< 50	
3-3	TR72-A01	↓	-0.39	> 0.5	-0.02	> 50	
3-4	TR73-A01	↓	-0.41	> 0.5	0.02	< 50	

Data for PCB RISC® Soil Test

Operator: Z SEMMO Date: 5/28/94 Location: FT MONMOUTH BLG 2010

	Sample ID	ΔOD Standards	OD sample 0.5 ppm	Interpretation	OD sample 50 ppm	Interpretation	Comments
4-1	TR74-A01	-0.05	-0.38	>0.5	0.06	<50	
4-2	TR75-A01	↓	-0.40	>0.5	0.15	<50	
4-3	TR76-A01		0.12	<0.5	0.32	<50	
4-4	TR05-A01	↓	-0.32	>0.5	0.22	<50	

Data for PCB RISC® Soil Test

Operator: _____ Date: 5/29/96 Location: FT Monmouth Bldg 2000

	Sample ID	ΔOD Standards	OD sample 0.5 ppm	Interpretation	OD sample 50 ppm	Interpretation	Comments
1-1	TR32-A01	-0.05	-0.29	> 0.5	0.39	< 50	
1-2	TR33-A01	↓	0.26	< 0.5	0.39	< 50	
1-3	TR34-A01	↓	0.31	< 0.5	0.50	< 50	
1-4	TR35-A01	↓	0.28	< 0.5	0.36	< 50	
2-1	TR22-A01	-.04	-.04	> 0.5	0.57	< 50	
2-2	TR42-A01	↓	-.38	> 0.5	0.46	< 50	
2-3	TR43-A01	↓	0.30	< 0.5	0.42	< 50	
2-4	TR44-A01	↓	0.28	< 0.5	0.47	< 50	
3-1	TR05-A02	-.13	0.34	< 0.5	0.42	< 50	
3-2	TR32-A02	↓	0.16	< 0.5	0.29	< 50	
3-3	TR53-A02	↓	-0.52	> 0.5	0.35	< 50	
3-4	TR75-A02	↓	-0.46	> 0.5	0.41	< 50	

Data for PCB RISC® Soil Test

Operator: _____ Date: 5/29/96 Location: E. Mammoth BD6 2000

	Sample ID	ΔOD Standards	OD sample 0.5 ppm	Interpretation	OD sample 50 ppm	Interpretation	Comments
4-1	TR12-A01	-0.06	-0.32	>0.5	0.53	<50	
4-2	TR13-A01		0.34	<0.5	0.55	<50	
4-3	TR22-A02		0.45	<0.5	0.47	<50	
4-4	TR42-A02	↓	0.02	<0.5	0.53	<50	
5-1	TR06-A01	-0.11	0.24	<0.5	0.64	<50	
5-2	TR14-A01		0.34	<0.5	0.65	<50	
5-3	TR23-A01		0.36	<0.5	0.44	<50	
5-4	TR24-A01	↓	-0.66	>0.5	0.29	<50	

Data for PCB RISC® Soil Test

Operator: R. SETNIK | Date: 5/30/96 | Location: FT. MONMOUTH BLDG. 2000

	Sample ID	ΔOD Standards	OD sample 0.5 ppm	Interpretation	OD sample 50 ppm	Interpretation	Comments
1-1	TR07-A01	-0.01	0.45	< 0.5	0.68	< 50	
1-2	TR12-A02	↓	0.01	< 0.5	0.55	< 50	
1-3	TR53-A03	↓	-0.57	> 0.5	0.43	< 50	
1-4	TR75-A03	↓	0.11	< 0.5	0.56	< 50	
1-5	TR24-A01 (RE)	↓	-0.56	> 0.5	0.43	< 50	
2-1	TR15-A01	-0.05	0.41	< 0.5	0.46	< 50	
2-2	TR24-A02	↓	0.04	< 0.5	0.38	< 50	
2-3	TR25-A01	↓	0.36	< 0.5	0.39	< 50	
2-4	TR53-A04	↓	0.85	> 0.5	0.33	< 50	
3-1	TR02-A02	-0.04	0.61	< 0.5	0.59	< 50	
3-2	TR04-A02	↓	-1.08	> 0.5	0.60	< 50	
3-3	TR72-A03	↓	-0.83	> 0.5	0.52	< 50	

Data for PCB RISC® Soil Test

Operator: _____ Date: 5/30/96 Location: Fort Monmouth

	Sample ID	ΔOD	OD sample	Interpretation	OD sample	Interpretation	Comments
		Standards	0.5 ppm		50 ppm		
4-1	TR51 - A02	-0.18	-1.02	>0.5	-0.26	>50	
4-2	TR51 - A03	↓	0.97	>0.5	0.64	<50	
4-3	TR61 - A02	↓	-1.02	>0.5	0.26	<50	
4-4	TR61 - A03	↓	-1.01	>0.5	0.35	<50	
4-5	TR72 - A02	↓	-1.00	>0.5	0.33	<50	
5-1	TR04 - A03	-0.19	-1.00	>0.5	0.46	<50	
5-2	TR53 - A05	↓	-0.80	>0.5	0.48	<50	
5-3	TR81 - A02	↓	0.20	<0.5	0.48	<50	
5-4	TR82 - A02	↓	-0.76	>0.5	0.54	<50	

Data for PCB RISC® Soil Test

Operator: _____ Date: 5/30/96 Location: Fort Monmouth, Bldg. 2525

Sample ID	ΔOD Standards	OD sample 0.5 ppm	Interpretation	OD sample 50 ppm	Interpretation	Comments
6-1	TR51 - A04	-0.24	-0.98	* >0.5	0.40	<50
6-2	TR61 - A04	↓	-0.97	>0.5	0.01	<50
6-3	TR64 - A03	↓	-0.87	>0.5	0.37	<50
6-4	TR66 - A02	↓	-0.40	>0.5	0.45	<50
7-1	TR04 - A04	-.07	-.71	>0.5	0.62	<50
7-2	TR82 - A03	↓	-.18	>0.5	0.59	<50
7-3	TR83 - A02	↓	0.29	<0.5	0.52	<50
8-1	TR61 - A05	-.03	-0.57	>0.5	0.51	<50
8-2	TR66 - A03	↓	0.14	<0.5	0.51	<50
8-3	TR73 - A03	↓	-0.50	>0.5	0.54	<50

Data for PCB RISC® Soil Test

Operator: K. DeTONO Date: 6/3/96 Location: FT Monmouth ECBRCC

	Sample ID	ΔOD	OD sample	Interpretation	OD sample	Interpretation	Comments
	Duplicate Numbers	Standards	0.5 ppm		50 ppm		
1	TR14-AC1(RE)	-0.14	0.45	<0.5	0.52	<50	
2	TR53-AC4(RE)	|	-0.66	>0.5	0.44	<50	
3	TR61-AC2(RE)	|	-0.69	>0.5	-0.06	>50	
4	TR72-AC1(RE)	|	-0.71	>0.5	0.04	<50	
5	TR83-AC2(RE)	V	0.13	<0.5	0.11	<50	

APPENDIX B

LABORATORY ANALYTICAL RESULTS

Weston Environmental Metrics, Inc. (Gulf Coast)
PCBs by GC

RFW Batch Number: 9606G503 Client: USACE-Ft. Monmouth Work Order: 03886-076-037-0 Report Date: 06/16/96 09:20 Page: 1

	Cust ID:	CW07-TR04-A0 4	CW07-TR12-A0 2	CW07-TR13-A0 1	CW07-TR32-A0 2	CW07-TR33-A0 1	CW07-TR53-A0 5
Sample Information	RFW#:	001	002	003	004	005	006
	Matrix:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	D.F.:	5.0	5.0	50	5.0	10	5.0
	Units:	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Surrogate: Tetrachloro-m-xylene		115 %	110 %	D %	105 %	95 %	100 %
Decachlorobiphenyl		135 %	170 * %	D %	130 %	140 %	120 %
Aroclor-1016		440 U	430 U	4200 U	460 U	910 U	480 U
Aroclor-1221		440 U	430 U	4200 U	460 U	910 U	480 U
Aroclor-1232		440 U	430 U	4200 U	460 U	910 U	480 U
Aroclor-1242		440 U	430 U	4200 U	460 U	910 U	480 U
Aroclor-1248		440 U	430 U	4200 U	460 U	910 U	480 U
Aroclor-1254		890 U	860 U	8400 U	910 U	1800 U	970 U
Aroclor-1260		1600	520	8400 U	320	460	1600

	Cust ID:	CW07-TR61-A0 1	CW07-TR61-A0 1	CW07-TR61-A0 1	CW07-TR61-A0 5	PBLKNY	PBLKNY BS
Sample Information	RFW#:	007	007 MS	007 MSD	008	96GP0563-MB1	96GP0563-MB1
	Matrix:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	D.F.:	250	250	250	50	0.50	0.50
	Units:	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Surrogate: Tetrachloro-m-xylene		D %	D %	D %	D %	85 %	90 %
Decachlorobiphenyl		D %	D %	D %	D %	105 %	110 %
Aroclor-1016		22000 U	22000 U	22000 U	4500 U	40 U	40 U
Aroclor-1221		22000 U	22000 U	22000 U	4500 U	40 U	40 U
Aroclor-1232		22000 U	22000 U	22000 U	4500 U	40 U	40 U
Aroclor-1242		22000 U	22000 U	22000 U	4500 U	40 U	40 U
Aroclor-1248		22000 U	22000 U	22000 U	4500 U	40 U	40 U
Aroclor-1254		44000 U	D %	D %	9000 U	80 U	105 %
Aroclor-1260		72000	97000	88000	6800	80 U	80 U

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of EPA CLP QC

Cust ID: PBLKNY BSD

Sample Information

RFW#: 96GP0563-MB1
Matrix: SOIL
D.F.: 0.50
Units: ug/Kg

Surrogate:	Tetrachloro-m-xylene	85	%
	Decachlorobiphenyl	110	%
Aroclor-1016		40	U
Aroclor-1221		40	U
Aroclor-1232		40	U
Aroclor-1242		40	U
Aroclor-1248		40	U
Aroclor-1254		97	%
Aroclor-1260		80	U

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of EPA CLP QC

APPENDIX C

ENSYS RISc SOIL TEST KIT

TEST INSTRUCTIONS

ENSYS INC
ENVIRONMENTAL PRODUCTS

PCB RISc® SOIL TEST SYSTEM

RAPID IMMUNOASSAY SCREEN

User's Guide

IMPORTANT NOTICE

This method correctly identifies 95% of samples that are PCB-free and those containing 1 ppm or greater of PCBs. A sample that develops less color than the standard is interpreted as positive. It contains PCBs. A sample that develops more color than the standard is interpreted as negative. It contains less than 1 ppm PCBs.

This test system should be used only under the supervision of a technically qualified individual who is capable of understanding any potential health and environmental risks of this product as identified in the product literature. The components must only be used for the analysis of soil samples for the presence of polychlorinated biphenyls. After use, the kits must be disposed of in accordance with applicable federal and local regulations.

TROUBLESHOOTER GUIDE

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

WASH STEP

Lack of vigorous washing may result in false positives or negatives depending on whether the wash error was committed on standard or sample tubes. Solution: Make sure to wash four times vigorously, washing the whole set of 12 tubes at once.

PIPETTE CALIBRATION

An out-of-calibration pipette may result in false positives or negatives depending on whether the amount is greater or less than the specified transfer volume. *Solution:* Check the calibration at least daily and after any extreme mechanical shock (such as dropping). An indication that the pipette is out of calibration is if the gold barrell is loose and will turn. (When set on 30 µl there should be about a 1/4 of an inch between the white plunger and the end of the clear pipette tip.)

AIR BUBBLES IN THE PIPETTE

The presence of air bubbles in the pipette tip when transferring extracts may result in false positives or negatives depending on whether the error was committed on standard or sample tubes. *Solution:* Quickly examine the pipette tip each time an aliquot is withdrawn and go back to the source and take another aliquot to displace the bubble iof necessary.

MIXING

Lack of thorough mixing, when instructed, can cause inconsistent results. *Solution:* Observe the times in the instructions and mix with sufficient force to ensure that the liquid is homogenous.

TIMING

It is important to follow the timing steps in the instructions carefully. The incubation step in the antibody tubes can vary a bit without harm to the tests. The color development step timing is critical and should be no less than 2 minutes and no greater than 3 minutes.

WIPING THE TUBES

Wiping of the tubes should be done before they are read in the spectrophotometer because smudges and fingerprints on the tubes can give potentially false negative readings.

MIXING LOT #'S

Never mix lots! Each kit's components are matched for optimal performance and may give inaccurate results with the components from other kits with different lot #'s. Also, NEVER mix components from different types of kits (ex: Petro kit buffer can not be used with a PAH kit).

STORAGE AND OPERATING TEMPERATURES

Temperature requirements are very important and should be strictly adhered to. This test kit should be stored at less than 80°F/27°C and operated between 40°F/4°C and 90°F/32°C.

SHELF-LIFE

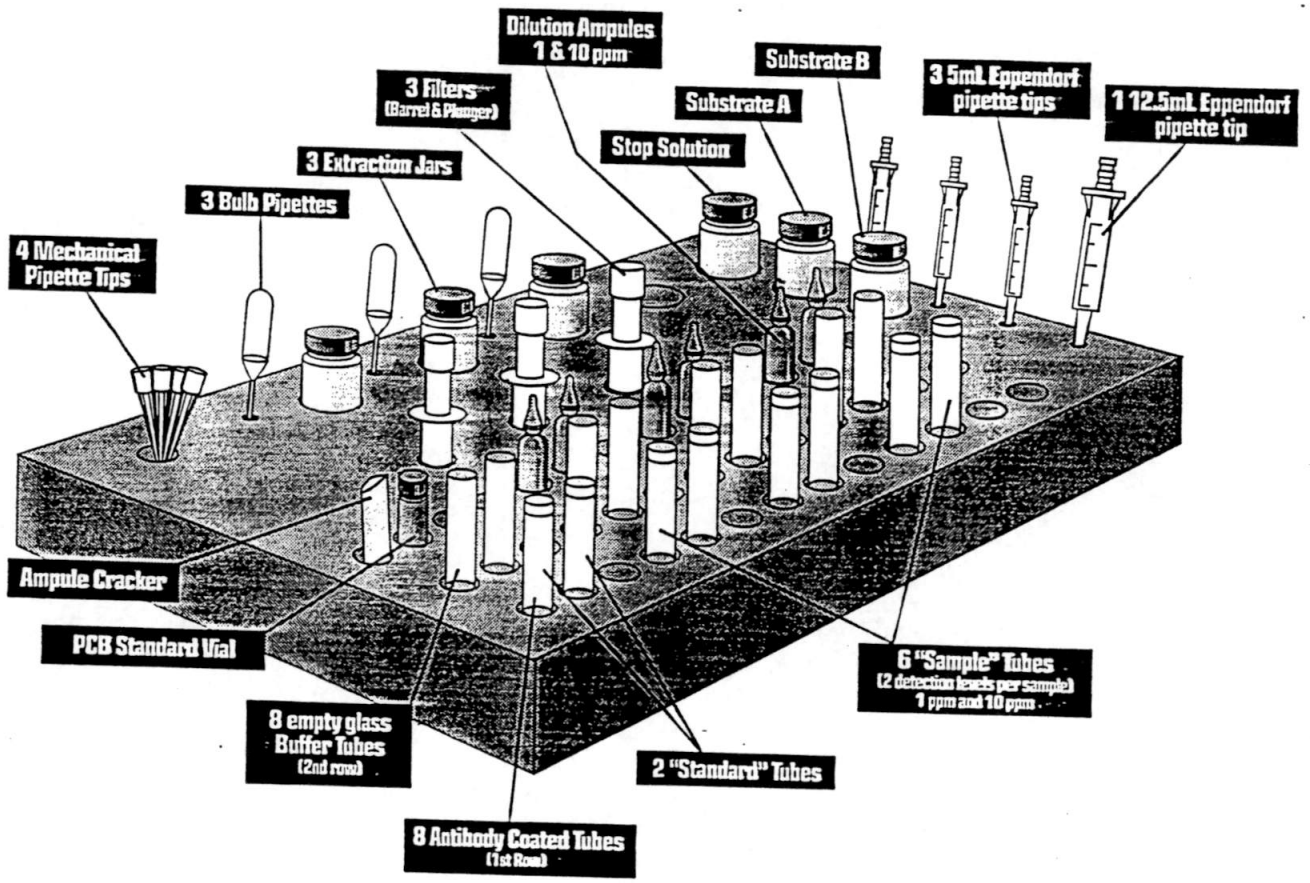
Each kit label contains the kit expiration date. To achieve accurate results, kits must be used prior to expiration.

WORKSTATION SET-UP

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

WORKSTATION SET-UP

- Mechanical pipette tips
- Filter barrels & plungers
- Ampule cracker
- Glass PCB buffer tubes
- Substrate A
- Eppendorf pipette tips
- Bulb pipettes
- PCB standard
- Antibody coated tubes
- Substrate B
- Extraction jars
- 1 & 10 ppm dilution ampules
- Stop Solution



Workstation shows components for 3 samples tested at 2 levels

TEST PREPARATION

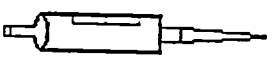
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING

- Do not attempt to run more than 12 tubes, two of which must be standards.
- Items that you will need that are not provided in the test kit include: a permanent marking pen, laboratory tissue (or paper towels), a liquid waste container, and disposable gloves.
- This User's Guide was written for analyzing soil samples for PCBs at 1 and 10 ppm. See table on page 12 for sensitivity to various aroclors.

TEST PREPARATION

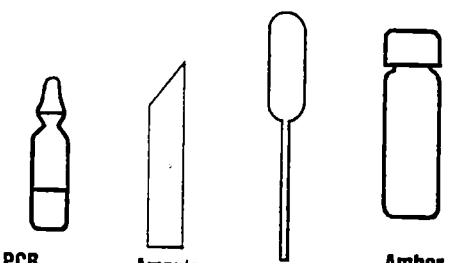
- Label all Eppendorf repeater tips. Tips can be reused for future analyses. Label the first 5mL tip "A", the second 5mL tip "B" and the third 5mL tip "Stop".
- Label the 12.5 mL tip "Buffer".



Eppendorf Tip

STANDARD PREPARATION

- Open PCB Standard ampules by slipping ampule cracker over top, and then breaking tip at scored neck. Transfer solution to empty vial with Bulb Pipettes.
- Label vial with current date. Standard is usable for 2 weeks. Always cap tightly when finished using standard.
- A new PCB Standard should be opened for every 4 samples.



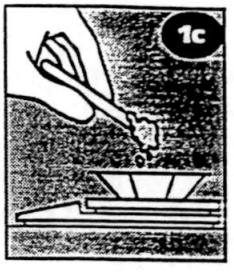
PCB Standard | Ampule cracker | Bulb pipette | Amber vial

PHASE 1

EXTRACTION & PREPARATION OF THE SAMPLE

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

WEIGH SAMPLE

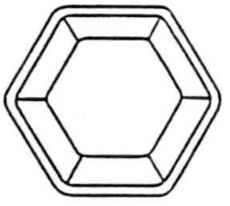


1a. Place unused weigh boat on pan balance.

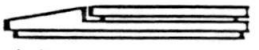
1b. Press ON/MEMORY button on pan balance. Balance will beep and display 0.0.

1c. Weigh out 10 ± 0.1 grams of soil.

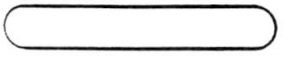
1d. If balance turns off prior to completing weighing, use empty weigh boat to retare, then continue.



Weigh Boat



Pan balance



Wooden spatula

EXTRACT PCBS

2a. Uncap extraction jar and place on a flat surface. Without contacting solvent puncture foil seal with ampule cracker or sharp object. Peel the remainder of the seal off extraction jar.

2b. Using wooden spatula, transfer 10 grams of soil from weigh boat into extraction jar.

2c. Recap extraction jar tightly and shake **vigorously** for one minute.

2d. Allow to settle for one minute.

Repeat steps **1a - 2c** for each sample to be tested.

Extraction jar

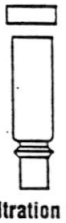
FILTER SAMPLE

3a. Disassemble filtration plunger from filtration barrel.

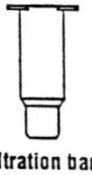
3b. Insert bulb pipette into top (liquid) layer in extraction jar and draw up sample. Transfer **at least** ½ bulb capacity into filtration barrel. **Do not use more than one full bulb.**

3c. Press plunger firmly into barrel until adequate filtered sample is available (place on table and press if necessary).

Repeat steps **3a - 3c** for each sample to be tested.



Filtration plunger



Filtration barrel

Bulb pipette

READ TO AVOID COSTLY MISTAKES

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

SAMPLE DILUTION PROGRAM

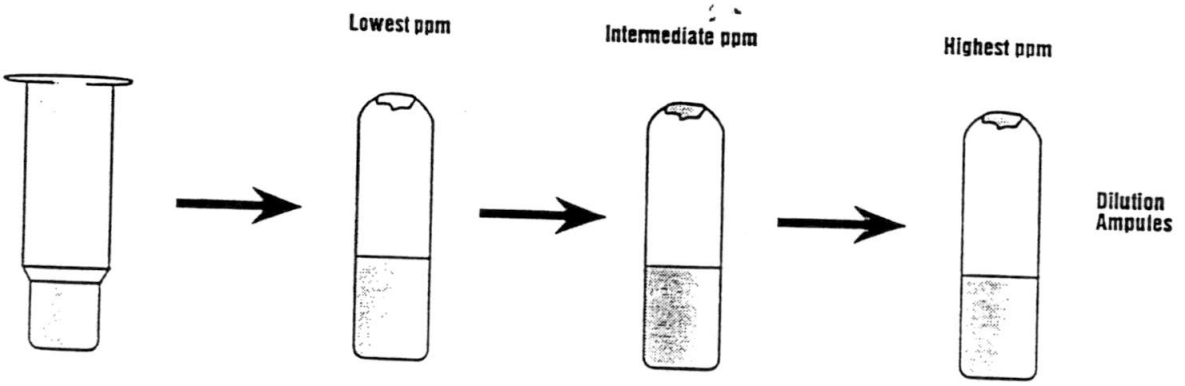
1. The sample dilution procedure on the next page is for standard detection levels. The following diagram represents the sample dilution procedure for all other detection levels.

2. Your kit may include extra dilution ampules to reach high detection levels.

3. EVERY AMPULE PROVIDED MUST BE USED!

   If there are any questions concerning the dilution procedure please call Technical Services before running the samples to help avoid costly mistakes.
   1-800-242-7472 or 919-941-5509 (option "4").

EXAMPLE:



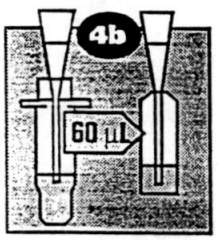
NOTE: Your Kit may include additional ampules in order to achieve your test levels. Always transfer filtered sample to the dilution ampule labeled with the lowest PPM level and then transfer from this ampule to the next higher level dilution tube.

PHASE 2
SAMPLE & STANDARD PREPARATION
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING

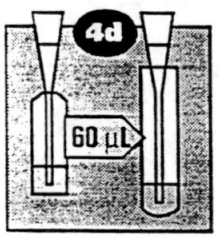
- Label the plastic antibody coated tubes with a permament marking pen.
- When using the mechanical pipette always withdraw and dispense below the liquid level.
- "Shake tubes" means to thoroughly mix the contents with special care not to spill or splash.

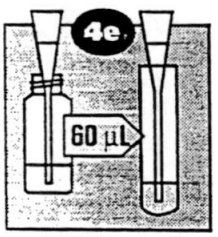
DILUTE SAMPLES AND STANDARDS



1 ppm

1 ppm 10 ppm





PCB Standard

4a. Set the Eppendorf Repeater on 4, assemble the "Buffer" tip and fill with Buffer.

4b. Dispense 1 mL of Buffer into each glass buffer tube.

4c. Open 1 and 10 ppm dilution ampules by slipping ampule cracker over top, and then breaking top at scored neck.

4d. Withdraw 60 µL of filtered sample using mechanical pipette and dispense below the liquid level in "1 ppm" dilution ampule. Gently shake ampule from side to side for 5 seconds to mix thoroughly.

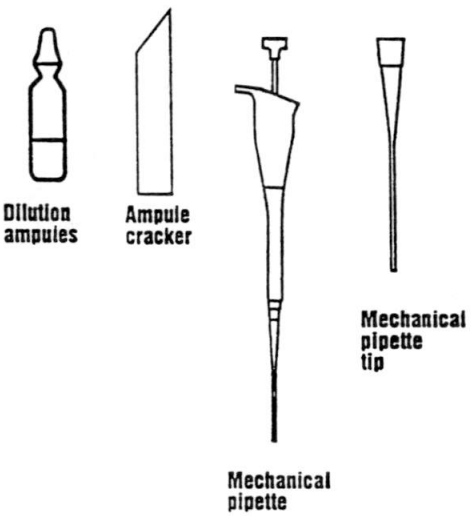
4e. Withdraw 60 µL from the "1 ppm" dilution ampule using mechanical pipette and dispense below the liquid level in "10 ppm" dilution ampule. Gently shake ampule from side to side for 5 seconds to mix thoroughly.

4f. Transfer 60 µL from each dilution ampule into glass buffer tubes. Always wipe tip after dispensing into buffer tube.

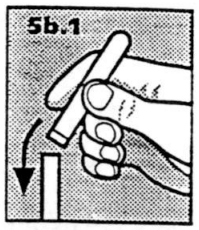
4g. Change pipette tip and repeat **4d - 4f** for each sample.

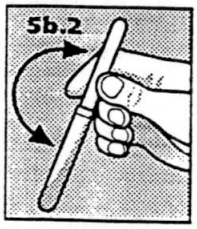
4h. Assemble new pipette tip on mechanical pipette and transfer 60 µL from Standard vial into two glass buffer tubes. Immediately replace cap on PCB Standard vial.

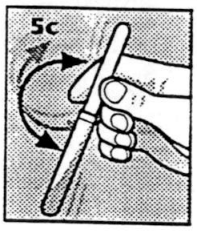
4i. Shake all glass buffer tubes for 5 seconds.



TRANSFER FROM DILUTION TUBE TO ANTIBODY COATED TUBE







5a. Set timer for 10 minutes.

5b. Working left to right in the workstation:

1. Fit all antibody coated tubes firmly on top of all corresponding glass buffer tubes.

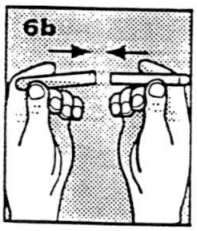
2. Start timer and immediately invert all connected tube pairs so that the liquid is poured into the antibody coated tubes. Return the tube pairs to the appropriate workstation row making sure the larger (antibody coated) tube is on the bottom.

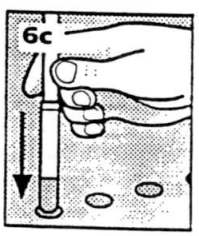
5c. Invert all tube pairs several more times making sure the pair is returned to the workstation with the larger (antibody coated) tube on the bottom.

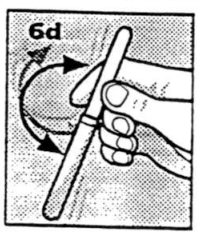
5d. Disconnect and discard the smaller (dilution) tubes. It is not important to worry about drops of liquid adhering to lips of tubes.

5e. Place conjugate tubes behind antibody tubes in workstation. Remove grey caps and discard.

TRANSFER OF CONJUGATE TO ANTIBODY COATED TUBES







AFTER 10 MINUTES, IMMEDIATELY:

6a. Set timer for 5 minutes.

6b. Working left to right in the workstation:

Start timer and immediately:

Dissolve the conjugate pellets by horizontally connecting the antibody coated tubes and conjugate tubes and **tilt the liquid up to pour it onto the conjugate.**

6c. Return the connected tubes to the appropriate workstation row making sure **the larger (antibody coated) tube is on the bottom. It is important that this step is completed within one minute for all tubes.**

6d. In order to adequately mix solution, **invert all connected tube pairs several more times** making sure that the pair is returned to the workstation with the larger (antibody coated) tube on the bottom.

6e. Disconnect and discard the conjugate tubes. It is not important to worry about the loss of liquid adhering to lip of tubes.

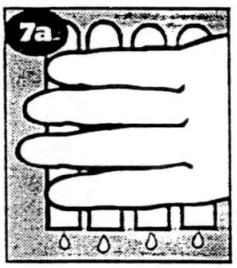
PHASE 4
INTERPRETATION

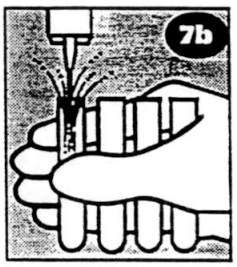
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING
WASH PROCEDURE

- An accurate test requires a virgorous wash accomplished by directing a strong stream into the antibody coated tubes.
- The wash solution is a harmless, dilute solution of detergent.

WASH



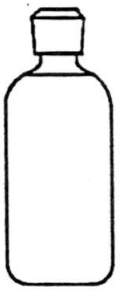


7a. After the 5 minute incubation (a total of 15 minutes), empty antibody coated tubes into liquid waste container.

7b. Wash antibody coated tubes by vigorously filling and emptying a total of 4 times.

7c. Tap antibody coated tubes upside down on paper towels to remove excess liquid. Residual foam in the tubes will not interfere with test results.

Note: When running up to 12 antibody coated tubes, tubes can be washed in two groups - one group immediately following the other group.



Wash bottle

PHASE 3
THE IMMUNOASSAY

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

COLOR DEVELOPMENT

8a. Set the Eppendorf Repeater on 2, assemble the "A" tip and fill with Substrate A (TMB, yellow label).

8b. Dispense once (200 µL) into each antibody coated tube.

8c. Set timer for exactly 2 1/2 minutes.

8d. Assemble "B" tip, fill with Substrate B, start timer, and dispense once (200 µL H_2O_2, green label) into each antibody coated tube.

8e. Shake all tubes for 5 seconds. Solution will turn blue in some or all antibody coated tubes.

8f. Assemble "Stop" tip, fill with Stop Solution (red label), and stop reaction at end of 2 1/2 minutes by dispensing once (200 µL) into each antibody coated tube.

Substrate A | Substrate B | Stop

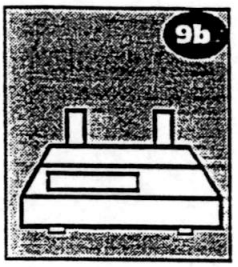
AROCLOR SENSITIVITY

Aroclor	Lowest Detection Level
1248	1.0 ppm
1254	0.5 ppm
1260	0.5 ppm
1242	2.0 ppm
1232	4.0 ppm
1016	5.0 ppm

PHASE 4
ANALYSIS OF RESULTS

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

SELECT STANDARD



9a. Wipe outside of all antibody coated tubes.

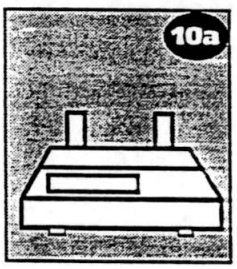
9b. Place both Standard tubes in photometer.

9c. Switch tubes until the photometer reading is negative or zero. Record reading.

If reading is greater than - 0.3 in magnitude, results are outside QC limits. Retest the sample(s).

9d. Remove and discard tube in right well. The tube in the left well is the darker standard.

MEASURE SAMPLE



10a. Place 1 ppm tube in right well of photometer and record reading.

If photometer reading is negative or zero, PCBs are present.

If photometer reading is positive, concentration of PCBs is less than 1 ppm.

10b. Place 10 ppm tube in right well of photometer and record reading.

If photometer reading is negative or zero, PCBs are present.

If photometer reading is positive, concentration of PCBs is less than 10 ppm.

QUALITY CONTROL

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

System Description

Each PCB RISc Soil 12 Test Case contains enough material to perform 12 test samples, each at two detection levels.

The PCB RISc Soil Test is divided into four phases. The instructions and notes should be reviewed before proceeding with each phase.

Hotline Assistance

If you need assistance or are missing necessary Test System materials, call toll free: 1-800-242-RISC (7472).

Validation and Warranty Information

Product claims are based on validation studies carried out under controlled conditions. Data has been collected in accordance with valid statistical methods and the product has undergone quality control tests of each manufactured lot.

PCB-free soil and soil containing 1 ppm or greater of PCBs were tested with the EnSys PCB RISc analytical method. The method correctly identified 95% of these samples. A sample that has developed less color than the standard is interpreted as positive. It contains PCBs. A sample that has developed more color than the standard is interpreted as negative. It contains less than 1 ppm PCBs.

The company does not guarantee that the results with the PCB RISc Soil 24 Test Case will always agree with instrument-based analytical laboratory methods. All analytical methods, both field and laboratory, need to be subject to the appropriate quality control procedures.

EnSys, Inc. warrants that this product conforms to the descriptions contained herein. No other warranties, whether expressed or implied, including warranties of merchantability and of fitness for a particular purpose shall apply to this product.

EnSys, Inc. neither assumes nor authorizes any representative or other person to assume for it any obligation or liability other than such as is expressly set forth herein.

Under no circumstances shall EnSys, Inc. be liable for incidental or consequential damages resulting from the use or handling of this product.

How It Works

Standards, Samples, and color-change reagents are added to test tubes, coated with a chemical specific to PCBs. The concentration of PCBs in an unknown **Sample** is determined by comparing its color intensity with that of a **Standard**.

Note: PCB concentration is inversely proportional to color intensity; the lighter the color development of the sample, the higher the concentration of PCBs.

Quality Control

Standard precautions for maintaining quality control:

- Do not use reagents or test tubes from one Test System with reagents or test tubes from another Test System.
- Do not use the Test System after any portion has passed its expiration date.
- Do not attempt the test using more than 12 antibody coated tubes (two of which are **Standards**) at the same time.
- Do not exceed incubation periods prescribed by the specific steps.
- Always follow the procedure in this user's guide.
- Use EPA Method 8080 or Code of Federal Regulations Title 40, Part 136, Appendix A, Method 680 to confirm results.

Storage and Handling Precautions

- Wear protective gloves and eyewear.
- Store kit at room temperature and out of direct sunlight (less than 80°F).
- Keep aluminized pouch (containing unused antibody coated tubes) sealed when not in use.
- If Stop Solution or liquid from the extraction jar comes into contact with eyes, wash thoroughly with cold water and seek immediate medical attention.
- Standard Solution contains PCBs. Test samples may contain PCBs. Handle with care.

EPPENDORF REPEATER & MECHANICAL PIPETTE

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

HOW TO OPERATE THE EPPENDORF REPEATER

To Set Or Adjust Volume

To determine the pipetting volume, the dial setting (1-5) is multiplied by the minimum pipetting volume of the tip.

To Assemble Pipette Tip

Slide filling lever down until it stops. Then raise the locking clamp and insert the tip until it clicks into position. Be sure the tip plunger is fully inserted into the barrel before lowering the locking clamp to affix the tip in place.

To Fill Tip

With tip mounted in position on pipette, immerse end of tip into solution. Slide filling lever upward slowly.

To Dispense Sample

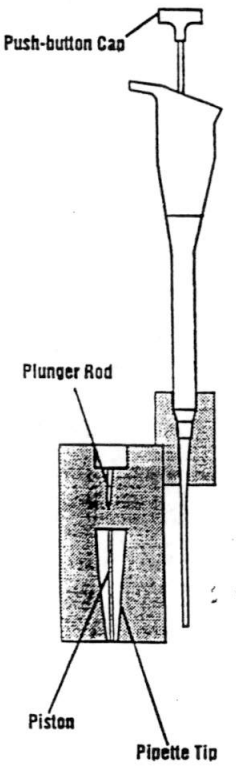
Check the volume selection dial to ensure pipetting volume. Place tip inside test tube so that tip touches the inner wall of tube. Completely depress the pipetting lever.

To Eject Tip

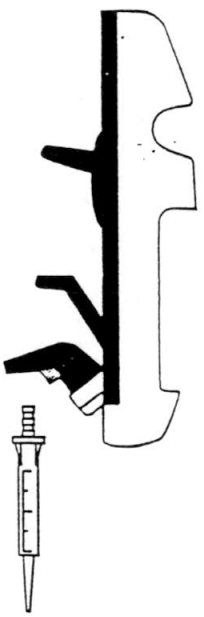
Empty tip of any remaining solution into appropriate container. Raise locking clamp upward, and remove the tip.

For additional information regarding operation and use of repeater, please refer to your Eppendorf Repeater manual.

Mechanical Pipette



Eppendorf Repeater



HOW TO OPERATE THE MECHANICAL PIPETTE

To Set Or Adjust Volume

Remove push-button cap and use it to loosen volume lock screw. Turn lower part of push-button to adjust volume up or down. Meter should read "060". Tighten volume lock screw and replace push-button cap.

To Assemble Pipette Tip

Slide larger mounting end of pipette tip onto end of pipette. Holding tip in place, press push-button until plunger rod enters pipette tip. Ensure no gap exists between piston and plunger rod.

To Withdraw Sample

With tip mounted in position on pipette, press push-button to first stop and hold it.

Place tip at bottom of liquid sample and slowly release push-button to withdraw measured sample. Ensure that no bubbles exist in liquid portion of sample. If bubbles exist, dispense sample and re-withdraw sample.

To Dispense Sample

Place tip into dispensing vessel (immersing end of the tip if vessel contains liquid) and slowly press push-button to first stop. (Do not push to second stop or tip will eject).

Remove tip from vessel and release push-button.

To Eject Tip

Press push-button to second stop. Tip is ejected.

For additional information regarding operation and use of pipette, please refer to your pipette manual.