SPMD Sampling Program

Data Summary Report

Prepared for:

General Electric
Albany, New York

Job Number:
GENspm 130

October 1999

QEA, LLC
October 1999

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INTRODUCTION

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SECTION 1
INTRODUCTION

This data summary report has been prepared by Quantitative Environmental Analysis, LLC (QEA) on behalf of the General Electric Company (GE) to present the results of semi-permeable membrane device (SPMD) sampling and analysis activities conducted in the upper Hudson River (Figure 1-1). This study was conducted in accordance with a work plan prepared by QEA (QEA, 1999), and was performed to evaluate the nature and source of PCB concentrations detected in the Hudson River at the Bakers Falls Bridge monitoring station (Figure 1-2; GE, 1999). Water column PCB concentrations at the Bakers Falls bridge station are typically below the method detection limit (11 ng/L; O'Brien & Gere, 1998). However, PCBs have been present at detectable concentrations at this station on several occasions in 1999. As SPMDs are capable of assimilating PCBs over a period of time, these devices are useful to qualitatively characterize low-level PCB sources.

1.1 PROGRAM OBJECTIVES

The principal objectives of the SPMD sampling program were to obtain data to support the following tasks:

- evaluate PCB concentration gradients and congener pattern differences in the Hudson River upstream of Bakers Falls;
- identify potential sources of PCBs to the Hudson River upstream of the Bakers Falls Bridge monitoring station; and
- evaluate whether PCB loading upstream of Bakers Falls has a measureable impact on PCB concentrations at Fort Edward.

1.2 APPROACH

The SPMD sampling program involved the deployment of SPMD samplers at 9 locations along the upper Hudson River between Rogers Island and Lake Luzerne (Figure 1-2). Two SPMDs were deployed at each site. One SPMD was allowed to remain in contact with the water for approximately two weeks, while the second was retrieved after approximately 4 weeks of contact time. Upon retrieval, the SPMDs were submitted to Environmental Sampling Technologies (EST) where they were subjected to a specialized extraction process. The sample extracts were then submitted to Northeast Analytical, Inc. (NEA) for congener specific PCB analysis. The methods and materials used to complete the SPMD sampling program are presented in Section 2. The results of the sampling program are presented in Section 3.

METHODS AND MATERIALS

Quantitative Environmental Analysis, LLC

SECTION 2
METHODS AND MATERIALS

2.1 SAMPLING EQUIPMENT

The SPMDs deployed during this study consisted of low-density polyethylene (LDPE) layflat tubing and high-purity synthetic triolein (≥95%). The SPMDs were obtained from EST, which holds the exclusive license for two patents for SPMD technology. The SPMDs used for this study were 2.5 cm wide by 91.4 cm long LDPE tubes (75-90 μm wall thickness) which contained 1 ml of triolein as a thin film spread over the entire tube (Figure 2-1). The SPMDs were heat sealed at both ends.

The SPMDs were delivered to QEA pre-mounted on a deployment rack or "spider" and sealed in gas tight, solvent-rinsed gallon cans for transport to the deployment site. The "spider" device consisted of a stainless steel disk with ten 2-inch vertical pegs on the outer edge around which the SPMD was wrapped (Figure 2-1). The "spiders" were placed in deployment devices consisting of a protective stainless steel mesh cylinder 6 in. in diameter and 5 in. high (Figure 2-1).

2.2 SAMPLER DEPLOYMENT

A typical SPMD deployment set up is presented in Figure 2-2. The SPMDs were deployed using a boat, and were placed near the center of the main channel of the river to avoid poorly mixed backwater areas to facilitate capture of a representative downstream gradient. SPMDs were deployed at the following locations (Figure 1-2):

- upstream of Corinth, downstream of the confluence of the Hudson and the Sacandaga Rivers,
- downstream of Corinth,
- upstream of the Sherman Island power dam,
- downstream of Glens Falls dam,
- 100-200 yards upstream of the Bakers Falls Bridge monitoring station,
- Bakers Falls Bridge monitoring station,
- Plunge Pool, and
- east and west channel at Rogers Island (upstream of the Fort Edward Yacht Basin to avoid boat traffic).

The SPMDs were placed at each sampling location at mid-depth in the water column, and were deployed in a manner designed to minimize disturbances by recreational boating traffic, wave action, floating debris, and vandalism. The SPMDs were anchored in position using a concrete block and nylon rope. A labeled buoy was placed at the surface of the water to mark the location of the SPMDs to facilitate retrieval. Field data, including the date and time, water depth, water temperature (at the surface and near the bottom), and visual observations were recorded at each sampling station, both at the time of deployment and retrieval.

Two SPMDs were deployed at each sampling station. One SPMD each was retrieved after two and four weeks deployment time. The SPMDs were deployed, retrieved and handled in accordance with the standard operating procedures that were developed by the SPMD manufacturer (EST). These procedures are presented in Appendix A.

2.3 LABORATORY ANALYSIS

Upon retrieval, the devices were returned to EST Labs via common courier for dialytic recovery of the analytes from the SPMDs (lipid + membrane). This process was followed by gel permeation chromatography (GPC) cleanup to remove triolein impurities and polyethylene waxes carried over during the dialysis extraction. The sample extracts were then submitted to NEA for congener specific PCB analysis. NEA performed these analyses in accordance with method NE013_04.SOP (NEA, 1999), which is an updated version of method NEA608CAP.

2.4 QUALITY ASSURANCE/QUALITY CONTROL

Quality assurance/quality control (QA/QC) samples were collected including matrix spike, blind duplicate and trip blanks. The QA/QC samples were collected at a rate of 5% of the total number of samples. The locations of the matrix spikes, blind duplicates and trip blanks are included in Table 2-1. Matrix spike samples are duplicate samples that are collected in the field and spiked with a known quantity of analyte in the laboratory. The percent recovery is then calculated. Blind duplicate samples are duplicates that are collected in the field and submitted to the laboratory without identifying the sampling location. Trip blanks are SPMDs sealed in 1-gallon cans that are opened during deployment and retrieval of the sampler SPMD to expose them to atmospheric conditions in a manner equivalent to the sample. Trip blank data is important to obtain and evaluate because SPMDs are very efficient air samplers.

Data generated during this program have not been formally validated. However, QEA performed a preliminary overview of the QA/QC data. This overview indicates that the following QA/QC objectives were met:

- matrix spike recoveries were acceptable at 103 and 104 %, respectively;
- the results of duplicate sample analyses were acceptable (duplicate sample results were below the method reporting limit (MRL) of 0.224 ug established by NEA, as were the original samples);
- trip blank analyses were below the MRL, and were therefore acceptable;
- the laboratory dialysis blank was below the MRL, and was therefore acceptable; and
- extraction and holding times were met for all samples.

RESULTS

Quantitative Environmental Analysis, LLC

SECTION 3
RESULTS

3.1 FIELD DATA

Field data was collected at the time of SPMD deployment and retrieval. These data are presented in Table 2-1, and include the date and time, water depth, water temperature (at the surface and near the bottom), and visual observations.

3.2 PCB DATA

PCB mass (total ug) and PCB homolog distributions repeated for each SPMD are presented measured in Table 3-1. PCB data from the routine Hudson River water monitoring at the Bakers Falls Bridge, Plunge Pool, and Route 197 Bridge sampling stations are included in Table 3-2 from April 21, 1999 to July 28, 1999. This time period corresponds to the approximate period of PCB detections at Bakers Falls Bridge, and the SPMD deployment period (April 21, 1999 – July 28, 1999). Upstream of Bakers Falls (Stations 1, 2, 3, 4, 5, and 6; Figure 1-2), the total PCB values were less than the MRL of 0.224 ug at all stations for both the 2 week and 4 week deployments, with the exception of the four week deployment at Station 4, which contained 0.233 ug of PCBs.

Downstream of Bakers Falls (Stations 7, 8, and 9; Figure 1-2), PCB mass ranged from 2.59 to 7.00 ug for the two week deployments. The Plunge Pool (Station 7) SPMDs contained the highest while the SPMDs deployed in the west channel at Rogers Island (Station 9) contained the lowest PCB mass. SPMDs deployed for four weeks contained from 3.21 to 8.28 ug of PCBs. Consistent with the two week deployments, the highest PCB mass was measured at Station 7, and the lowest at Station 9.

PCB homolog distributions for SPMDs that contained detectable amounts of PCBs are presented in Table 3-1. Water column PCB homolog distributions from the Bakers Falls Bridge, Plunge Pool, and the Route 197 Bridge sampling stations from April 21, 1999 through July 27, 1999 are included in Table 3-2. All water column PCB detections at Bakers Falls Bridge and Route 197 Bridge, and all but two at the Plunge Pool were below the Practical Quantitation Limit of 44 ng/L (PQL; O'Brien & Gere, 1998). Quantification of PCB congeners and homolog distributions is less accurate in samples that contain PCBs below the PQL (O'Brien & Gere, 1998).

3.3 CONDITIONS POTENTIALLY AFFECTING SAMPLE QUALITY

SPMD biofouling can impede PCB flux across the membrane and thus lower the effective sampling rate. Biofouling was observed on most of the SPMDs, with the degree of biofouling increasing with the length of deployment at several of the locations. A description of the extent of biofouling observed is included in Table 2-1. As evaluation of SPMD data is qualitative, and biofouling was observed on most of the SPMDs, reduced sampling efficiency due to biofouling is not considered to have a significant impact on the ability to interpret the data.

The protective cage containing the SPMD (4 week contact time) located at station 8 (east channel at Rogers Island) appeared to have sediment on the outside of the cage. This may indicate that the cage came in contact with sediment during a period of low flow. This may have influenced the mass of PCB accumulated in the SPMD. However, the PCB composition and mass in this sample was consistent with the other SPMDs located downstream of Bakers Falls (stations 7, 8, and 9), suggesting that PCBs measured in this sample were not significantly impacted by exposure to sediment.

REFERENCES

REFERENCES

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Northeast Analytical, Inc. 1999. Standard Operating Procedure. NE013_04.SOP. (Includes guidelines set forth in *Quality Assurance Plan,* Green Bay Mass Balance Study, I. PCBs and Dieldrin, U.S. EPA Great Lakes National Program Office. Prepared by Deborah L. Swackhamer, Quality Assurance Coordinator, Field and Analytical methods Committees, University of Minnesota, December 11, 1987.)

O'Brien & Gere Engineers, Inc. 1998. *Fort Edward Dam PCB Remnant Deposit Containment, 1997 Post-Construction Monitoring Program.* Prepared for General Electric Company, Corporate Environmental Programs, Albany, NY. November, 1998.

Quantitative Environmental Analysis, LLC. 1999. *SPMD Sampling Plan.* Prepared for General Electric Company, Corporate Environmental Programs, Albany, NY. June, 1999.

TABLES

Quantitative Environmental Analysis, LLC

TABLE 2-1
GENERAL ELECTRIC COMPANY
SPMD SAMPLING PROGRAM
FIELD DATA SUMMARY

Station No.	Location	Contact Time	Status	Date	Time	Water Depth (ft)	Water Temp. (C)		Observations
							Surface	Bottom	
1	Upstream of Cornith, downstream of Hudson, Sacandaga confluence	2 weeks	Deployed	6/24/99	7:45	6	22.3	22.2	
			Retrieved	7/8/99	1:00	6	24.8	--	Some Biofouling.
		4 weeks	Deployed	6/24/99	7:45	6	22.3	22.2	
			Retrieved	7/22/99	8:30	3	24.5	24.5	Biofouling on the outside of cage and on membrane, consistant with other samples.
2	Downstream of International Paper facility in Corinth	2 weeks	Deployed	6/24/99	11:50	12	23.1	22.4	
			Retrieved	7/8/99	11:45	12	24.9	--	Biofouling on the outside of cage and on membrane, consistant with other samples.
		4 weeks	Deployed	6/24/99	11:50	12	23.1	22.4	
			Retrieved	7/22/99	9:55	12	24.9	24.3	Biofouling on the outside of cage and on membrane, small catfish inside of cage.
		4 weeks	Deployed	6/24/99	11:50	12	23.1	22.4	**Blind Duplicate**
			Retrieved	7/22/99	9:55	12	24.9	24.3	Biofouling on the outside of cage and on membrane, small catfish inside of cage.
3	Downstream of the Niagara Mohawk Queensbury site	2 weeks	Deployed	6/23/99	16:15	48	24.6	21.8	
			Retrieved	7/7/99	17:13	48	26.8	26.2	
		4 weeks	Deployed	6/23/99	16:15	48	24.6	21.8	
			Retrieved	7/21/99	16:00	48	27.3	28.4	Small amout of biofouling, Trip blank performed.
4	Downstream of Glens Falls and adjacent industries	2 weeks	Deployed	6/24/99	9:45	4	23.7	23.7	
			Retrieved	7/8/99	9:12	4	25.8	--	SPMD moved downstream apporx. 150 Yds., replaced within 10 Yds. of original location.
		4 weeks	Deployed	6/24/99	9:45	4	23.7	23.7	
			Retrieved	7/22/99	9:45	4	26.5	26.4	Substantial biofouling on membrane and cage, benthic organsims in cage.
5	Approximately 100 yds upstream of Bakers Falls monitoring station	2 weeks	Deployed	6/24/99	8:15	4	23.6	23.6	
			Retrieved	7/8/99	8:10	4	25.7	--	Green mossy algae on cage, brown biofouling on membrane
		4 weeks	Deployed	6/24/99	8:15	4	23.6	23.6	
			Retrieved	7/22/99	13:25	4	27.0	27.0	Cage covered with a grass-mat, heavy biofouling on membrane, two small catfish in cage.
		2 weeks	Deployed	6/24/99	8:15	4	23.6	23.6	**Matrix Spike**
			Retrieved	7/8/99	8:10	4	25.7	--	Green mossy algae on cage, membrane relatively clean.

TABLE 2-1
GENERAL ELECTRIC COMPANY
SPMD SAMPLING PROGRAM
FIELD DATA SUMMARY

Station No.	Location	Contact Time	Status	Date	Time	Water Depth (ft)	Water Temp. (C)		Observations
							Surface	Bottom	
6	Bakers Falls Bridge monitoring station	2 weeks	Deployed	6/23/99	15:00	10	23.5	23.6	
			Retrieved	7/8/99	7:56	10	25.5	--	
		4 weeks	Deployed	6/23/99	15:00	10	23.5	23.6	
			Retrieved	7/22/99	13:35	10	27.1	27.0	Little biofouling on membrane, two small snails in cage.
		2 weeks	Deployed	6/23/99	15:00	10	23.5	23.6	**Blind Duplicate**
			Retrieved	7/8/99	7:56	10	25.5	--	
7	Plunge Pool	2 weeks	Deployed	6/23/99	10:40	32	22.8	23.4	
			Retrieved	7/7/98	10:20	32	25.0	26.0	
		4 weeks	Deployed	6/23/99	10:40	32	22.8	23.4	
			Retrieved	7/21/99	9:15	32	25.0	25.1	
		4 weeks	Deployed	6/23/99	10:40	32	22.8	23.4	**Matrix Spike**
			Retrieved	7/21/99	9:15	32	25.0	26.0	
8	East Channel Rogers Island	2 weeks	Deployed	6/23/99	14:05	4	25.0	25.0	
			Retrieved	7/7/99	15:45	4	27.5	25.0	
		4 weeks	Deployed	6/23/99	14:05	4	25.0	25.0	
			Retrieved	7/21/99	13:55	2	27.5	27.5	Covered in mud - may have rested on bottom; small catfish in cage, Trip blank performed
9	West Channel Rogers Island	2 weeks	Deployed	6/23/99	15:00	7	25.0	25.0	
			Retrieved	7/7/99	16:05	7	27.3	--	
		4 weeks	Deployed	6/23/99	15:00	7	25.0	25.0	
			Retrieved	7/21/99	14:15	6	27.4	27.3	Biofouling on membrane; small catfish in bottom of cage

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TABLE 3-1
GENERAL ELECTRIC COMPANY
SPMD SAMPLING PROGRAM
PCB DATA SUMMARY

Station No.	Station Description	Date	Deployment Time	PCBs (ug)	Homolog (% Wt.)									
					Mono	Di	Tri	Tetra	Penta	Hexa	Hepta	Octa	Nona	Deca
1	Upstream of Cornith, downstream of Hudson, Sacandaga confluence	07/08/99	2 weeks	<0.224	--	--	--	--	--	--	--	--	--	--
		07/22/99	4 weeks	<0.224	--	--	--	--	--	--	--	--	--	--
2	Downstream of International Paper facility in Corinth	07/08/99	2 weeks	<0.224	--	--	--	--	--	--	--	--	--	--
		07/22/99	4 weeks	<0.224	--	--	--	--	--	--	--	--	--	--
		07/22/99	4 weeks (dup.)	<0.224	--	--	--	--	--	--	--	--	--	--
3	Downstream of the Niagara Mohawk Queensbury site	07/07/99	2 weeks	<0.224	--	--	--	--	--	--	--	--	--	--
		07/21/99	4 weeks	<0.224	--	--	--	--	--	--	--	--	--	--
4	Downstream of Glens Falls and adjacent industries	07/08/99	2 weeks	<0.224	--	--	--	--	--	--	--	--	--	--
		07/22/99	4 weeks	0.233	0.00	1.07	21.35	40.43	27.63	8.04	1.48	0.00	0.00	0.00
5	Approximately 100 yds upstream of Bakers Falls monitoring station	07/08/99	2 weeks	<0.224	--	--	--	--	--	--	--	--	--	--
		07/22/99	4 weeks	<0.224	--	--	--	--	--	--	--	--	--	--
6	Bakers Falls Bridge monitoring station	07/08/99	2 weeks	<0.224	--	--	--	--	--	--	--	--	--	--
		07/08/99	2 weeks (dup.)	<0.224	--	--	--	--	--	--	--	--	--	--
		07/22/99	4 weeks	<0.224	--	--	--	--	--	--	--	--	--	--
7	Plunge Pool	07/07/99	2 weeks	7.00	0.12	6.66	39.68	43.91	8.39	1.18	0.06	0.00	0.00	0.00
		07/21/99	4 weeks	8.28	0.14	6.54	37.09	45.29	9.37	1.48	0.10	0.00	0.00	0.00
8	East Channel Rogers Island	07/07/99	2 weeks	3.42	0.38	8.59	36.97	44.29	8.11	1.57	0.10	0.00	0.00	0.00
		07/21/99	4 weeks	5.75	0.26	6.69	35.07	45.33	10.19	2.14	0.30	0.02	0.00	0.00
9	West Channel Rogers Island	07/07/99	2 weeks	2.59	0.59	10.34	41.34	38.15	8.05	1.44	0.08	0.00	0.00	0.00
		07/21/99	4 weeks	3.21	0.28	8.92	37.52	42.88	8.43	1.79	0.19	0.00	0.00	0.00
8	Trip Blank	07/21/99	4 weeks	<0.224	--	--	--	--	--	--	--	--	--	--
3	Trip Blank	07/21/99	4 weeks	<0.224	--	--	--	--	--	--	--	--	--	--

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TABLE 3-2
GENERAL ELECTRIC COMPANY
SPMD SAMPLING PROGRAM
PRELIMINARY 1999 HUDSON RIVER WATER COLUMN MONITORING RESULTS: APRIL 21 - JULY 28, 1999 (1)

Date Collected	Location	Sampling Personnel	Approx HRM (2)	Comments	Flow (3) (cfs)	Daily Flow (4) (cfs)	Water Temp (C)	TSS (mg/L)	Total PCB (ng/L)	Homolog Distribution (weight percent) (5)						
										Mono	Di	Tri	Tetra	Penta	Hexa	Hepta
04/21/99	B.F.Br	QEA	197.0	P	7,460	7,670	8	<1.0	11	0.0	15.8	33.1	25.8	19.2	6.2	0.0
	PLUNGEPOOL	HSI	196.9	P			7	<1.0	14	0.0	7.6	39.4	35.4	12.6	5.0	0.0
	Rt.197 Br.	QEA	194.2	P			9	<1.0	17	0.0	6.3	28.5	36.2	20.4	8.6	0.0
	Rt.197 Br.	QEA	194.2	P, BD			9	1.0	20	0.0	10.3	24.1	29.5	24.2	11.8	0.0
04/28/99	B.F.Br	QEA	197	P	4,160	4,240	10	1.6	14	0.0	10.0	46.2	29.9	9.7	4.1	0.0
	PLUNGEPOOL	HSI	196.9				7	1.9	51	0.0	14.2	44.9	32.7	6.6	1.7	0.0
	Rt.197 Br.	QEA	194.2	P			11	1.3	32	0.0	10.3	32.4	35.4	16.5	5.4	0.0
05/05/99	B.F.Br	QEA	197	P	4,670	4,380	15	1.1	11	0.0	10.0	26.5	27.4	25.9	10.2	0.0
	B.F.Br	HSI	197	BD			15	1.4	<11	--	--	--	--	--	--	--
	PLUNGEPOOL	QEA	196.9	P			13	1.2	19	0.0	7.9	36.3	35.8	15.4	4.6	0.0
	Rt.197 Br.	QEA	194.2	P			15	1.2	15	0.0	8.1	28.5	38.6	18.3	6.6	0.0
05/12/99	B.F.Br	QEA	197	P	3,700	3,100	16	1.0	11	0.0	9.5	40.6	29.4	16.2	4.4	0.0
	B.F.Br	QEA	197	P, BD			16	1.1	11	0.0	10.4	36.3	22.3	22.6	8.5	0.0
	PLUNGEPOOL	HSI	196.9	P			14	1.5	12	0.0	10.5	43.1	29.8	13.8	3.0	0.0
	Rt.197 Br.	QEA	194.4	P			16	1.2	14	0.0	10.3	38.2	32.9	14.4	4.3	0.0
05/19/99	B.F.Br	QEA	197	P	3,150	2,960	18	2.3	16	0.0	11.1	39.3	18.9	23.0	7.7	0.0
	PLUNGEPOOL	HSI	196.9	P			17	7.6	30	0.0	4.5	39.6	40.4	12.7	2.7	0.0
	Rt.197 Br.	QEA	194.4	P			18	2.9	18	0.0	12.6	45.0	27.9	12.0	2.5	0.0
	Rt.197 Br.	QEA	194.4	BD, P			18	2.4	18	0.0	7.7	37.0	31.0	20.6	3.6	0.0
05/26/99	B.F.Br	QEA	197		3,898	4,290	15	1.7	<11	----	----	----	----	----	----	----
	PLUNGEPOOL	HSI	197				16	2.0	<11	----	----	----	----	----	----	----
	Rt.197 Br.	QEA	194.4	P			15	2.1	15	0.0	7.6	39.1	35.4	14.7	3.3	0.0
06/02/99	B.F.Br	QEA	197		2,735	2,270	23	1.7	<11	----	----	----	----	----	----	----
	B.F.Br	QEA	197	BD			23	1.9	<11	----	----	----	----	----	----	----
	PLUNGEPOOL	HSI	196.9	P			20	1.5	16	0.0	9.9	48.1	27.9	11.5	2.6	0.0
	Rt.197 Br.	QEA	194.4	P			23	2.2	16	0.0	4.0	50.2	29.2	13.2	3.4	0.0
06/09/99	B.F.Br	QEA	197		2,980	2,940	23	2.0	<11	----	----	----	----	----	----	----
	PLUNGEPOOL	HSI	197	P			23	1.8	16	0.0	11.8	45.7	28.3	11.0	3.2	0.0
	Rt.197 Br.	QEA	194.4	P			23	1.8	19	0.0	8.9	41.4	35.8	11.6	2.3	0.0
	Rt.197 Br.	QEA	194.4	BD,P			23	2.0	20	0.0	7.7	38.1	38.0	13.8	2.4	0.0
06/16/99	B.F.Br	QEA	197	P	2,680	2,710	22	1.8	13	0.0	12.4	45.1	15.9	22.8	3.8	0.0
	PLUNGEPOOL	HSI	197	P			23	1.9	25	0.0	19.8	44.6	25.5	9.1	1.0	0.0
	Rt.197 Br.	QEA	194.4	P			22	1.8	26	0.0	7.6	46.6	32.4	12.4	1.1	0.0

TABLE 3-2
GENERAL ELECTRIC COMPANY
SPMD SAMPLING PROGRAM
PRELIMINARY 1999 HUDSON RIVER WATER COLUMN MONITORING RESULTS: APRIL 21 - JULY 28, 1999 (1)

Date Collected	Location	Sampling Personnel	Approx HRM (2)	Comments	Flow (3) (cfs)	Daily Flow (4) (cfs)	Water Temp (C)	TSS (mg/L)	Total PCB (ng/L)	Homolog Distribution (weight percent) (5)						
										Mono	Di	Tri	Tetra	Penta	Hexa	Hepta
06/23/99	B.F.Br	QEA	197		2,550	2,670	24	2.0	<11	----	----	----	----	----	----	----
	PLUNGEPOOL	HSI	197	P			24	2.9	22	0.0	9.4	45.2	35.5	8.6	1.4	0.0
	Rt.197 Br.	QEA	194.4	P			24	2.2	19	0.0	11.4	40.4	35.5	11.0	1.9	0.0
06/30/99	B.F.Br	QEA	197		3,010	2,020	23	1.7	<11	----	----	----	----	----	----	----
	PLUNGEPOOL	HSI	197				24	2.1	52	0.0	8.1	40.2	41.7	8.8	1.2	0.0
	Rt.197 Br.	QEA	194.4	BD, P			23	2.2	19	0.0	16.2	34.9	35.9	11.5	1.5	0.0
	Rt.197 Br.	QEA	194.4	P			23	1.9	15	0.0	22.1	34.7	29.2	12.7	1.3	0.0
07/07/99	B.F.Br	QEA	197		5,400	3,090	26	2.7	<11	----	----	----	----	----	----	----
	PLUNGEPOOL	HSI	197	P			26	5.1	20	0.0	11.6	42.4	33.6	10.7	1.9	0.0
	Rt.197 Br.	QEA	194.4	P			26	2.9	15	0.0	16.1	39.2	33.4	10.6	0.7	0.0
07/14/99	B.F.Br	QEA	197		1870	2,890	24	2.4	<11	----	----	----	----	----	----	----
	B.F.Br	QEA	197	BD				2.3	<11	----	----	----	----	----	----	----
	PLUNGEPOOL	HSI	197	P			24	1.8	12	0	17.29	38.44	34.93	7.88	1.45	0
	Rt.197 Br.	QEA	194.4				25	2.2	<11	----	----	----	----	----	----	----
07/21/99	B.F.Br	QEA	197		1,680	1,970	25	1.9	<11	----	----	----	----	----	----	----
	PLUNGEPOOL	HSI	197	P			25	2.1	15	0	12.01	40.42	39.33	7.03	1.21	0
	Rt.197 Br.	QEA	194.4				25	2.3	<11	----	----	----	----	----	----	----
	Rt.197 Br.	QEA	194.4	BD				2.6	<11	----	----	----	----	----	----	----
07/28/99	B.F.Br	QEA	197		2,250	2,160	26	1.4	<11	----	----	----	----	----	----	----
	PLUNGEPOOL	HSI	197	P			26	1.1	33	0	5.83	39.44	47.72	5.42	1.59	0
	Rt.197 Br.	QEA	194.4	P			26	1.8	13	0	15.72	32.51	39.48	9.46	2.83	0

(1) Samples analyzed by capillary column using Method NE013_04.SOP unless otherwise noted. Method NE013_04.SOP data has been adjusted for analytical bias, as described in Correction of Analytical Biases in the 1991-1997 GE Hudson River PCB Database (O'Brien & Gere Engineers, Inc., September 1997).

(2) HRM = Hudson River Mile. HRM 0.0 is located at the Battery in New York City.

(3) Instantaneous flows obtained from the Fort Edward gaging station when the Rt. 197 Bridge sampling is performed.

(4) Daily flow is presented as mean daily flow for the Fort Edward gaging station from provisional data provided by USGS.

(5) Homolog groups octa-, nona-, and deca-chlorinated biphenyls were not detected greater than 0.02%.

Key:

BD = Blind Duplicate

P = Practical quantitation limit (PQL) note that identifies PCB concentrations between 11 and 44 ng/L.

HSI = Samples collected by HSI Geotrans personnel

FIGURES

QEA
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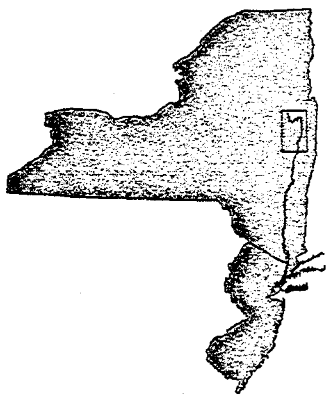
LOCATION MAP OF THE
UPPER HUDSON RIVER



Hudson River Scale

3 0 3 Miles

N

GENERAL ELECTRIC COMPANY
SPMD Sampling Program

Figure 1-1.
Hudson River location map.

Note: Numbers along river indicate river miles measured from the Battery

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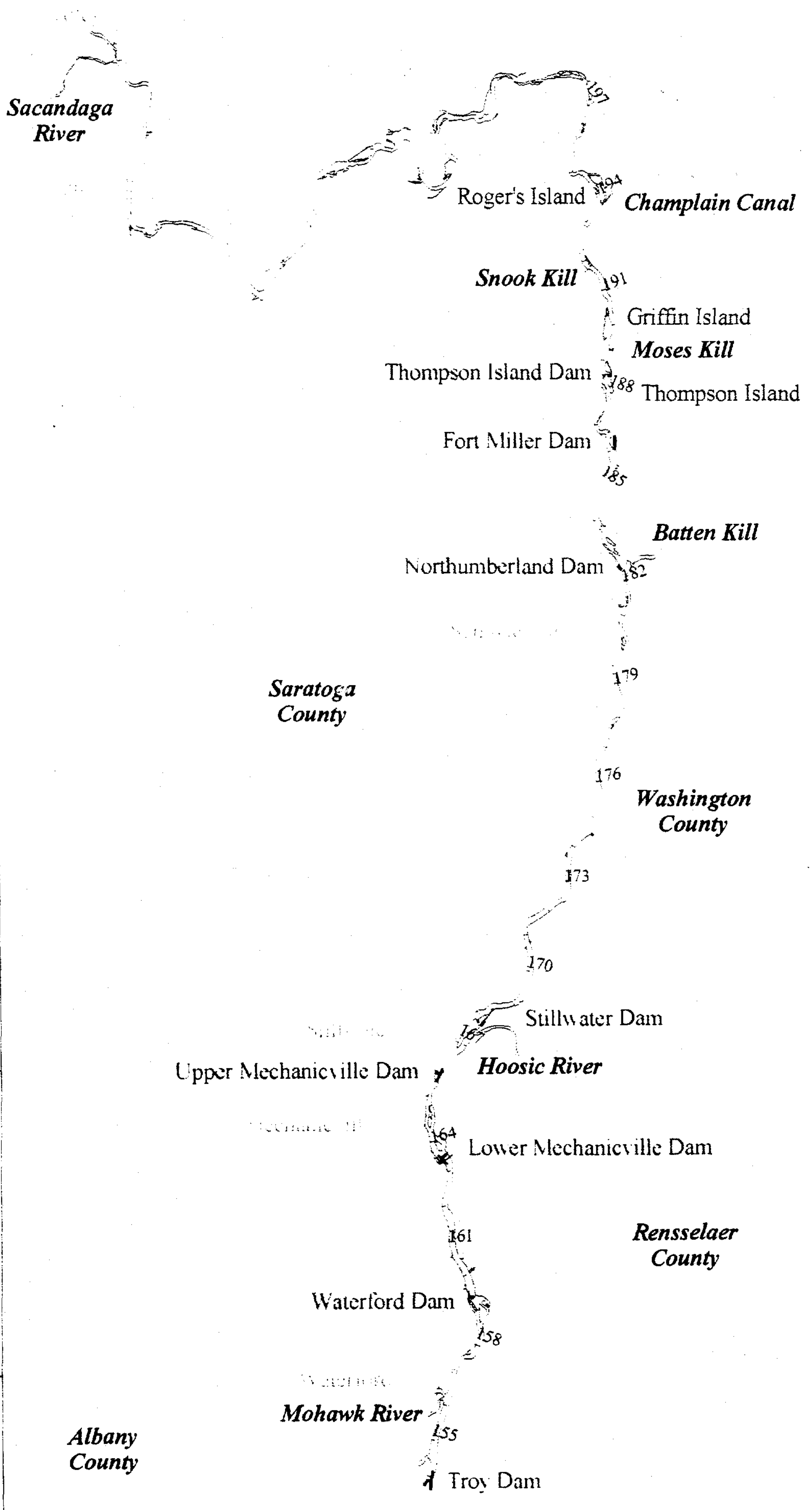
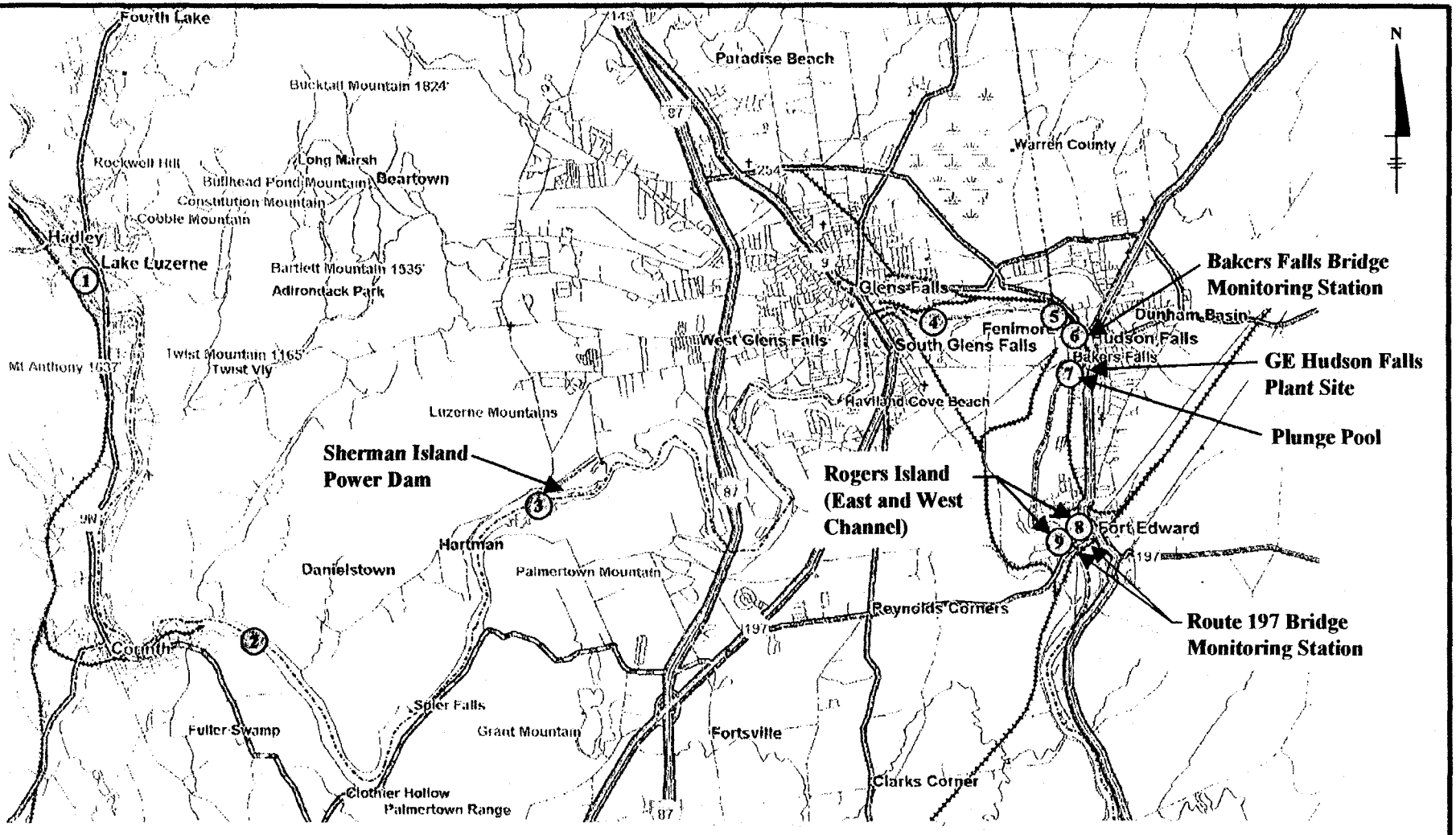
QEA
Quantitative Environmental Analysis, LLC

Project: GENspm 130 October, 1999





GENERAL ELECTRIC COMPANY
SPMD SAMPLING PROGRAM
SAMPLE LOCATION MAP

MDL:URSPMDs.ppt

FIGURE 1-2

SCALE: AS SHOWN

FINAL

Quantitative Environmental Analysis, LLC

GENspm 130 October 1999

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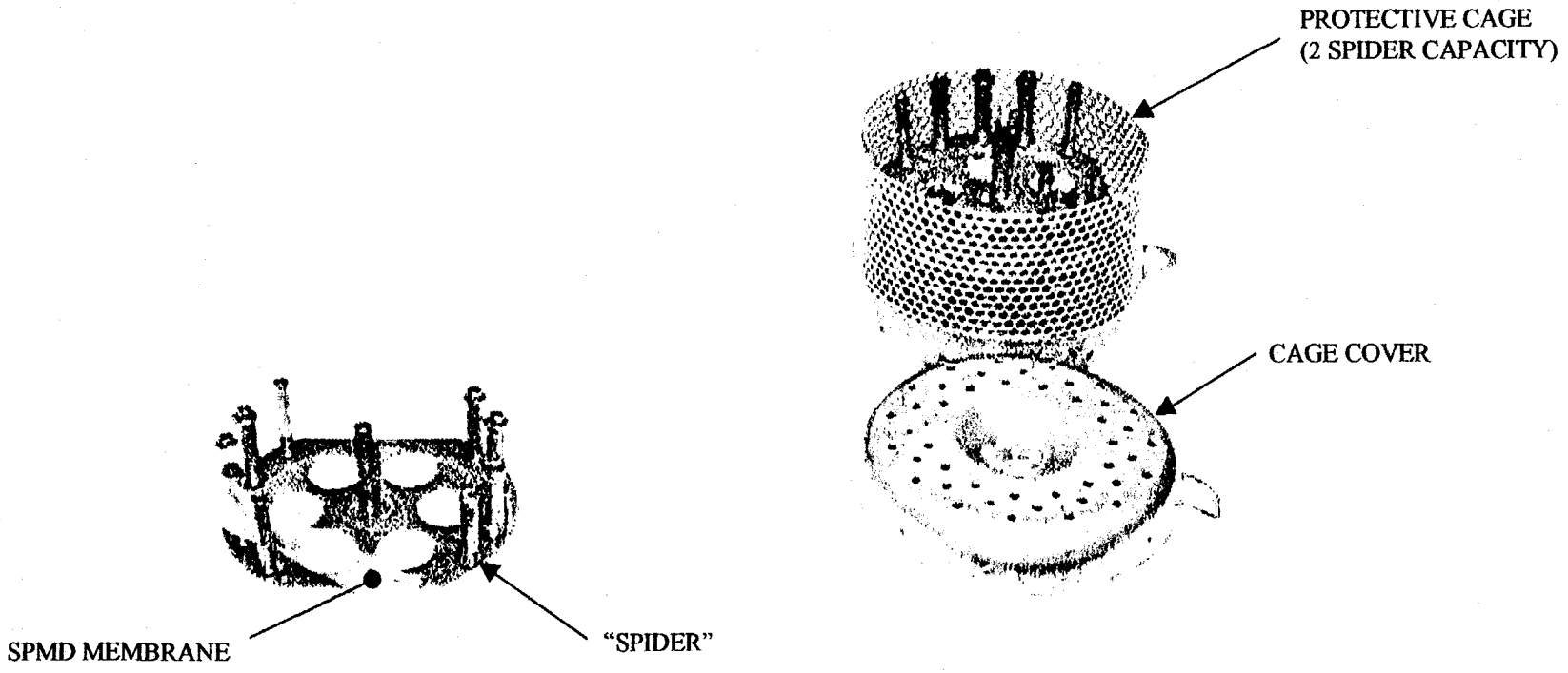

GENERAL ELECTRIC COMPANY
SPMD SAMPLING PROGRAM
SPMD APPARATUS

MDL: D:\SPMDphoto

FIGURE 2-1

SCALE: NONE

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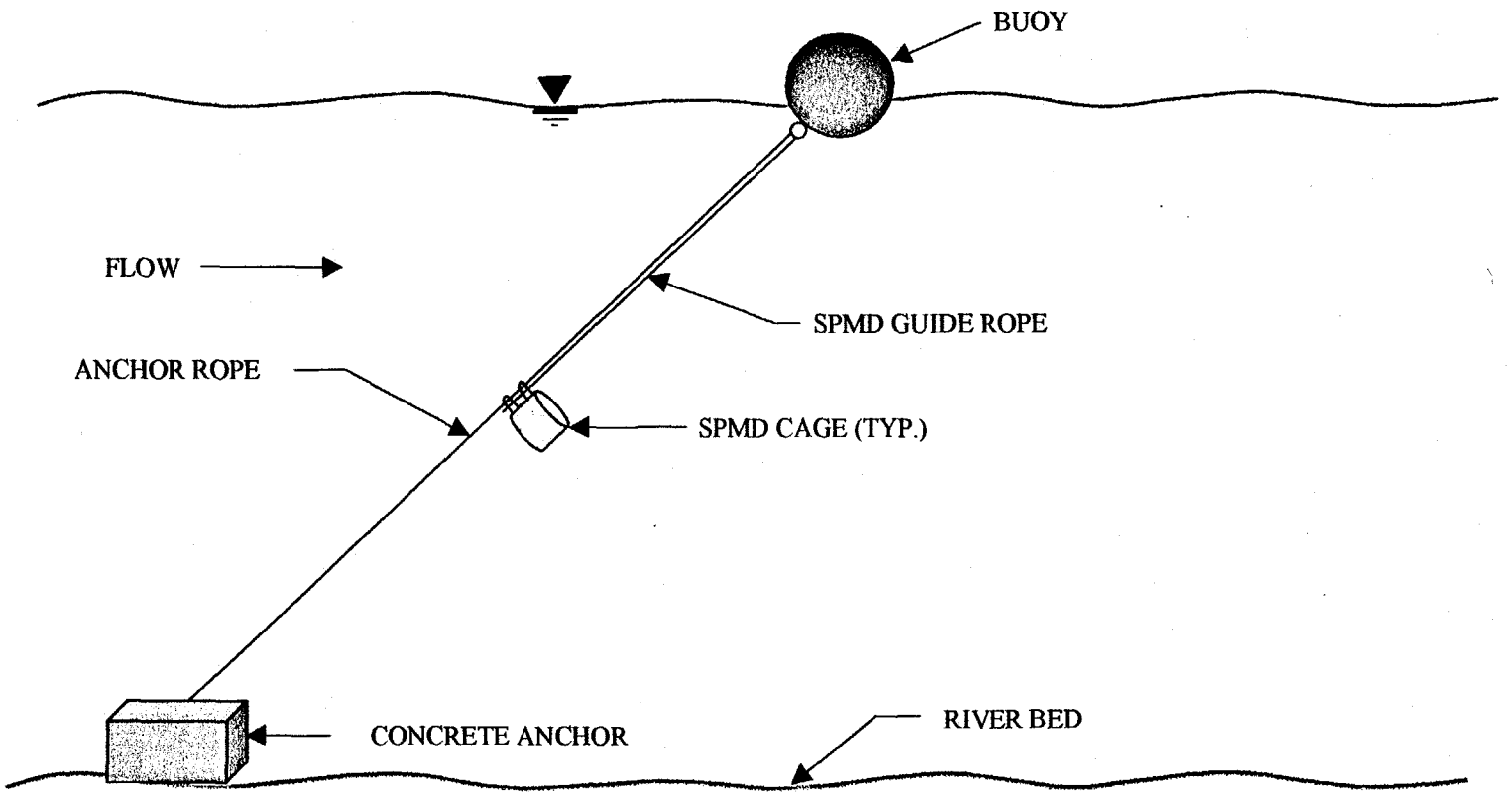
October 8, 1999



GENERAL ELECTRIC COMPANY
SPMD SAMPLING PROGRAM
TYPICAL SPMD DEPLOYMENT

MDL: D:\SPMDdeploy1.ppt

FIGURE 2-2

SCALE: NONE

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GENspm 130

October 8, 1999

APPENDICES

Quantitative Environmental Analysis, LLC

APPENDIX A
STANDARD OPERATING PROCEDURES FOR SPMD SAMPLING[1]

Introduction

Upon arrival from EST, the shipping containers will be placed into refrigerated storage (preferable below 5 °C) to await deployment. Clean, disposable gloves will be worn at all times when handling the sampling device. The polyethylene membrane will not be handled at any time.

Materials

- Disposable gloves
- Boat with motor
- Rope
- Buoys
- Concrete blocks
- Thermometer
- Field notebooks
- Deployment devices (cages)
- Gallon cans with spiders inside
- Trip blanks
- Church keys
- Rubber mallet
- Chains of custody
- Coolers with ice for transporting cans with spiders inside
- Packing, labeling and shipping materials
- 2-gallon Ziploc® bags

[1]The following information is adapted from standard operating procedures (SOP) literature provided to QEA by EST.

SPMD Deployment/Retrieval Procedures

SPMD Deployment

- Record the position of the sampling location in the field notebook along with other pertinent descriptive information about the site.

- Record the depth and water temperature at the site.

- Expose the trip blank by CAREFULLY working open the lid from a blank SPMD can with a church key. Be careful not to damage the lid or the seal may be compromised. Expose the trip blank to the atmosphere and conditions in a manner equivalent to the sampler SPMDs. Given that SPMDs are efficient air samplers, exposure to air should be minimized.

- Unscrew the lid on the deployment device.

- Using a church key, carefully work open the lid of the gallon can containing a fresh SPMD.

- Don a clean pair of disposable gloves, grasp the spider by the metal plate or center post and lift slightly. DO NOT touch the membrane. Gently turn and pull the carrier out of the can taking care not to damage or abrade the membrane.

- While holding the spider carrier, slide the carrier into the deployment canister (cage). Again, make sure that the threaded rod runs up through the carrier's center post (tube). Spiders can be placed in with the metal plate up or down.

- Depending on the number of SPMDs used in each cage and the size of the cage used (2 or 5-device holder), add required spacers.

- Slowly thread the lid back onto the canister making sure there is no resistance and the threads are not being stripped. Be sure the mounting ring on the lid matches with its opposing ring on the device body. These rings MUST be fastened together to ensure that the lid does not unscrew.

- Attach a rope to the rings to fasten them and tie off the rope so the SPMD will be positioned at the appropriate depth in the water column between the buoy and the cement block(s). Securely attach the rope to the cement block and to the lower ring on the deployment device. Set the depth of the device in relation to the anchor, attach the buoy marker above the device, linking the two rings together in the process.

- Carefully lower the anchor weight, cage with spiders, and buoy marker into the water.

- Replace the lid on the blank and tap it closed with a rubber mallet.

- Note time of deployment.

Note: When removing SPMDs from their devices, basically reverse the above procedures. A rubber mallet is the most effective tool to seal the lids back on the cans in the field. Be sure to expose the trip blanks during deployment as well as during retrieval of the SPMDs.

SPMD Retrieval

- Locate the sampler buoy.

- Measure the water temperature.

- Expose the trip blank as during deployment. Be sure to wear a new pair of disposable gloves when removing the lid of the blank can with the church key.

- Pull the buoy, SPMD cage and cement block(s) out of the water. Remove the rope from the cement block and SPMD device.

- Don a fresh pair of disposable gloves. Unscrew the lid of the cage and remove each spider carefully. Using the church key, open the gallon can from which the spider originally came and place it in with the metal plate side up. Tap the lid back on with a rubber mallet. Replace blank in its original can and tap lid back on.

- Record time of SPMD retrieval.

- Label can appropriately.

- Place can into a 2-gallon Ziploc® bag.

- Place cans in coolers with ice and packing materials. Ship overnight to EST labs.

- Clean the deployment devices while still wet.