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Analyses of Archived Water Samples for Organic Pollutants 99 pp

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Narragansett Bay Estuary Program

ANALYSES OF ARCHIVED WATER SAMPLES
FOR ORGANIC POLLUTANTS

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Final Report for the

Narragansett Bay Project

May 1988

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Final Report

to the

Narragansett Bay Project Office

ANALYSES OF ARCHIVED WATER SAMPLES FOR ORGANIC POLLUTANTS

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FOREWORD

The United States Congress created the National Estuary Program in 1984, citing its concern for the "health and ecological integrity" of the nation's estuaries and estuarine resources. Narragansett Bay was selected for inclusion in the National Estuary Program in 1985 and the Narragansett Bay Project (NBP), a multi-year study of the Bay and its resources, was established. Under the joint sponsorship of the U.S. Environmental Protection Agency and the Rhode Island Department of Environmental Management, the NBP has involved participation by local, state, and federal agencies, the academic community, and local interest and user groups. The purpose of the Narragansett Bay Project is first to identify and evaluate pollution problems and causes in the Bay through a five-year plan of scientific research. Based on the results, the NBP will then develop a comprehensive management plan by December, 1990, which will recommend actions to improve and protect the Bay from further degradation.

In March, 1988, the Administrator of EPA and the Governor of Rhode Island signed an agreement officially designating Narragansett Bay as an "estuary of national significance". The State of Rhode Island pledged to make a good faith effort to institute whatever corrective actions are recommended by the management plan as necessary to protect the Bay. The EPA will continue to support the NBP through 1995 for the express purpose of overseeing implementation of the recommended actions and monitoring their effectiveness. After 1995, the State of Rhode Island will assume responsibility for implementation of the management plan to protect the Bay and its resources for future generations.

The NBP has established the following seven priority issues for Narragansett Bay:

- management of fisheries
- nutrients and potential for eutrophication
- impacts of toxic contaminants
- health and abundance of living resources
- health risk to consumers of contaminated seafood
- land-based impacts on water quality
- recreational uses

The NBP is taking an ecosystem approach to address these problems and has funded research that will help to improve our understanding of various aspects of these priority problems. The Project is also working to expand and coordinate existing programs among state agencies, governmental institutions, and academic researchers in order to apply research findings to the practical needs of managing the Bay and improving the environmental quality of its watershed.

This report represents the technical results of an investigation performed for the Narragansett Bay Project. The information in this document has been funded wholly or in part by the United States Environmental Protection Agency under assistance agreement #CX812768 to the Rhode Island Department of Environmental Management. It has been subject to the Agency's and the Narragansett Bay Project's peer and administrative review and has been accepted for publication by the Management Committee of the Narragansett Bay Project. The results and conclusions contained herein are those of the author(s) and do not necessarily represent the views or recommendations of the NBP. Final recommendations for management actions will be based upon the results of this and other investigations.

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SUMMARY

The objective of this study was to provide information on the sources, magnitude and transport of selected organic pollutants in Narragansett Bay. Water samples were collected from 11 point sources (all but one were wastewater treatment facilities), 5 river mouths, and 4 bay stations at 4 different times - October 1985, November 1985, April 1986, and May 1986. The samples were filtered to separate particulate and dissolved components, and these two fractions were then analyzed for: polychlorinated biphenyls (PCBs), hexachlorocyclohexanes (HCHs), petroleum hydrocarbons (PHCs), polycyclic aromatic hydrocarbons (PAHs), substituted benzotriazoles (BZTs), phthalic acid esters, and the fecal sterol, coprostanol. Most of the compounds measured in this study showed a strong preference for the particulate phase; therefore, a much larger number of particulate samples were analyzed and only this data is reported in the results and discussion section. However, all of the data is reported in the appendices.

A statistical comparison of the 5 rivers was impossible because of the large standard deviations obtained on most of the analyses over the 4 different sampling dates. For example, the average concentrations of PCBs in the Woonasquatucket (25.3 ng/l) and Blackstone rivers (20.9 ng/l) were consistently higher than the other 3 rivers on all 4 dates; however, they were not statistically different than the other rivers. Nevertheless, the average values for PCBs in these two rivers exceeded the EPA water quality criteria for chronic toxicity in freshwater (14 ng/l). Taking into account the flow rates of the rivers over the course of the study, the Blackstone River was the largest single source of suspended solids (SS), PCBs, PHCs and the major phthalate-di(2-ethylhexyl-)phthalate (DEHP) to the bay; the Taunton River was the major source of most PAHs; and the Pawtuxet River was the largest contributor of coprostanol.

The Newport plant exceeded its interim permit limitation of 75 mg SS/l (daily maximum) for its effluent. Also, coprostanol levels at the Newport, Bristol, Quonset Point and East Greenwich plants were much higher than at the other facilities. Considering the flow rates of the various point sources, the Fields Point plant was the largest source of SS, PCBs, PHCs, a major PAH (fluoranthene) and DEHP to the bay; and the Newport plant was the major source of coprostanol.

In October 1985, the point sources were the major contributor of most components to the bay; and during November and April, the rivers usually contributed more fluoranthene, PHCs, PCBs and SS. In May 1986, the point sources were again the major supplier of most components. Overall, the point sources were the largest supplier of coprostanol, DEHP, PHCs and SS; and the rivers were the major source of fluoranthene and PCBs. The November values were the highest for SS, PCBs, fluoranthene and DEHP; and the May values showed the highest levels for PHCs and coprostanol. Based on this work, we estimate the following inputs into Narragansett Bay from combined rivers and point sources: 48 metric tons of SS/day; 72 grams of PCBs/day; 613 Kg of PHCs/day; 488 grams of fluoranthene/day; 14 Kg of DEHP/day and 39 Kg of coprostanol/day.

In the bay samples, the concentration of most components in surface waters was highest at Fox Point and decreased to the West Passage; however, in the case of DEHP and coprostanol, Conimicut Point had the highest concentration. For bottom waters, the highest values were usually observed at Conimicut Point, with the exception of DEHP and coprostanol where the concentrations were highest at Fox Point. In all cases, the observed concentrations were less than those reported for chronic toxicity in salt water.

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I. INTRODUCTION

In March 1986, the Narragansett Bay Project Office issued an RFP to analyze archived water samples for organic pollutants in order to provide information on the sources, magnitude, and transport of these components in Narragansett Bay. The samples had been collected under dry weather conditions from 9 to 11 point sources, 5 river mouths, and 4 bay stations at four different times: October 1985, November 1985, April 1986, and May 1986. The rationale for the work, the locations of the stations, and the collection methods employed have been described in detail by Hunt et al., 1987a, b, c, d. Most of the major sources of pollutants to the bay were investigated in this study, and the samples were collected at various times during 1985-86 in order to provide as much detail as possible on the seasonal variation of inputs to the Narragansett Bay estuary under dry weather conditions.

All samples were filtered and the particulate fractions were dried and weighed to determine suspended solids which were then archived at -20^{o}C. The aqueous phases were extracted with methylene chloride and the extracts stored in the dark at room temperature. The results of this work were reported by Quinn et al., 1986.

This report describes how the archived samples were analyzed (starting in July, 1986), presents the results of these analyses, and discusses the sources, magnitude and transport of organic pollutants in Narragansett Bay.

II. SAMPLING

(Refer to Figure II-1 and Table II-1.)

All samples were collected under dry weather conditions:

Point Source Samples (11 point sources including waste water treatment facilities, WWTF).

These samples were provided by DEM personnel and they were 24 hour composite effluent samples that were collected over the 24-48 hour period preceding sample collection in the adjacent bay receiving waters. The samples were collected with a polyethylene or glass container and stored in 4-liter glass bottles.

River Samples (5 rivers)

The samples were collected by URI/EPA and Bay Project personnel. They were collected from the river mouths (S ^{0}/oo was usually <0.3 ^{0}/oo)at 4 different times over the 24-48 hour period preceding sample collection in the bay. The samples were collected from the surface in a Teflon bucket and stored in 4-liter glass bottles.

Narragansett Bay Samples (4 stations)

These samples were collected by URI personnel from 4 stations in the bay. They were collected on ebb tide from 2-4 depths at each station using Teflon tubing and a pumping system. The samples were stored in 4-liter glass bottles.

Complete details of the sample locations and collection procedures have been described in four reports by Hunt et al., 1987a, b, c, d.

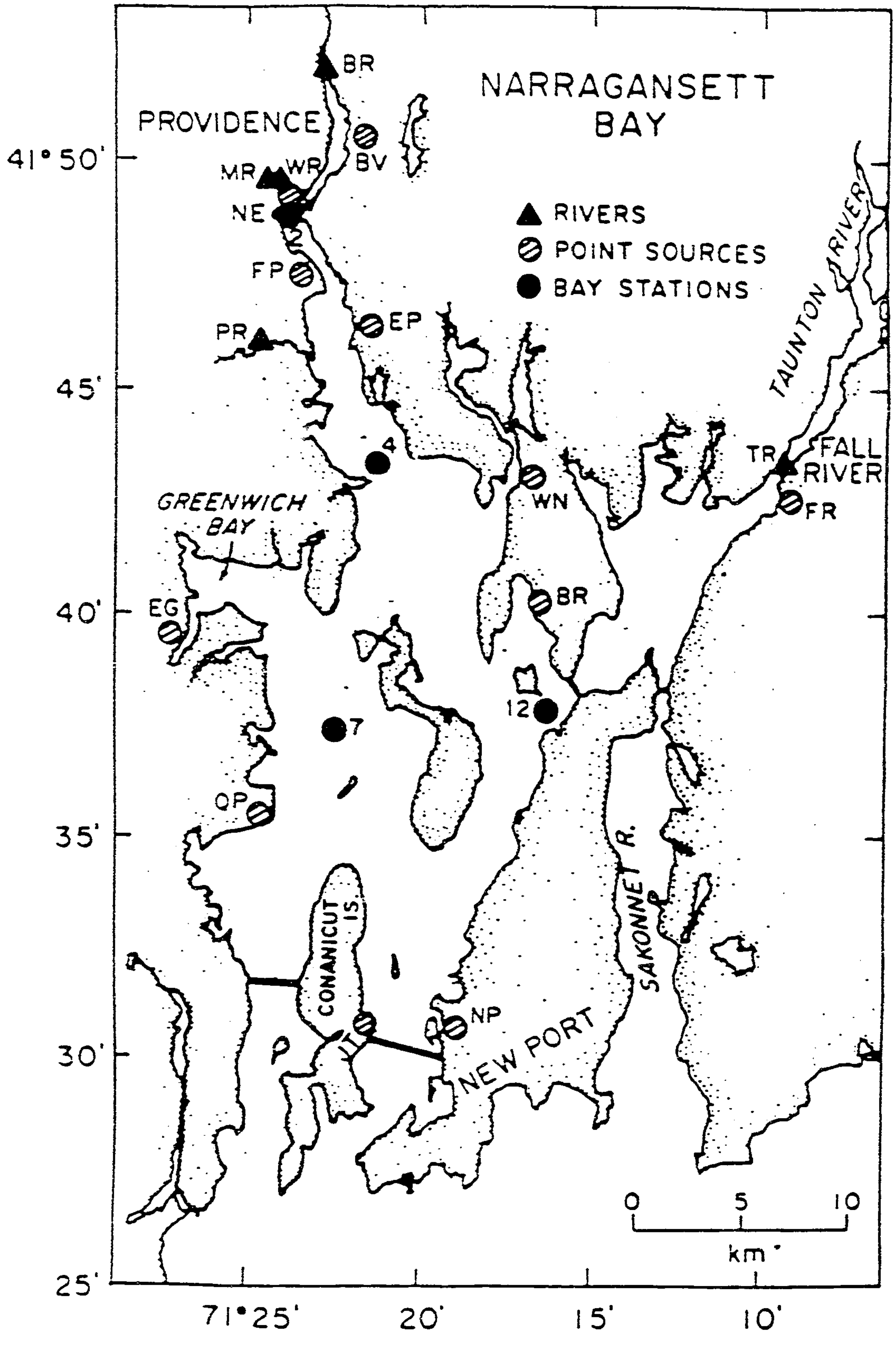

Figure II-1. Sampling locations for point source, river and Narragansett Bay water samples.

Table II-1. Rivers, point sources, and bay stations sampled in this study.

Rivers(5)

- Blackstone River (BR)
- Moshassuck River (MR)
- Pawtuxet River (PR)
- Taunton River (TR)
- Woonasquatucket River (WR)

Point Sources(11)--All but Narragansett Electric are WWTF.

- Blackstone Valley Plant (BV)
- Bristol Plant (BR)
- East Greenwich Plant (EG)
- East Providence Plant (EP)
- Fields Point Plant (FP)
- Fall River Plant (FR)
- Jamestown Plant (JT)
- Narragansett Electric Co. (NE)
- Newport Plant (NP)
- Quonset Point Plant (QP)
- Warren Plant (WN)

Bay(4)

Station 2 - Fox Point

Station 4 - Conimicut Point

Station 7 - West Passage

Station 12 - Hog Island

III. METHODS

(Refer to Figure III-1.)

All samples were returned to the laboratory and processed within a maximum of four days after collection. This delay was caused by the time required to process the large number of samples in this study. Therefore, a small amount of methylene chloride (3 ml/l) was added to all samples as soon as they were received in the laboratory in order to retard bacterial alteration/degradation and preserve the samples before processing. This small amount of solvent is soluble in water and it is unlikely that any of the particulate components were extracted into the dissolved phase due to the solvent.

Filtration and extraction

The water samples were filtered through precombusted and preweighed glass fiber filters (11 cm Whatman GF/C, particle size retention of 1.2 um) to isolate the particulate/suspended components. In the case of point source samples, the amount was about 4 liters and about 4 filters were used; for the river and bay samples, the volume was usually 12 liters and this also required about 4 filters. After rinsing with Milli-Q water and drying to constant weight at room temperature, the filters were reweighed to determine the amount of suspended solids (SS) in each sample and then stored at -20°C.

Internal standards (see Analyses Section) were added to each filtrate (dissolved/soluble components) and these solutions were extracted once with a 10% volume of methylene chloride in the original glass sample container. The organic extracts were then isolated, solvent exchanged with hexane and reduced in volume to about 15 ml on a

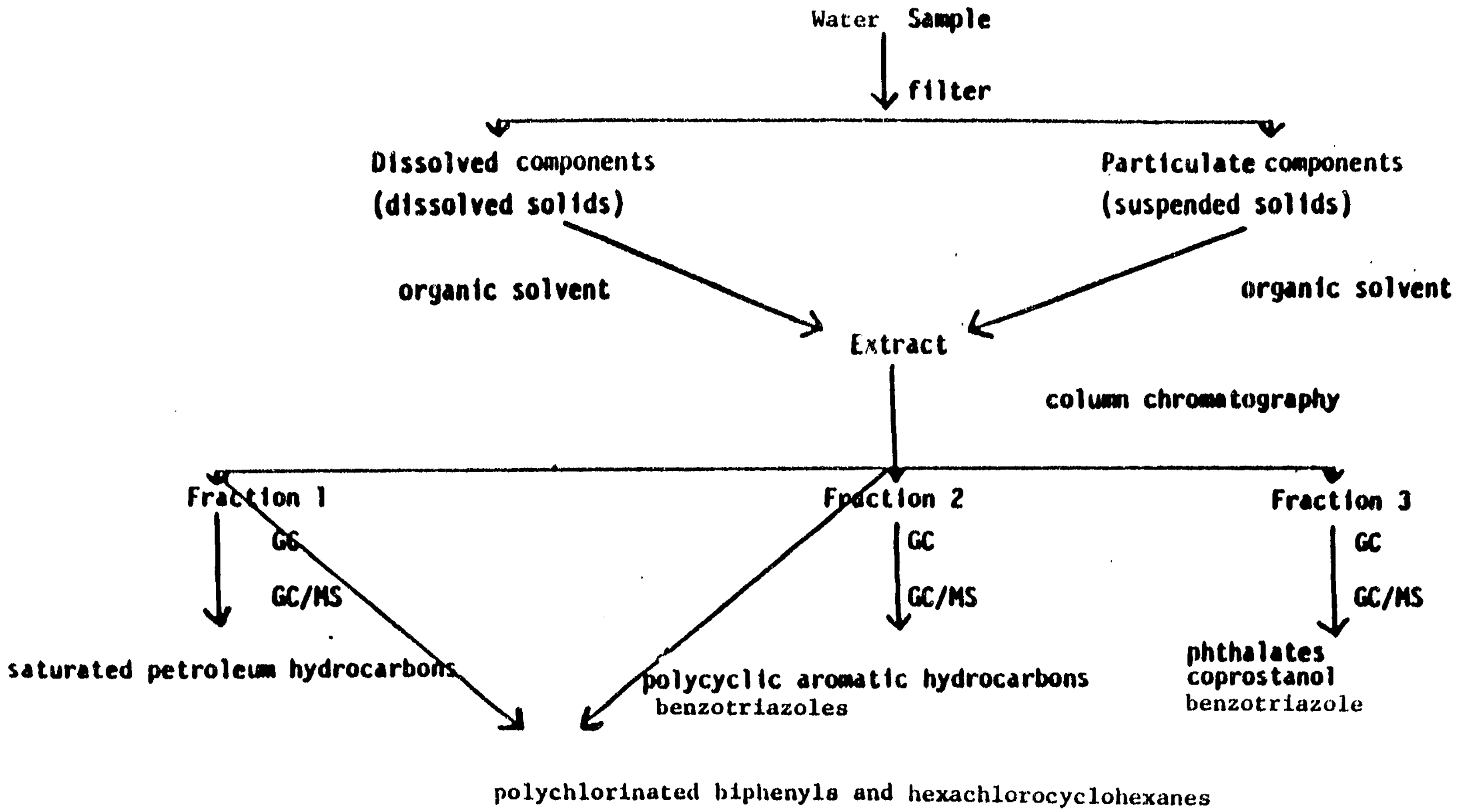

Figure III-1. Flow chart for the analyses of organic pollutants in water samples.

rotary evaporator under reduced pressure at <30°C, and stored at room temperature.

The filters for each sample were shredded into small pieces using forceps and then transferred to a round bottom flask, also using the forceps. Internal standards were then added followed by 50 to 200 ml of methanol, depending on the type and size of the sample. This mixture was refluxed for 2 hrs, cooled, and the methanol was then decanted into a separatory funnel. The filters were rinsed with hexane and the rinse was combined with the extract in the separatory funnel which also contained distilled water in a volume equal to or greater than that of the methanol used to extract the sample. The water:methanol mixture was extracted 3 times with hexane and the extracts were combined and reduced to about 15 ml using rotary evaporation and stored at room temperature.

Separation

All extracts were separated into three fractions by silica gel chromatography using a method modified from Pruell and Quinn (1985). According to this procedure, the sample was reduced in volume to about 2 ml of hexane and charged to a 0.5 cm x 10 cm column of fully activated silica gel (Grace Grade 922) using nitrogen to produce a flow rate of about 5 ml/minute. The first fraction (f_1) was eluted with 15 ml of hexane and contained saturated petroleum hydrocarbons (PHCs). The second fraction (f_2) was eluted with 15 ml of 80:20, hexane:methylene chloride; this fraction contained polycyclic aromatic hydrocarbons (PAHs) with 2-6 fused rings, and C_{10} and CL-benzotriazoles (BZTs). Phthalic acid esters, C_1-benzotriazole, coprostanol and cholesterol were eluted into the third fraction (f_3) using 15 ml of 50:50, methylene chloride:ethyl acetate. In addition, the polychlorinated biphenyls (PCBs) and hexachlorocyclohexanes (HCHs) were obtained by charging a known amount of sample to a silica gel column and eluting with 80:20, hexane:methylene chloride.

Analyses

Each fraction was concentrated on a rotary evaporator and analyzed on one of several different Hewlett-Packard gas chromatographs (GC). The f_1 was processed using a 5840A GC (FID) equipped with a 0.25mm i.d. x 15 m DB 5 (0.25 um; J & W, Inc.) fused silica capillary column with helium as the carrier gas (about 1 ml/min) and temperature programmed from 35 to 290°C at 8°C/min. Second fractions (f_2) were analyzed under similar conditions on a 5890 GC. The f_3 was measured on a 5710A GC (FID) using a 15 m DB-5 column which was programmed from 150 to 290°C at 4°C/min with a helium flow of about 1 ml/min. PCBs were anlayzed on a 5710A GC (ECD) using a 30 m DB-5 column programmed from 100-290°C at 8°C/min with a helium flow of 1 ml/min.

The unresolved complex mixture (UCM) of saturated hydrocarbons in f_1 and was measured by planimetry and its area compared to that of the n-docosane (n-C_{22}) internal standard. Resolved peaks were quantified against the internal standards using Hewlett Packard integrators (3388A and 3390A). The 16 priority pollutant PAHs and two BZTs in f_2 were quantified against m-terphenyl internal standard. Those components in f_3 were measured using the n-tricosanol (n-C_{23OH}) internal standard; they included four priority pollutant phthalates, (dibutyl-, butyl benzyl-, bis(2-ethylhexyl-), and di-n-octyl-), C_1-BZT and the sterols, coprostanol and cholesterol. The method of quantitation of PCBs as Aroclor equivalents is loosely based on the initial algorithm of Webb and McCall (1973). The compound octachloronaphthalene (ocn) is added as an internal standard in the early stages of the analytical scheme. Response factors are calculated from chromatograms of injected calibration mixtures made from Aroclor standards obtained from the EPA pesticide and industrial chemical repository in North Carolina. A known mass of an Aroclor standard and a known mass of ocn are formulated into a calibration standard and injected so as to bracket a suite of samples to be quantified. The same procedure is used to determine response factors of 10 individual chlorinated biphenyl congeners and in some cases, certain pesticides (i.e. HCHs - 3 isomers). Specifically, for the Aroclor determination, 4 peaks were judiciously selected in each of the major Aroclors observed in the local environment (i.e. Ar 1242, Ar 1254 and Ar 1260). These 4 peaks are summed and, with the use of ocn, a response factor relating the mass of ocn to the total mass of each Aroclor is calculated using the equation:

$$RF_{\text{analyte to ocn}} = (PH_{\text{analyte}}/[\text{analyte}]) / (PH_{\text{ocn}}/[\text{ocn}])$$

PH_{analyte} and PH_{ocn} are the peak height of the compound of interest and ocn respectively; [analyte] and [ocn] are the formulated concentrations of the analyte and ocn. In general, the analyte can be a specific congener or pesticide or the sum of the 4 indicative peaks specific to the Aroclor formulation. Once the factor is calculated the same 12 peaks (4 for each of the three Aroclor formulations) can be used to determine the mass of each Aroclor in a sample using the following formula (or in an analogous manner any other of the compounds of interest may be determined). For example for Ar 1254:

$$[(PH_{\text{4 peaks Ar 1254}} / RF_{\text{Ar 1254 to ocn}}) / (PH_{\text{ocn}})]\, M_{\text{ocn}} = M_{(\text{Ar 1254})s}$$

where:

$PH_{\text{4 peaks Ar 1254}}$ is the sum of the 4 peaks specific to Ar 1254; RF_{Ar}

$_{1254\ \text{to ocn}}$ is the response factor of those 4 peaks with respect to ocn, see above;

PH_{ocn} is the peak height of ocn;

M_{ocn} is the mass of ocn added as an internal standard;

and $M_{(Ar\ 1254)s}$ is the calculated mass of Ar 1254 in the sample.

The procedure of categorizing a PCB distribution into Aroclor equivalents was primarily an algorithm for use with the less efficient packed columns used for gas chromatographic analyses just a few years ago. The method is based on the subjective observations of the analyst and is not without its difficulties; however, many of the water quality standards and much of the scientific literature is still utilizing Aroclor based computations. So it is continued in the present study along with the more objective isomer/congener based data. This move from the Aroclor based to the congener based determinations is due to the present widespread and growing use of the extremely efficient capillary chromatographic columns. However, of the possible 209 congeners potentially present, many have not yet been synthesized and isolated in sufficient quantities that make them easily available to analytical chemists. The congeners determined in the present study have been selected because of their presence in the Aroclor mixtures commonly observed in Narragansett Bay as well as their apparent chromatographic purity on the specific column used in our laboratory as determined by detailed GC/MS analyses of PCB mixtures.

Several samples were initially analyzed without the addition of internal standards in order to assess the background levels of these compounds. In all cases, the background levels were insignificant when compared with the amount of internal standard added. Authentic standards were obtained for all of the individual compounds analyzed. Peak identification by retention time on DB-5 was confirmed by analyses on a second GC column (DB-1701) and/or derivatization for approximately 15 samples, and by gas chromatography-mass spectrometry for about 10 samples. The latter instrumentation included a Finnigan 4531 GC-MS with a Nova 3 computer and a 30 m DB-5 fused silica capillary column (J & W, Inc.) and it was located at the Environmental Research Laboratory, EPA/Narragansett.

QUALITY ASSURANCE

Detailed information on the work/quality assurance plan used in this study was included in the proposal for this project. The plan is identical to the one used in the Blackstone River Study (Quinn et al., 1987) and is reported in Appendix C.

Reporting of Data

For purposes of discussion, the various peaks from the three Aroclor mixtures (1242, 1254 and 1260) were summed and called polychlorinated biphenyls (PCBs). The resolved peaks and unresolved complex mixture (UCM) of saturated hydrocarbons in f_1 were summed and called petroleum hydrocarbons (PHCs).

The criteria for selection of specific components in the results and discussion section of this report are as follows:

a) they have been measured in other studies (e.g. suspended solids (SS));

b) they represent different chemical classes (e.g. fluoranthene (FLR) and benzo(ghi)perylene (B(ghi)PR) are important PAHs, and di(2-ethylhexyl-)phthalate (DEHP) is a prominent phthalic acid ester);

c) they are regulated under EPA water quality criteria (e.g. PCBs, PHCs and FLR);

d) they are useful in tracing specific sources of contamination (e.g. coprostanol (COP) is an indicator of municipal sewage discharges);

e) they show interesting trends in the data (e.g. B(ghi)PR is only present in river samples).

A total of 146 samples (116 particulate and 30 soluble) were analyzed, and all of the data is reported in the appendices. Most of the components measured in this study showed a strong preference for the particulate phase; therefore, a much larger number of these samples were analyzed, and only this data is included in the results and discussion section.

IV. RESULTS AND DISCUSSION

Rivers

The average concentrations (mass/liter) of selected particulate components in rivers discharging into Narragansett Bay are shown in Table IV-1. The concentration information for each river(and for the point sources) are presented in order to compare them to regulatory or water quality criteria. Comparisons of this nature are important in evaluating which aquatic systems are in a degraded state and which are not. Those that show high levels of certain constituents can be selected for regulatory action in the cases of WWTF or, in the cases of rivers, authorities would be able to apply already limited monetary resources to those that are the most degraded. Also, much can be learned about the nature of the pollution source by an evaluation of the concentration distribution of the compounds within a sample. For example, in a WWTF, if concentrations of some compounds are high, the treatment processes may not be operating correctly or the processes may be overwhelmed by high levels in the influent, due possibly to illicit industrial dumping or storm associated pollutants. These kinds of problems can be indicated by an evaluation of concentration data. The corresponding values based on particle loadings (mass/mg SS) are shown in Table IV-2. The large standard deviations (based on 4 sampling dates) for most of these measurements make any detailed comparison of means very difficult. It is not known whether the concentrations measured in the samples are within the population distributions of the variables; a larger data base would be necessary to ascertain this. However, because of the small data size, it is possible that while an inference statistic would indicate non significance, in actuality, there may be significance to the observation. So, it must be noted that while only vast differences between

Table IV-1. Concentrations of particulate components in rivers discharging into Narragansett Bay.

		SS mg/l	PCB ng/l	PHC ug/l	FLR ng/l	B(ghi)PR ng/l	DEHP ug/l	COP ug/l
Pawtuxet (PR)	mean	6.99	6.79	49.0	50.2	36.4	1.32	3.24
	stdev	0.92	2.43	16.6	32.0	22.3	1.25	1.97
	min	5.89	4.69	30.4	14.5	21.7	0.37	1.46
	max	8.08	10.2	68.2	91.3	69.6	3.13	5.96
Moshassuck (MR)	mean	6.87	11.5	65.7	97.7	39.3	1.80	1.39
	stdev	4.60	2.79	82.3	104	29.6	1.93	0.86
	min	2.94	8.10	13.9	21.8	13.5	0.43	0.64
	max	13.2	13.9	188	251	71.1	4.59	2.63
Woonasquatucket (WR)	mean	7.94	25.3	63.4	80.5	26.6	1.16	3.80
	stdev	2.25	12.3	54.9	70.6	12.9	1.29	2.99
	min	4.81	11.7	22.2	19.2	10.3	0.44	1.40
	max	9.79	40.8	141	157	41.7	3.09	8.05
Blackstone (BR)	mean	5.85	20.9	46.6	40.8	25.5	1.07	0.69
	stdev	1.68	8.80	9.23	23.4	31.8	1.78	0.86
	min	4.31	10.2	36.8	13.1	N.D.	N.D.	0.04
	max	7.66	30.5	59.1	60.2	71.9	3.73	1.93
Taunton (TR)	mean	8.48	3.10	14.5	252	31.6	1.53	0.33
	stdev	6.61	1.67	9.91	295	38.1	2.41	0.20
	min	3.99	1.68	5.43	6.04	N.D.	0.15	0.07
	max	18.3	5.44	24.0	629	86.3	5.14	0.53

N.D. = none detected.

Table IV-2. Particle loadings in rivers discharging into Narragansett Bay.

		PCB	PHC	FLR	B(ghi)PR	DEHP	COP
		ng/mgSS	ug/mgSS	ng/mgSS	ng/mgSS	ug/mgSS	ug/mgSS
Pawtuxet (PR)	mean	0.98	6.96	7.14	5.53	0.18	0.47
	stdev	0.37	1.99	4.76	4.20	0.15	0.28
	min	0.65	4.52	2.46	3.22	0.05	0.22
	max	1.52	9.40	13.6	11.8	0.39	0.82
Moshassuck (MR)	mean	2.05	7.40	13.2	5.40	0.51	0.31
	stdev	0.76	4.54	7.65	1.90	0.72	0.27
	min	1.03	4.73	5.33	3.59	0.03	0.08
	max	2.76	14.2	20.4	8.02	1.56	0.64
Woonasquatucket (WR)	mean	3.12	7.31	9.07	3.50	0.14	0.46
	stdev	1.03	4.91	6.61	1.73	0.13	0.29
	min	2.13	3.44	2.46	1.32	0.05	0.18
	max	4.37	14.4	16.0	5.24	0.33	0.86
Blackstone (BR)	mean	3.50	8.21	7.48	4.04	0.24	0.15
	stdev	0.89	1.42	4.66	3.93	0.40	0.19
	min	2.37	6.61	1.90	N.D.	N.D.	0.01
	max	4.43	9.98	13.3	9.39	0.83	0.43
Taunton (TR)	mean	0.52	2.46	45.7	6.38	0.35	0.06
	stdev	0.33	1.85	75.0	10.2	0.63	0.04
	min	0.09	0.30	0.99	N.D.	0.03	N.D.
	max	0.89	4.36	158	21.6	1.29	0.10

N.D. = none detected.

Table IV-3. Water quality criteria for selected pollutants (EPA, 1986).

	PCB ng/l	PHC[1] µg/l	FLR µg/l	Phthalates[2] µg/l
Freshwater				
Acute	2,000	1,000	3,980	940
Chronic	14	1-100	ID	3
Saltwater				
Acute	10,000	1,000	40	2,944
Chronic	30	1-100	16	3.4

[1] no set criteria, only results of toxicology studies; dependent on type of petroleum;

[2] data for total phthalate esters;

ID = insufficent data to set criterion.

Table IV-3a. Discharge data for point sources and rivers during the 1985-86 study.

		MLD			
	Oct. 1985	Nov. 1985	April 1986	May 1986[1]	
Rivers[2]					
Pawtuxet	254 ± 13.5	1550 ±399	688 ±123	340 ± 51.1	
Moshassuck	18.4± 1.34	148 ± 97.1	94.8± 19.3	39.2± 3.46	
Woonasquatucket[3]	39.8± 8.33	265 ± 46.3	159 ± 5.65	62.0± 3.74	
Blackstone	1100 ± 43.7	3780 ±617	2090 ± 77.1	825 ± 99.4	
Taunton	306 ± 22.3	1540 ±177	878 ± 71.2	337 ± 39.8	
Point Sources[4]					Type[8]
Bristol	8.09[6]	11.7	7.69	4.85	primary
Blackstone Valley[7]	85.6[6]	75.8	87.1	94.3	secondary
E. Greenwich	3.92[6]	3.98	3.88	3.90	secondary
E. Providence	18.2	28.4	32.2	30.3	secondary
Fields Point[7]	197	205	231	348	secondary
Fall River[7]	87.1	96.6	94.7	85.2	secondary
Narra. Electric[5]	--	--	--	--	industrial
Newport[7]	43.6	32.2	45.4	26.5	primary
Warren	5.31	10.6	8.71	5.98	secondary
Jamestown	not collected	4.17	1.89	1.14	secondary
Quonset Point	not collected	5.68	1.80	2.77	primary

[1] Only used flow during dry weather portion of the sampling period:

[2] Source: USGS records;

[3] Final flows;

[4] Source: SINBADD cruise reports: Hunt et al. 1987a, b, c, d;

[5] Narragansett Electric was not included because it withdraws and returns water from the Providence River for cooling purposes;

[6] estimated using average of other dates;

[7] combined system.

[8] source: DEM, 1984 and 1988 (personal communication); Narragansett Electric is an industrial effluent, all others are WWTF effluents.

two numbers would rigorously be found statistically significant in the present study (since only 4 samples were collected), it may not be prudent to rule out the possibility of true differences being present. For example, the concentrations of PCBs in the Woonasquatucket and Blackstone rivers were consistently higher than the other 3 rivers on all 4 dates; however, they were not statistically different than the other rivers. Also, very high levels of fluoranthene (FLR) in the Taunton River were observed on the first two sampling dates, while the values were similar to the other rivers on the last two dates.

Water quality criteria are guidelines used to determine if a water body has levels of pollutants that may be hazardous to aquatic life. The criteria are based on bioassay tests done by the EPA, and reflect the total concentration in the water. Table IV-3 shows the EPA water quality criteria for several organic components. On this basis, the average values for PCBs in the Woonasquatucket (25.3 ng/l) and Blackstone River (20.9 ng/l) are at or exceed the criteria for chronic contamination in freshwater (14 ng/l).

Figure IV-1 illustrates the average percent contribution of the individual rivers to the total amount of various components discharged into the bay, taking into account the flow rates of the rivers over the course of this investigation. It is always difficult to estimate the mass transport from heterogeneous flowing systems since concentration and flow are variable and correlated,and these systems are not usually as well sampled as would be necessary to accurately characterize. Thus, assumptions and approximations have been made that would give relatively accurate estimates of the mass output from the rivers and wastewater treatment facilities. Mass transport was calculated using

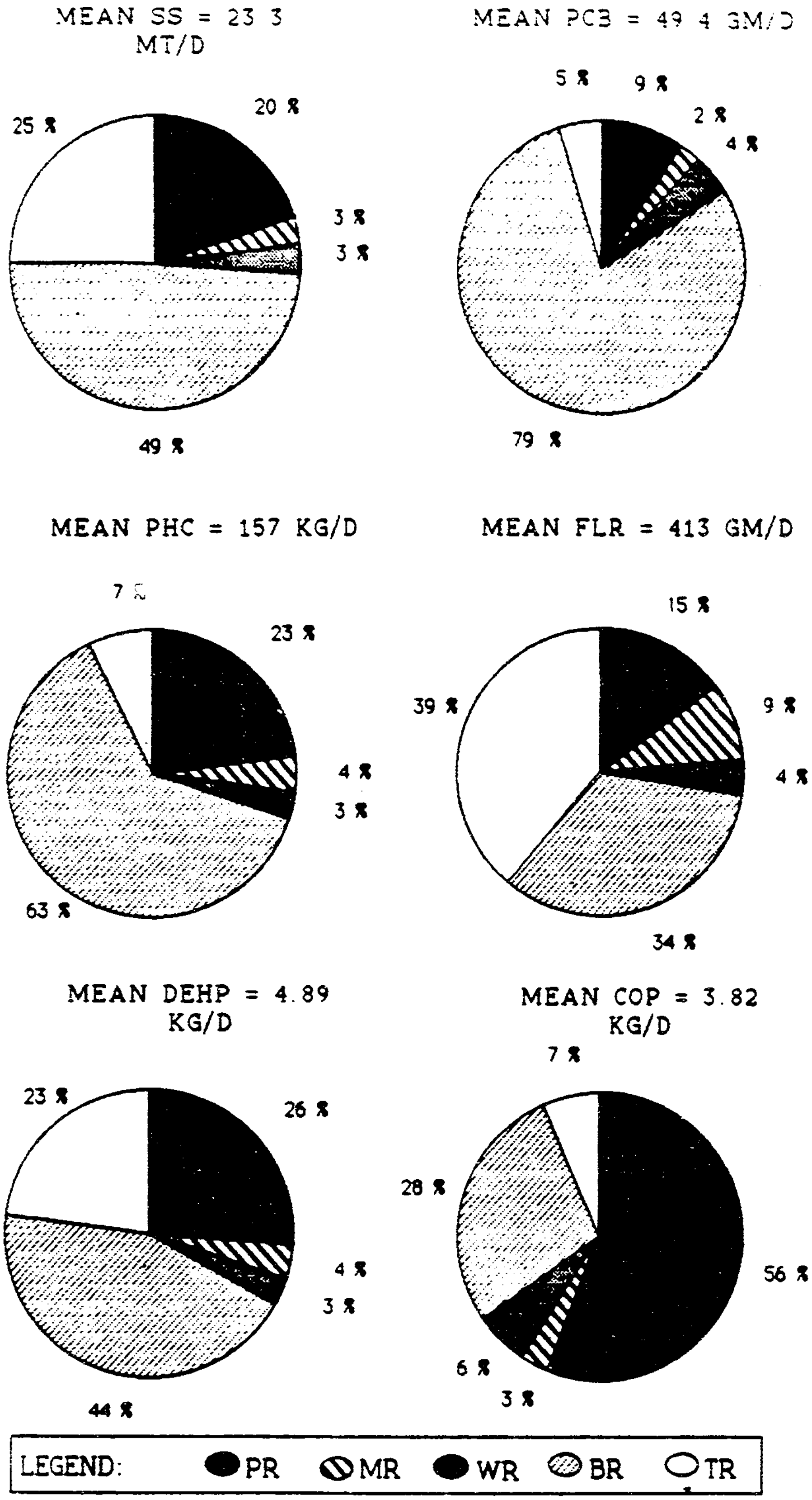

Figure IV-1. Percent contribution of particulate components from rivers discharging into Narragansett Bay. MT/D = metric tons/day; GM/D = grams/day; KG/D = kilograms/day.

individual composited concentrations determined from the samples collected and multiplying by the average flow discharge for the period of sampling. These flows were provided by USGS records available at the time in the case of the rivers. In the case of the WWTF samples, records from the individual treatment plants were obtained (Appendix A has the flow data used for these calculations). The USGS records are reported in cubic ft/sec and were converted to l/day to achieve a daily discharge and a resulting daily mass transport of pollutants. The results depicted in figure IV-1 would therefore represent most closely the average transport only during the sampling times. Caution is advised in applying the information since the situation may be considerably different during times other than when the samples were collected; more frequent sampling would be necessary to ascertain longer term trends. For these data, it is evident that the Blackstone River is the largest single source of SS, PCBs, PHCs and DEHP; the Taunton River is the major source of FLR; and the Pawtuxet River is the largest contributor of coprostanol (COP).

Point Sources

Table IV-4 shows the average concentrations of particulate components in point source effluents discharging into Narragansett Bay, and Table VI-5 lists the concentrations based on the particle loadings of these effluents. The data indicate that the Newport treatment plant exceeded both its monthly mean (50 mg SS/l) and daily maximum (75 mg SS/l) interim permit levels. Coprostanol (COP), while not considered an organic pollutant, is found in sewage effluent; the levels of this compound were much higher in the primary treatment facilities (Bristol, Newport, and Quonset Point) than in the secondary treatment facilities, with the exception of the East Greenwich plant. It should be noted that only trace levels of COP were detected in the effluent of the Narragansett Electric plant since this is not a municipal wastewater treatment facility. The PAH, B(ghi)PR, was not detected in any of the point source effluents and thus may be useful as a chemical indicator for industrial and runoff pollution sources.

Figure IV-2 illustrates the average percent contribution of the individual point sources to the total amount of various components discharged into the bay, taking the individual flow rates into account. The four largest point sources are shown and the remaining seven are combined and listed as others. From the data presented, the Fields Point plant is the largest source of SS, PCBs, PHCs, FLR and DEHP; and the Newport plant is the major contributor of COP.

Rivers and Point Sources

By incorporating the average daily mass emissions from both the point sources and the rivers, an overall comparison of the transport of each can be made. Table IV-6 shows the same data in mass/day form instead of in a, percentage of the total input, form. Figure IV-3 compares the contribution of both rivers and point sources to Narragansett Bay on the four different sampling dates under dry weather conditions. The 11 point sources account for essentially all of the sewage effluent discharged directly into the bay. Of the total sewage effluent eventually entering the bay, 80% is included in the 11 point sources sampled in this study; the other 20% is discharged into the Blackstone River (Woonsocket WWTF) and Pawtuxet rivers (West Warwick WWTF, Warwick WWTF and Cranston WWTF).

In October 1985, the point sources (WWTF) were the major contributor of all components, with the exception of fluoranthene (FLR). During the November period, the rivers contributed more FLR, PHCs, PCBs and SS, and they also supplied more FLR, PCBs and SS during April, 1986. In May, the point sources were again the major suppliers of all components, except PCBs. Overall, the point sources were the largest supplier of COP, DEHP, PHCs, and SS; and the rivers were the major source of FLR and PCBs.

Table IV-6 presents data on the amounts of the various components transported to the bay over the four sampling periods. The November values were the highest for SS, PCBs, FLR, DEHP; and the May values showed the highest levels for PHCs and COP. Overall, it is clear that large quantities of these components are entering the bay throughout the year from the various rivers and point sources.

Bay

Table IV-7 shows the concentrations of particulate components in Narragansett Bay surface water samples; and Table IV-8 presents the data for bottom water samples. The concentrations based on particle loadings in surface and bottom waters are shown in Tables IV-9 and IV-10, respectively. A depiction of the average trends for both surface and bottom waters are illustrated in Figure IV-4 (in the interest of clarity, only stations 2, 4 and 7 [i.e. a western transect] are represented in this figure; station 12 shows trends that are similar to station 7). In general, the concentration of components in surface waters was highest at station 2 and decreased to station 7; however, in the case of DEHP and COP, station 4 had the highest concentration. For bottom waters, the highest values were usually observed at station 4, with the exception of DEHP and COP. In all cases, the observed concentrations are less than those reported for chronic toxicity in saltwater (Table IV-3).

Table IV-4. Concentrations of particulate components in point sources discharging into Narragansett Bay.

		SS	PCB	PHC	FLR	B(ghi)PR	DEHP	COP
		mg/l	ng/l	ug/l	ng/l	ng/l	ug/l	ug/l
BRISTOL	mean	61.2	83.3	1360	127	N.D.	42.9	357
(BR)	stdev	16.4	34.3	1230	81.6	N.D.	36.4	237
	min	47.5	47.2	500	52.8	N.D.	5.97	106
	max	80.8	116	3180	243	N.D.	76.1	672
B'STONE VALLEY	mean	61.7	113	974	154	N.D.	16.5	31.7
(BV)	stdev	35.0	66.3	831	79.7	N.D.	11.6	30.3
	min	31.0	37.8	459	92.9	N.D.	2.32	6.08
	max	109	187	2210	265	N.D.	29.9	75.7
E. GREENWICH	mean	85.0	75.0	2290	91.4	N.D.	49.6	136
(EG)	stdev	34.8	62.2	1440	84.4	N.D.	21.0	30.4
	min	51.9	N.D.	915	N.D.	N.D.	23.6	101
	max	134	151	4320	189	N.D.	72.4	175
E. PROVIDENCE	mean	13.4	12.0	106	8.81	N.D.	10.8	10.1
(EP)	stdev	4.50	2.50	68.1	11.3	N.D.	17.8	9.96
	min	10.3	9.05	54.0	N.D.	N.D.	0.18	4.66
	max	20.0	15.0	199	25.3	N.D.	37.4	25.0
FIELD'S POINT	mean	45.7	56.4	1000	190	N.D.	19.1	45.3
(FP)	stdev	17.0	52.2	332	63.6	N.D.	20.7	25.7
	min	30.0	N.D.	790	102	N.D.	1.84	15.3
	max	61.6	103	1500	249	N.D.	48.4	68.5
FALL RIVER	mean	27.0	14.2	631	58.2	N.D.	8.96	13.6
(FR)	stdev	9.56	28.4	314	11.0	N.D.	6.03	3.28
	min	14.8	N.D.	339	42.1	N.D.	3.25	11.0
	max	34.8	56.7	924	66.9	N.D.	16.0	18.1
NARR. ELECTRIC	mean	5.28	3.88	21.0	13.2	N.D.	9.87	0.36
(NE)	stdev	4.25	5.24	25.8	5.74	N.D.	9.62	0.28
	min	1.87	N.D.	4.65	10.1	N.D.	0.64	N.D.
	max	11.1	11.1	59.2	21.8	N.D.	21.3	0.66
NEWPORT	mean	92.7	38.7	821	173	N.D.	38.6	475
(NP)	stdev	37.1	27.9	536	84.7	N.D.	21.7	343
	min	61.7	N.D.	450	73.2	N.D.	19.0	133
	max	145	65.0	1620	265	N.D.	66.5	945
WARREN	mean	35.7	16.4	218	33.8	N.D.	7.64	16.6
(WN)	stdev	22.8	17.6	142	41.3	N.D.	11.3	11.0
	min	4.53	N.D.	16.5	N.D.	N.D.	1.02	1.62
	max	58.9	39.1	352	84.1	N.D.	24.6	27.7
JAMESTOWN	mean	10.8	12.5	68.6	47.4	N.D.	2.83	4.77
(JT)	stdev	5.18	8.95	34.3	25.5	N.D.	4.01	2.54
	min	6.42	4.72	36.9	22.0	N.D.	0.23	3.07
	max	16.5	22.3	105	73.0	N.D.	7.45	7.69
QUONSET PT.	mean	55.5	102	626	419	N.D.	16.5	170
(QP)	stdev	12.7	85.0	226	416	N.D.	20.9	43.5
	min	42.4	37.0	388	112	N.D.	2.99	126
	max	67.7	198	837	893	N.D.	40.5	213

N.D. = none detected.

Table IV-5. Particle loadings in point sources discharging into Narragansett Bay.

		PCB	PHC	FLR	B(ghi)PR	DEHP	COP
		ng/mgSS	ug/mgSS	ng/mgSS	ng/mgSS	ug/mgSS	ug/mgSS
BRISTOL	mean	1.44	20.1	1.96	N.D.	0.74	5.61
(BR)	stdev	0.75	13.0	0.80	N.D.	0.68	3.17
	min	0.75	10.5	1.11	N.D.	0.13	2.22
	max	2.44	39.3	3.01	N.D.	1.51	9.80
B'STONE VALLEY	mean	1.88	14.6	2.72	N.D.	0.36	0.48
(BV)	stdev	0.73	4.26	1.05	N.D.	0.41	0.28
	min	0.95	11.2	1.44	N.D.	0.06	0.15
	max	2.65	20.2	3.96	N.D.	0.97	0.72
E. GREENWICH	mean	1.03	26.8	1.01	N.D.	0.71	1.90
(EG)	stdev	0.95	10.9	0.75	N.D.	0.43	1.08
	min	N.D.	11.6	N.D.	N.D.	0.18	0.75
	max	2.01	36.7	1.73	N.D.	1.14	3.35
E. PROVIDENCE	mean	0.93	7.42	0.74	N.D.	0.96	0.65
(EP)	stdev	0.21	2.54	0.88	N.D.	1.67	0.40
	min	0.75	5.00	N.D.	N.D.	0.01	0.42
	max	1.23	9.92	2.02	N.D.	3.46	1.25
FIELD'S POINT	mean	0.93	22.9	4.44	N.D.	0.50	0.93
(FP)	stdev	1.09	5.65	1.97	N.D.	0.68	0.28
	min	N.D.	14.5	3.18	N.D.	0.06	0.51
	max	2.06	26.3	7.33	N.D.	1.51	1.11
FALL RIVER	mean	0.41	22.8	2.29	N.D.	0.43	0.53
(FR)	stdev	0.81	4.79	0.49	N.D.	0.44	0.16
	min	N.D.	16.0	1.81	N.D.	0.09	0.40
	max	1.63	26.8	2.85	N.D.	1.08	0.76
NARR. ELECTRIC	mean	0.94	4.78	3.62	N.D.	4.50	0.13
(NE)	stdev	1.09	4.25	1.90	N.D.	5.31	0.11
	min	N.D.	0.57	0.96	N.D.	0.06	N.D.
	max	1.92	10.3	5.40	N.D.	11.4	0.26
NEWPORT	mean	0.42	8.38	1.86	N.D.	0.47	4.80
(NP)	stdev	0.33	2.01	0.60	N.D.	0.30	2.05
	min	N.D.	6.57	1.02	N.D.	0.17	1.85
	max	0.82	11.2	2.35	N.D.	0.72	6.52
WARREN	mean	0.60	5.59	0.84	N.D.	0.25	0.46
(WN)	stdev	0.48	1.38	1.00	N.D.	0.29	0.19
	min	N.D.	3.64	N.D.	N.D.	0.04	0.34
	max	1.16	6.90	1.99	N.D.	0.66	0.75
JAMESTOWN	mean	1.08	6.32	4.72	N.D.	0.19	0.45
(JT)	stdev	0.31	0.56	2.49	N.D.	0.23	0.11
	min	0.74	5.74	2.39	N.D.	0.04	0.33
	max	1.35	6.86	7.35	N.D.	0.45	0.55
QUONSET PT.	mean	1.68	11.0	7.41	N.D.	0.36	3.14
(QP)	stdev	1.09	1.68	7.34	N.D.	0.51	0.89
	min	0.87	9.15	2.64	N.D.	0.05	2.24
	max	2.92	12.4	15.9	N.D.	0.96	4.03

N.D. = none detected.

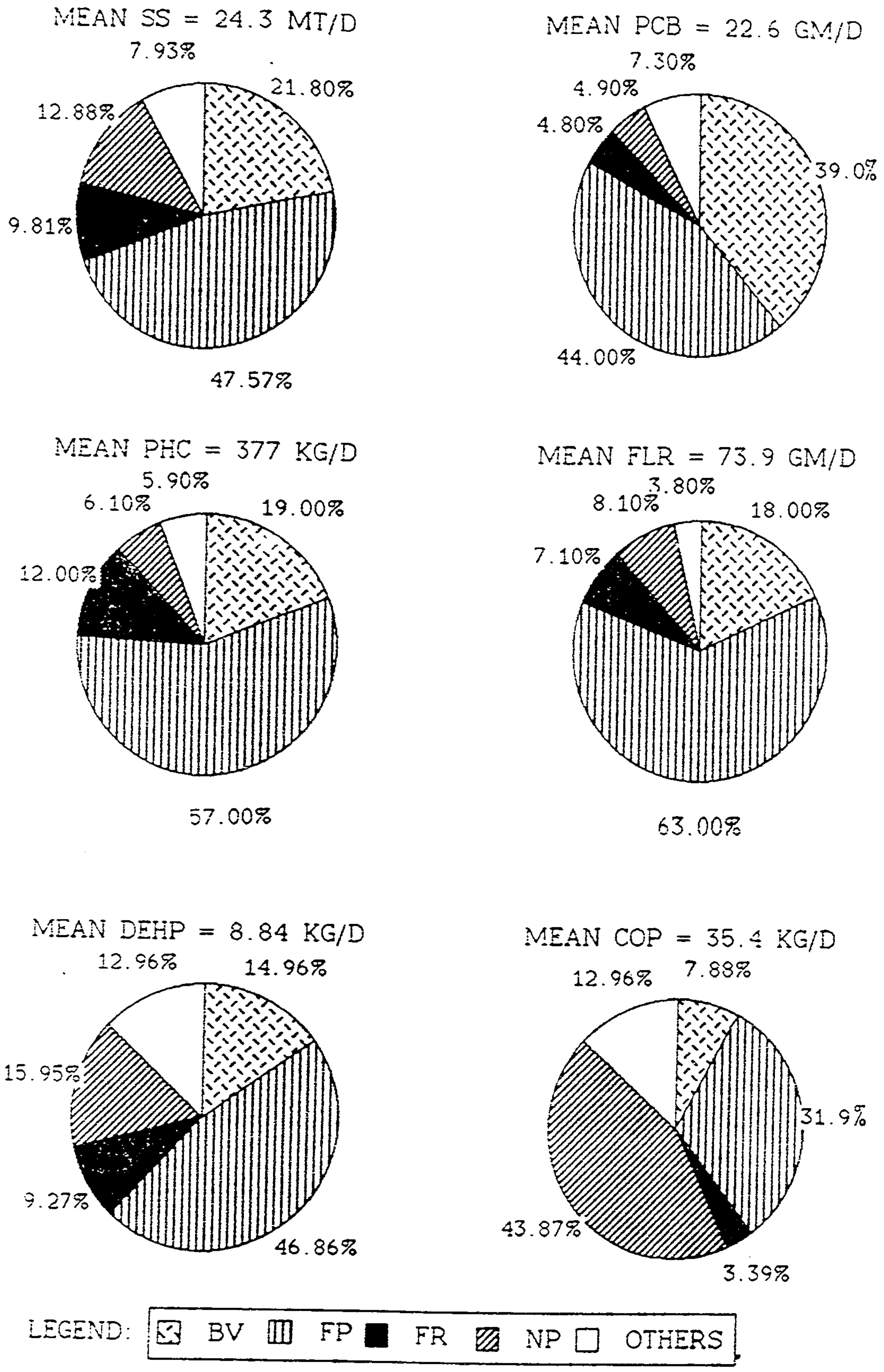

Figure IV-2. Percent contribution of particulate components from point sources discharging into Narragansett Bay. MT/D = metric tons/day; GM/D = grams/day; KG/D kilograms/day.

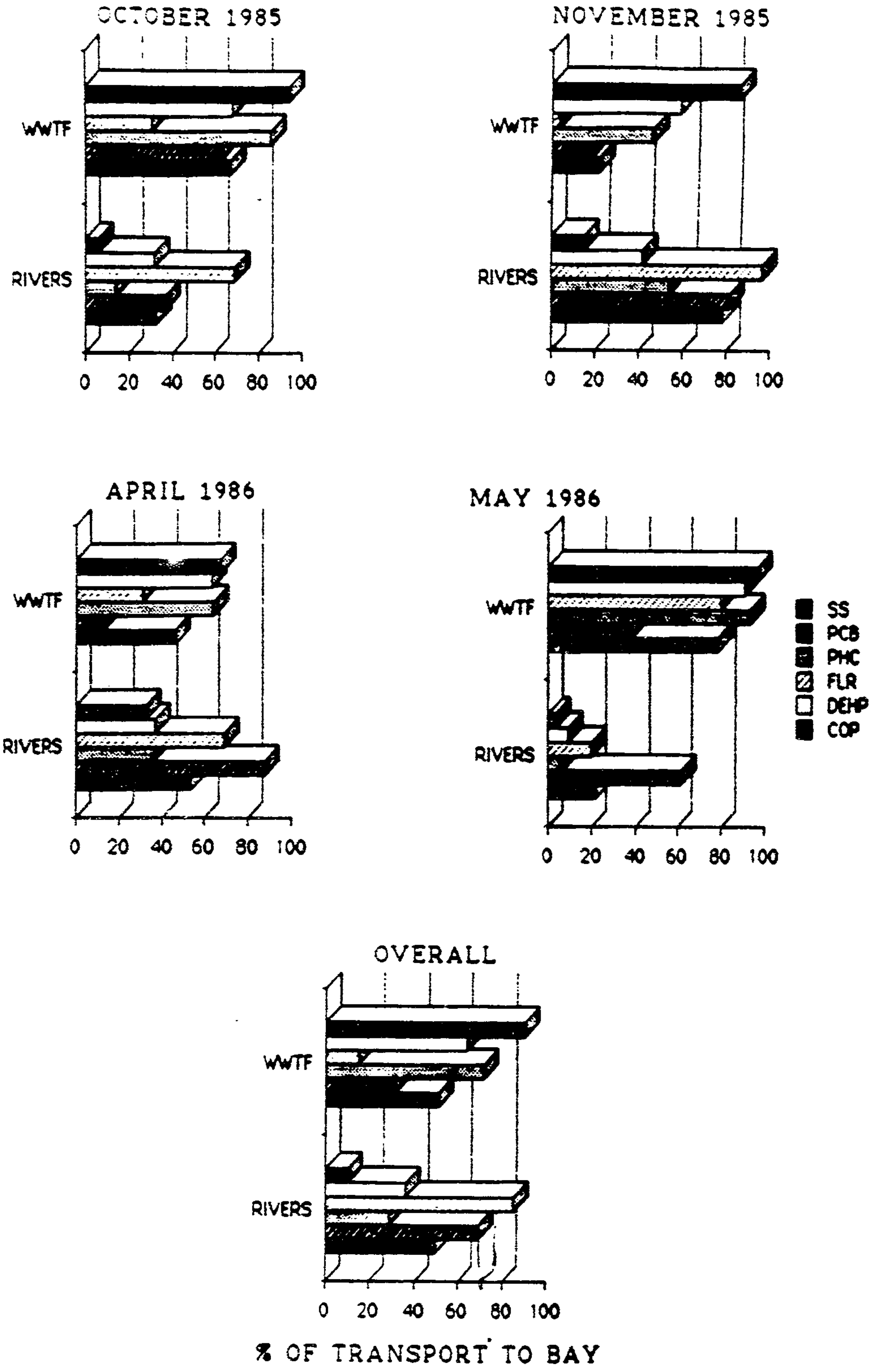

Figure IV-3. Comparison of river and point source particulate components discharged into Narragansett Bay.

Table IV-6. Transport of particulate components to Narragansett Bay from point sources and rivers.

	SS MT/D	PCB GM/D	PHC KG/D	FLR GM/D	DEHP KG/D	COP KG/D
October 1985	38.3	64.5	419	285	14.8	46.3
November 1985	63.1	136	599	1310	31.0	30.9
April 1986	38.7	35.0	492	236	3.34	19.2
May 1986	50.3	52.9	942	119	5.88	60.7
Overall	47.6	72.1	613	488	13.8	39.3
st. dev.	11.7	44.3	231	553	12.5	18.1
rsd (%)	25	61	38	110	91	46

Table IV-7. Concentrations of particulate components in Narragansett Bay surface water samples.

	SS	PCB	PHC	FLR	B(ghi)PR	DEHP	COP
	mg/l	ng/l	ug/l	ng/l	ng/l	ug/l	ug/l
Station 2							
mean	3.89	7.23	25.9	12.0	4.18	0.24	0.22
stdev	1.94	5.89	23.4	7.55	5.99	0.24	0.15
min	2.17	2.56	10.74	5.53	N.D.	N.D.	N.D.
max	6.57	15.9	60.1	22.9	12.70	0.54	0.33
Station 4							
mean	3.60	4.67	12.6	4.59	1.20	1.68	0.31
stdev	1.62	1.42	6.12	1.63	2.41	2.20	0.25
min	1.89	3.22	5.16	2.71	N.D.	0.04	0.10
max	5.72	6.48	19.7	6.70	4.81	4.72	0.66
Station 7							
mean	2.31	0.87	3.70	2.54	0.50	0.01	0.11
stdev	0.31	1.55	1.33	0.75	1.00	0.02	0.09
min	2.00	N.D.	1.85	1.78	N.D.	N.D.	N.D.
max	2.73	3.18	4.70	3.36	2.00	0.03	0.23
Station 12							
mean	1.61	3.07	4.00	2.00	N.D.	0.19	0.09
stdev	0.30	2.45	1.83	0.55	N.D.	0.35	0.10
min	1.16	0.93	2.20	1.38	N.D.	N.D.	N.D.
max	1.84	6.60	6.53	2.71	N.D.	0.72	0.24

N.D. = none detected.

Table IV-8. Concentrations of particulate components in Narragansett Bay bottom water samples.

	SS mg/l	PCB ng/l	PHC ug/l	FLR ng/l	B(ghi)PR ng/l	DEHP ug/l	COP ug/l
Station 2							
mean	2.91	3.41	13.3	5.75	2.03	0.08	0.14
stdev	1.02	1.16	9.35	2.06	3.18	0.09	0.12
min	1.85	1.76	6.16	4.37	N.D.	N.D.	N.D.
max	4.04	4.24	26.1	8.81	6.70	0.16	0.26
Station 4							
mean	14.5	4.82	14.8	11.1	7.95	0.03	0.08
stdev	14.0	3.80	10.3	8.08	8.11	0.02	0.10
min	3.42	N.D.	5.71	4.83	N.D.	N.D.	N.D.
max	33.6	8.31	28.3	22.9	19.2	0.05	0.19
Station 7							
mean	3.16	2.40	3.89	2.95	N.D.	0.01	0.05
stdev	0.56	1.04	1.85	0.87	N.D.	0.01	0.06
min	2.79	1.15	2.21	2.14	N.D.	N.D.	N.D.
max	3.99	3.63	6.33	4.18	N.D.	0.02	0.10
Station 12							
mean	2.97	2.00	3.44	2.71	N.D.	0.18	0.06
stdev	0.79	1.74	1.10	0.74	N.D.	0.33	0.05
min	2.11	0.44	2.08	1.59	N.D.	N.D.	N.D.
max	3.66	4.00	4.75	3.12	N.D.	0.67	0.12

N.D. = none detected.

Table IV-9. Particle loadings of particulate components in Narragansett Bay surface water samples.

	PCB ng/mgSS	PHC ug/mgSS	FLR ng/mgSS	B(ghi)PR ng/mgSS	DEHP ug/mgSS	COP ug/mgSS
Station 2						
mean	1.83	5.86	3.07	0.84	0.09	0.07
stdev	0.82	2.28	1.01	0.99	0.11	0.06
min	0.65	3.88	1.95	N.D.	N.D.	0.02
max	2.41	9.14	4.26	1.93	0.25	0.15
Station 4						
mean	1.45	3.71	1.45	0.64	0.65	0.08
stdev	0.61	1.67	0.74	1.27	0.78	0.03
min	0.88	1.75	0.78	N.D.	0.01	0.05
max	2.20	5.32	2.37	2.55	1.60	0.12
Station 7						
mean	0.32	1.67	1.11	0.23	N.D.	0.02
stdev	0.56	0.72	0.36	0.46	0.01	0.03
min	N.D.	0.68	0.74	N.D.	N.D.	N.D.
max	1.17	2.35	1.53	0.91	0.01	0.06
Station 12						
mean	1.82	2.54	1.34	N.D.	0.11	0.05
stdev	1.33	1.12	0.68	N.D.	0.20	0.06
min	0.80	1.26	0.79	N.D.	N.D.	N.D.
max	3.77	3.91	2.34	N.D.	0.41	0.14

N.D. = none detected.

Table IV-10. Particle loadings of particulate components in Narragansett Bay bottom water samples.

	PCB ng/mgSS	PHC ug/mgSS	FLR ng/mgSS	B(ghi)PR ng/mgSS	DEHP ug/mgSS	COP ug/mgSS
Station 2						
mean	1.22	4.21	2.06	1.06	0.03	0.05
stdev	0.46	1.61	0.56	1.73	0.04	0.04
min	0.78	2.71	1.27	N.D.	N.D.	N.D.
max	1.87	6.46	2.53	3.62	0.09	0.10
Station 4						
mean	0.37	1.32	1.08	0.62	N.D.	0.01
stdev	0.33	0.43	0.54	0.68	N.D.	0.02
min	N.D.	0.84	0.55	N.D.	N.D.	N.D.
max	0.79	1.68	1.66	1.58	0.01	0.04
Station 7						
mean	0.77	1.20	0.96	N.D.	N.D.	0.02
stdev	0.35	0.42	0.37	N.D.	N.D.	0.02
min	0.39	0.76	0.71	N.D.	N.D.	N.D.
max	1.24	1.59	1.50	N.D.	0.01	0.04
Station 12						
mean	0.60	1.25	1.04	N.D.	0.08	0.02
stdev	0.46	0.69	0.45	N.D.	0.10	0.02
min	0.21	0.70	0.43	N.D.	N.D.	N.D.
max	1.09	2.25	1.48	N.D.	0.21	0.06

N.D. = none detected.

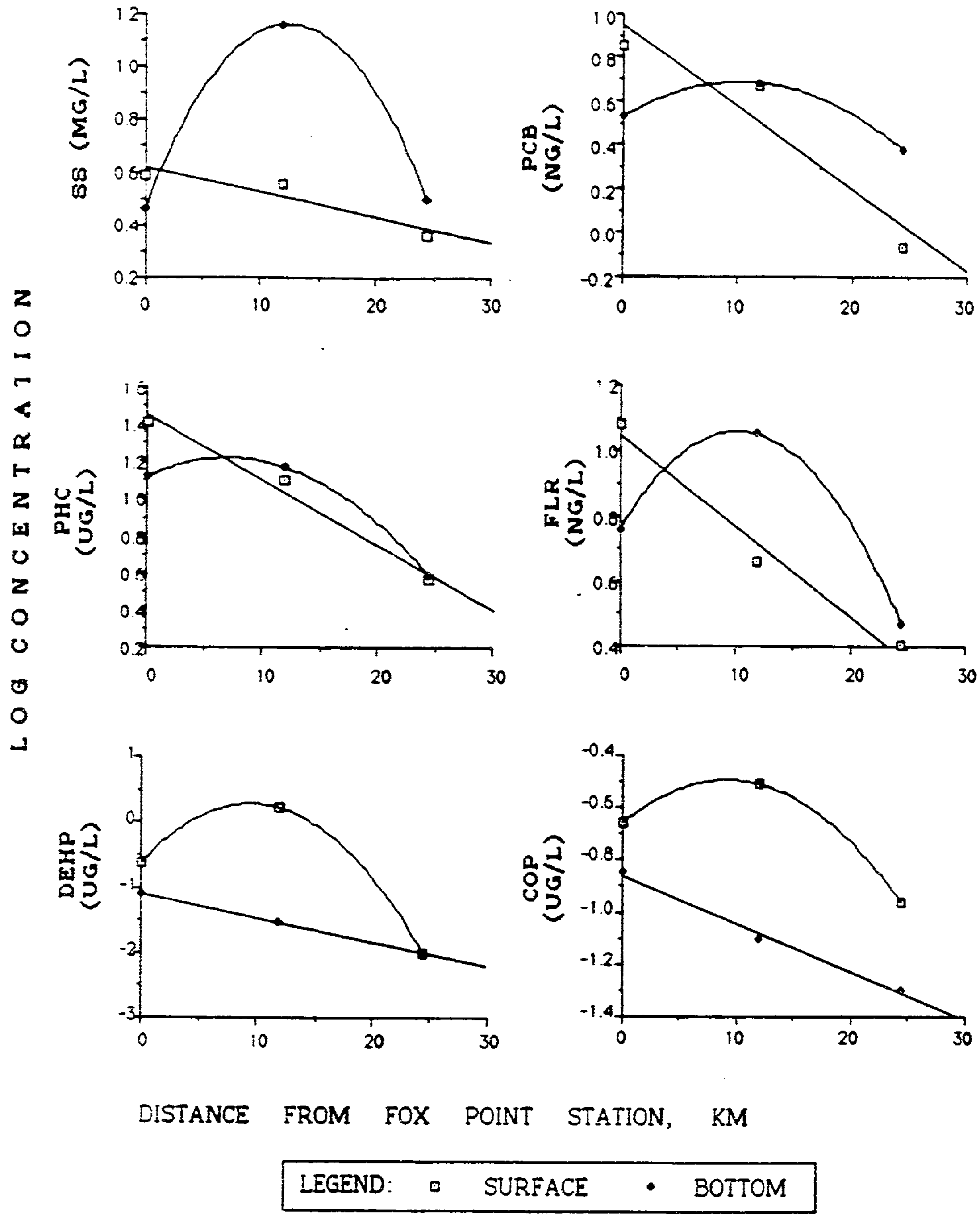

Figure IV-4. Concentrations of particulate components in Narragansett Bay surface and bottom waters.

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APPENDIX A.

Concentrations of components in rivers and point sources discharging into Narragansett Bay.

List of PCBs and PAHs

PCBs

IUPAC No.	Congener
101	2,2',4,5,5'-pentachlorobiphenyl
151	2,2',3,5,5',6-hexachlorobiphenyl
153	2,2',4,4',5,5'- "
138	2,2',3,4,4',5'- "
180	2,2',3,4,4',5,5'-heptachlorobiphenyl
170	2,2',3,3',4,4',5- "
201	2,2',3,3',4,5',6,6'-octachlorobiphenyl
195	2,2',3,3',4,4',5,6- "
194	2,2',3,3',4,4',5,5'- "
209	2,2',3,3',4,4',5,5',6,6'-decachlorobiphenyl

PAHs

Abbreviation	Compound
Nap	Naphthalene
AcL	Acenaphthylene
Acn	Acenaphthene
Flu	Fluorene
Phe	Phenanthrene
Ane	Anthracene
Flr	Fluoranthene
Pyr	Pyrene
BaA	Benzo(a)anthracene
Chr	Chrysene
B(b+k)F	Benzo(b+k)fluoranthene
BaP	Benzo(a)pyrene
InP	Indeno(1,2,3-cd)pyrene
DbA	Dibenzo(a,h)anthracene
Bpr	Benzo(ghi)perylene

Table A-1. Concentrations of organics in rivers and point sources discharging into Narragansett Bay (October 21-25, 1985).

RIVERS		SS (MG/L)	PCBs (NG/L)			
			Ar 1242	Ar 1254	Ar 1260	Total
PAWTUXET	P	6.73	3.42	4.54	2.25	10.2
	S		N.D.	N.D.	N.D.	N.D.
MOSHASSUCK	P	2.94	2.56	3.54	2.00	8.10
WOONASQUATUCKET	P	9.34	7.89	19.5	13.4	40.8
	S		N.D.	N.D.	N.D.	N.D.
BLACKSTONE	P	4.52	3.47	8.55	5.88	17.9
	S		N.D.	1.16	N.D.	1.16
TAUNTON	P		N.D.	1.68	N.D.	1.68

POINT SOURCES		SS (MG/L)	PCBs (NG/L)			
			Ar 1242	Ar 1254	Ar 1260	Total
BRISTOL	P	68.6	47.3	61.9	N.D.	109
BLACKSTONE VAL.	P	66.9	89.1	56.9	N.D.	146
	S		11.6	3.7	N.D.	15.3
EAST GREENWICH	P	51.9	41.5	43.4	N.D.	84.9
	S		N.D.	N.D.	N.D.	N.D.
EAST PROVIDENCE	P	10.3	N.D.	12.7	N.D.	12.7
FIELD'S POINT	P	61.6	N.D.	103	N.D.	103
	S		N.D.	N.D.	N.D.	N.D.
FALL RIVER	P	34.8	29.5	27.2	N.D.	56.7
NARR. ELECTRIC	P	11.1	N.D.	N.D.	N.D.	N.D.
NEWPORT	P	92.0	N.D.	39.4	N.D.	39.4
	S		N.D.	N.D.	N.D.	N.D.
WARREN	P	4.53	N.D.	5.27	N.D.	5.27
JAMESTOWN		N.C.	N.C.	N.C.	N.C.	N.C.
QUONSET POINT		N.C.	N.C.	N.C.	N.C.	N.C.

N.C. = Not collected P= Particulate S= Soluble
N.D. = Not detected

Table A-2. Concentrations of organics in rivers and point sources discharging into Narragansett Bay (October 21-25, 1985).

RIVERS		PCB Congeners (NG/L)									
		101	151	153	138	180	170	201	195	194	209
PAWTUXET	P	0.550	0.190	0.240	0.310	0.160	0.070	0.340	0.100	0.040	0.070
	S	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
MOSHASSUCK	P	0.410	0.130	0.190	0.270	0.150	0.080	0.260	0.100	0.040	0.030
WOONASQUATUCKET	P	2.34	0.940	2.09	2.55	1.46	0.860	0.700	0.120	0.220	0.060
	S	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
BLACKSTONE	P	0.820	0.310	0.520	0.670	0.520	0.230	0.490	0.130	0.140	0.070
	S	0.159	0.033	0.069	0.073	0.033	0.016	0.033	0.010	0.010	[illegible]
TAUNTON	P	0.170	0.060	0.110	0.130	0.100	0.030	0.180	0.060	0.030	0.030

POINT SOURCES		PCB Congeners (NG/L)									
		101	151	153	138	180	170	201	195	194	209
BRISTOL	P	8.15	1.91	3.34	4.30	1.30	0.660	0.973	N.D.	0.417	N.D.
BLACKSTONE VAL.	P	7.41	1.48	0.388	3.77	1.15	0.544	1.26	0.373	0.437	N.D.
	S	0.41	0.09	0.104	0.15	N.D.	0.018	0.08	0.024	0.020	N.D.
EAST GREENWICH	P	5.51	1.30	2.17	3.03	0.686	0.389	0.703	0.162	0.155	N.D.
	S	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
EAST PROVIDENCE	P	1.51	0.422	0.628	0.831	0.306	0.119	0.875	0.303	0.144	0.116
FIELD'S POINT	P	11.4	2.54	5.38	8.54	2.49	1.47	1.95	0.590	0.535	0.201
	S	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
FALL RIVER	P	3.70	0.892	1.26	1.54	N.D.	0.186	0.811	0.316	N.D.	0.357
NARR. ELECTRIC	P	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
NEWPORT	P	4.84	0.841	2.00	2.60	1.26	0.468	1.12	0.295	N.D.	N.D.
	S	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
WARREN	P	0.753	0.218	0.166	0.326	0.139	N.D.	0.626	0.229	N.D.	0.055
JAMESTOWN		N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.
QUONSET POINT		N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.

N.C.= Not collected P= Particulate S= Soluble
N.D.= Not detected

Table A-3. Concentrations of organics in rivers and point sources discharging into Narragansett Bay (October 21-25, 1985).

RIVERS		HCHs (NG/L)				Hydrocarbons (UG/L)		
		a	b	g	Total	F1-UCM	F1-RES	Tot F1
PAWTUXET	P	0.017	0.025	0.020	0.062	29.0	1.36	30.4
	S	N.D.	N.D.	6.050	6.050	1.85	0.12	1.97
MOSHASSUCK	P	N.D.	N.D.	N.D.	N.D.	12.6	1.32	13.9
WOONASQUATUCKET	P	0.031	N.D.	0.032	0.063	59.4	4.19	63.6
	S	0.140	N.D.	0.695	0.835	5.72	0.35	6.07
BLACKSTONE	P	N.D.	N.D.	N.D.	N.D.	43.8	1.26	45.1
	S	2.300	0.480	4.670	7.450	7.49	0.18	7.67
TAUNTON	P	N.D.	N.D.	N.D.	N.D.	4.68	0.75	5.43

POINT SOURCES		HCHs (NG/L)				Hydrocarbons (UG/L)		
		a	b	g	Total	F1-UCM	F1-RES	Tot F1
BRISTOL	P	77.3	N.D.	112	189	851	141	992
BLACKSTONE VAL.	P	N.D.	N.D.	N.D.	N.D.	705	41.6	747
	S	1.291	0.270	13.25	14.811	0.82	18.3	19.1
EAST GREENWICH	P	24.1	N.D.	53.5	77.6	1580	323	1900
	S	*	*	*	*	67.9	4.32	72.2
EAST PROVIDENCE	P	1.99	N.D.	6.94	8.93	52.0	4.38	56.4
FIELD'S POINT	P	6.44	N.D.	39.6	46.0	776	115.0	891
	S	N.D.	N.D.	23.4	23.4	87.4	10.0	97.4
FALL RIVER	P	N.D.	N.D.	N.D.	N.D.	834	46.1	880
NARR. ELECTRIC	P	N.D.	N.D.	N.D.	N.D.	6.07	0.22	6.29
NEWPORT	P	17.7	N.D.	N.D.	17.7	525	78.8	604
	S	N.D.	N.D.	8.25	8.25	12.0	1.74	13.7
WARREN	P	0.719	N.D.	N.D.	0.719	14.9	1.56	16.5
JAMESTOWN		N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.
QUONSET POINT		N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.

N.C.= Not collected P= Particulate S= Soluble

N.D.= Not detected *= Quantitation was not possible but g-HCH was detected.

TableA-4. Concentrations of organics in rivers and point sources discharging into Narragansett Bay (October 21-25, 1985).

RIVERS		PAHs (NG/L)														
		Nap	AcL	Acn	Flu	Phe	Ane	Flr	Pyr	BaA	Chr	B(b+k)F	BaP	InP	DbA	Bpr
PAWTUXET	P	3.61	N.D.	2.54	2.65	63.4	2.78	91.3	61.6	7.42	62.4	54.9	14.0	16.6	N.D.	21.7
	S	29.5	2.10	15.9	6.04	33.9	9.65	24.6	27.1	2.26	11.6	5.03	N.D.	N.D.	N.D.	N.D.
MOSHASSUCK	P	2.07	0.35	1.31	1.64	37.5	1.22	60.1	40.6	6.38	44.5	42.2	7.82	6.77	1.95	13.5
WOONASQUATUCKET	P	3.13	N.D.	2.32	3.15	67.4	3.22	124	83.1	14.6	89.1	74.8	19.9	14.2	4.35	41.7
	S	10.1	2.49	10.5	8.55	27.4	2.85	28.6	22.3	2.42	7.56	2.07	N.D.	N.D.	N.D.	N.D.
BLACKSTONE	P	4.47	N.D.	1.28	1.90	31.9	2.51	60.0	41.3	8.86	46.8	37.4	9.36	8.57	2.93	17.6
	S	18.6	1.90	6.10	6.62	18.1	4.47	28.0	24.8	2.79	11.8	9.32	1.56	0.87	N.D.	N.D.
TAUNTON	P	7.77	N.D.	6.19	7.19	246	4.48	343	221	19.6	132	146	24.6	20.6	5.02	26.7

POINT SOURCES		PAHs (NG/L)														
		Nap	AcL	Acn	Flu	Phe	Ane	Flr	Pyr	BaA	Chr	B(b+k)F	BaP	InP	DbA	Bpr
BRISTOL	P	N.D.	N.D.	N.D.	N.D.	244	N.D.	116	272	98.0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
BLACKSTONE VAL.	P	18.6	N.D.	N.D.	N.D.	152	N.D.	265	339	118	163	181	N.D.	N.D.	N.D.	N.D.
	S	1042	N.D.	N.D.	N.D.	101	N.D.	80.3	46.7	N.D.	N.D.	62.3	N.D.	N.D.	N.D.	N.D.
EAST GREENWICH	P	N.D.	N.D.	13.7	N.D.	84.8	23.4	46.5	170	N.D.	102	41.7	N.D.	22.3	N.D.	N.D.
	S	37.5	N.D.	126	14.8	56.4	N.D.	16.0	52.7	12.3	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
EAST PROVIDENCE	P	N.D.	N.D.	N.D.	N.D.	5.30	N.D.	5.64	13.4	N.D.	4.55	N.D.	N.D.	N.D.	N.D.	N.D.
FIELDS POINT	P	N.D.	N.D.	N.D.	N.D.	45.2	N.D.	249	243	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	S	1975	N.D.	207	326	428	N.D.	65.4	68.5	8.25	21.8	N.D.	N.D.	N.D.	N.D.	N.D.
FALL RIVER	P	85.8	N.D.	N.D.	N.D.	80.8	N.D.	63.1	70.1	7.71	28.8	20.7	N.D.	N.D.	N.D.	N.D.
NARR. ELECTRIC	P	N.D.	N.D.	N.D.	N.D.	3.44	N.D.	10.6	5.11	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
NEWPORT	P	N.D.	N.D.	20.4	54.1	236	N.D.	216	179	N.D.	61.5	40.2	N.D.	148	N.D.	N.D.
	S	35.4	59.4	39.7	38.4	59.5	17.0	22.4	20.1	N.D.	7.14	N.D.	N.D.	N.D.	N.D.	N.D.
WARREN	P	N.D.	N.D.	N.D.	N.D.	3.28	N.D.	N.D.	9.47	N.D.	4.37	N.D.	N.D.	N.D.	N.D.	N.D.
JAMESTOWN		N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.
QUONSET POINT		N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.

N.C.= Not collected P= Particulate S= Soluble
N.D.= Not detected

TableA-5. Concentrations of organics in rivers and point sources discharging into Narragansett Bay (October 21-25, 1985).

RIVERS		BZTs (NG/L)			Phthalates (UG/L)				Sterols (UG/L)	
		C10	CL	C1	DBP	BBP	DEHP	DOP	Cop	Chol
PAWTUXET	P	17.4	3.05	N.D.	N.D.	N.D.	1.09	N.D.	1.46	2.52
	S	2.46	N.D.	890	N.D.	0.09	0.07	N.D.	0.09	0.21
MOSHASSUCK	P	N.D.	N.D.	N.D.	N.D.	0.12	4.59	0.14	1.24	2.36
WOONASQUATUCKET	P	N.D.	N.D.	N.D.	N.D.	1.55	3.09	N.D.	8.05	9.75
	S	N.D.	N.D.	N.D.	N.D.	0.11	1.18	N.D.	0.04	0.13
BLACKSTONE	P	N.D.	N.D.	N.D.	N.D.	N.D.	3.73	N.D.	1.93	3.69
	S	N.D.	N.D.	N.D.	N.D.	0.12	0.72	N.D.	0.07	0.16
TAUNTON	P	N.D.	N.D.	N.D.	N.D.	0.04	0.56	N.D.	0.07	0.8

POINT SOURCES		BZTs (NG/L)			Phthalates (UG/L)				Sterols (UG/L)	
		C10	CL	C1	DBP	BBP	DEHP	DOP	Cop	Chol
BRISTOL	P	N.D.	N.D.	N.D.	N.D.	N.D.	76.1	N.D.	672	574
BLACKSTONE VAL.	P	N.D.	N.D.	N.D.	N.D.	N.D.	20.1	8.04	22.8	111.0
	S	N.D.	N.D.	N.D.	N.D.	0.57	1.93	N.D.	1.41	2.51
EAST GREENWICH	P	N.D.	N.D.	N.D.	N.D.	N.D.	59.0	N.D.	175	182
	S	N.D.	N.D.	N.D.	N.D.	N.D.	6.30	N.D.	3.46	3.49
EAST PROVIDENCE	P	N.D.	N.D.	N.D.	N.D.	N.D.	2.00	N.D.	4.66	6.82
FIELD'S POINT	P	N.D.	N.D.	N.D.	N.D.	N.D.	18.0	N.D.	68.5	83.5
	S	N.D.	N.D.	N.D.	N.D.	1.53	5.03	N.D.	4.45	10.0
FALL RIVER	P	N.D.	N.D.	N.D.	N.D.	N.D.	11.9	3.83	18.1	35.0
NARR. ELECTRIC	P	N.D.	N.D.	N.D.	N.D.	N.D.	0.64	N.D.	N.D.	0.41
NEWPORT	P	N.D.	N.D.	N.D.	N.D.	N.D.	66.5	N.D.	468	488
	S	N.D.	N.D.	N.D.	N.D.	N.D.	9.11	N.D.	1.74	2.72
WARREN	P	N.D.	N.D.	N.D.	N.D.	N.D.	1.02	N.D.	1.62	2.56
JAMESTOWN		N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.
QUONSET POINT		N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.

N.C.= Not collected P= Particulate S= Soluble
N.D.= Not detected

TableA-6. Concentrations of organics in rivers and point sources discharging into Narragansett Bay (November 18-21, 1985).

RIVERS		SS (MG/L)	PCBs (NG/L) Ar 1242	Ar 1254	Ar 1260	Total
PAWTUXET	P	8.08	N.D.	4.29	2.45	6.74
	S		N.D.	N.D.	N.D.	N.D.
MOSHASSUCK	P	4.09	N.D.	5.06	5.16	10.2
WOONASQUATUCKET	P	4.81	N.D.	6.60	5.07	11.7
BLACKSTONE	P	7.66	N.D.	11.6	13.4	25.0
	S		N.D.	N.D.	N.D.	N.D.
TAUNTON	P	3.99	N.D.	2.18	N.D.	2.18
	S		N.D.	N.D.	N.D.	N.D.

POINT SOURCES		SS (MG/L)	PCBs (NG/L) Ar 1242	Ar 1254	Ar 1260	Total
BRISTOL	P	47.7	37.5	78.8	N.D.	116
BLACKSTONE VAL.	P	31.0	49.1	33.1	N.D.	82.2
	S		N.D.	N.D.	N.D.	N.D.
EAST GREENWICH	P	75.3	75.8	75.6	N.D.	151
	S		N.D.	N.D.	N.D.	N.D.
EAST PROVIDENCE	P	10.8	N.D.	9.05	N.D.	9.05
FIELD'S POINT	P	32.1	N.D.	66.2	N.D.	66.2
	S		N.D.	N.D.	N.D.	N.D.
FALL RIVER	P	14.8	N.D.	N.D.	N.D.	N.D.
NARR. ELECTRIC	P	1.87	N.D.	N.D.	N.D.	N.D.
NEWPORT	P	61.7	N.D.	50.4	N.D.	50.4
WARREN	P	37.1	N.D.	21.4	N.D.	21.4
JAMESTOWN	P	16.5	N.D.	22.3	N.D.	22.3
QUONSET POINT	P	42.4	N.D.	37.0	N.D.	37.0

P= Particulate S= Soluble

N.D.= Not detected

Table A-7 Concentrations of organics in rivers and point sources discharging into Narragansett Bay (November 18-21, 1985).

RIVERS		PCB Congeners (NG/L)									
		101	151	153	138	180	170	201	195	194	209
PAWTUXET	P	0.388	0.130	0.209	0.327	0.173	0.137	0.285	0.067	0.048	0.179
	S	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
MOSHASSUCK	P	0.520	0.223	0.444	0.647	0.295	0.278	0.274	0.038	0.107	0.069
WOONASQUATUCKET	P	0.781	0.263	0.554	0.843	0.536	0.282	0.352	0.127	0.103	0.115
BLACKSTONE	P	0.922	0.375	0.893	1.193	1.289	0.533	0.737	0.131	0.430	0.184
	S	0.245	0.054	0.078	0.086	0.051	0.024	0.036	0.010	0.014	0.006
TAUNTON	P	0.252	0.079	0.109	0.150	0.094	0.031	0.276	0.108	0.038	0.048
	S	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.

POINT SOURCES		PCB Congeners (NG/L)									
		101	151	153	138	180	170	201	195	194	209
BRISTOL	P	6.57	1.54	1.72	3.39	0.537	0.471	0.564	0.293	0.233	N.D.
BLACKSTONE VAL.	P	2.54	0.487	0.622	1.42	N.D.	0.263	0.531	0.183	0.142	N.D.
	S	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
EAST GREENWICH	P	7.38	1.82	0.443	N.D.	0.770	0.498	1.11	0.378	0.241	N.D.
	S	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
EAST PROVIDENCE	P	0.979	0.299	0.370	0.634	0.312	0.148	0.679	0.237	0.130	N.D.
FIELD'S POINT	P	5.56	1.60	2.54	4.55	1.59	0.957	0.871	0.139	0.332	N.D.
	S	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
FALL RIVER	P	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
NARR. ELECTRIC	P	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
NEWPORT	P	5.41	N.D.	1.12	2.40	0.760	0.656	1.04	0.347	0.709	N.D.
WARREN	P	2.08	0.495	0.789	1.32	0.477	0.280	0.750	0.277	0.231	0.148
JAMESTOWN	P	2.50	N.D.	0.600	1.32	0.308	0.392	N.D.	N.D.	N.D.	N.D.
QUONSET POINT	P	3.06	0.966	1.24	2.02	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.

P= Particulate S= Soluble

N.D.= Not detected

TableA-8. Concentrations of organics in rivers and point sources discharging into Narragansett Bay (November 18-21, 1985).

RIVERS		HCHs (NG/L)				Hydrocarbons (UG/L)		
		a	b	g	Total	F1-UCM	F1-RES	Tot F1
PAWTUXET	P	N.D.	N.D.	N.D.	N.D.	54.0	2.03	56.0
	S	0.182	0.130	1.299	1.611	4.21	0.99	5.20
MOSHASSUCK	P	N.D.	N.D.	N.D.	N.D.	19.8	1.64	21.4
WOONASQUATUCKET	P	0.014	N.D.	0.017	0.031	21.1	1.06	22.2
BLACKSTONE	P	N.D.	N.D.	N.D.	N.D.	57.5	1.56	59.1
	S	N.D.	N.D.	N.D.	N.D.	2.77	0.18	2.95
TAUNTON	P	0.420	N.D.	N.D.	0.420	6.00	0.38	6.38
	S	0.786	N.D.	0.610	1.40	0.56	0.23	0.79

POINT SOURCES		HCHs (NG/L)				Hydrocarbons (UG/L)		
		a	b	g	Total	F1-UCM	F1-RES	Tot F1
BRISTOL	P	N.D.	N.D.	N.D.	N.D.	449	51.4	500
BLACKSTONE VAL.	P	N.D.	N.D.	1.36	1.36	460	24.9	485
	S	0.334	0.276	5.94	6.55	4.33	2.5	6.83
EAST GREENWICH	P	N.D.	N.D.	N.D.	N.D.	1930	86.1	2016
	S	0.679	N.D.	3.80	4.48	128	6.86	135
EAST PROVIDENCE	P	N.D.	N.D.	N.D.	N.D.	50.1	3.91	54.0
FIELD'S POINT	P	N.D.	N.D.	N.D.	N.D.	794	30.2	824
	S	N.D.	N.D.	19.7	19.7	49.4	5.20	54.6
FALL RIVER	P	N.D.	N.D.	N.D.	N.D.	321	18.3	339
NARR. ELECTRIC	P	N.D.	N.D.	N.D.	N.D.	4.05	0.60	4.65
NEWPORT	P	N.D.	N.D.	N.D.	N.D.	393	57.0	450
WARREN	P	0.056	N.D.	0.296	0.352	242	13.8	256
JAMESTOWN	P	N.D.	N.D.	N.D.	N.D.	97.3	7.52	105
QUONSET POINT	P	N.D.	N.D.	N.D.	N.D.	355	33.1	388

P= Particulate S= Soluble

N.D.= Not detected

TableA-9. Concentrations of organics in rivers and point sources discharging into Narragansett Bay (November 18-21, 1985).

RIVERS		PAHs (NG/L)														
		Nap	AcL	Acn	Flu	Phe	Ane	Flr	Pyr	BaA	Chr	B(b+k)F	BaP	InP	DbA	Bpr
PAWTUXET	P	1.36	1.15	1.26	N.D.	12.0	1.24	40.5	35.8	23.9	34.6	51.7	8.90	10.8	3.85	28.3
	S	N.D	N.D	N.D	N.D	30.0	N.D	42.4	33.7	N.D	9.7	19.20	N.D	N.D	N.D	N.D
MOSHASSUCK	P	3.89	N.D.	N.D.	N.D.	6.70	N.D.	21.8	20.1	7.07	16.8	26.2	10.1	8.88	4.22	14.7
WOONASQUATUCKET	P	1.74	N.D.	N.D.	N.D.	7.06	1.11	21.6	18.0	8.17	17.1	24.9	4.33	7.70	2.62	25.2
BLACKSTONE	P	2.90	2.75	1.42	1.91	22.8	3.62	60.2	50.7	19.2	53.3	91.2	31.8	32.4	20.8	71.9
	S	2.6	N.D.	N.D.	N.D.	12.7	N.D.	22.3	28.8	1.62	10.0	11.20	N.D.	N.D.	N.D.	N.D.
TAUNTON	P	[illegible]	N.D.	4.85	6.58	368	7.25	629	418	54.4	272	358	69.8	63.2	28.0	86.3
	S	93.4	N.D.	46.7	37.4	761	10.5	591	370	17.0	81.6	32.4	3.79	1.80	N.D.	2.94

POINT SOURCES		PAHs (NG/L)														
		Nap	AcL	Acn	Flu	Phe	Ane	Flr	Pyr	BaA	Chr	B(b+k)F	BaP	InP	DbA	Bpr
BRISTOL	P	8.71	N.D.	N.D.	N.D.	75.5	N.D.	52.8	105	41.5	19.6	27.9	N.D.	N.D.	N.D.	N.D.
BLACKSTONE VAL.	P	8.80	N.D.	N.D.	N.D.	51.6	N.D.	92.9	120	46.7	67.1	38.4	N.D.	7.90	N.D.	N.D.
	S	65.3	N.D.	N.D.	N.D.	N.D.	N.D.	31.5	33.2	N.D.	110	261	N.D.	N.D.	N.D.	N.D.
EAST GREENWICH	P	0.00	N.D.	N.D.	N.D.	161	N.D.	130	369	29.3	54.7	65.4	N.D.	74.7	N.D.	N.D.
	S	208	N.D.	102	33.7	143	23.3	35.3	60.4	14.7	10.2	N.D.	N.D.	N.D.	N.D.	N.D.
EAST PROVIDENCE	P	2.79	N.D.	N.D.	N.D.	5.87	N.D.	4.28	10.7	3.82	6.35	5.10	N.D.	N.D.	N.D.	N.D.
FIELDS POINT	P	0.00	N.D.	N.D.	N.D.	62.9	N.D.	102	188	0.00	31.1	45.5	N.D.	N.D.	N.D.	N.D.
	S	225	N.D.	N.D.	80.5	121	N.D.	33.4	51.7	N.D.	12.0	N.D.	N.D.	N.D.	N.D.	N.D.
FALL RIVER	P	151	N.D.	N.D.	11.5	83.9	N.D.	42.1	71.9	0.00	14.4	11.3	N.D.	N.D.	N.D.	N.D.
NARR. ELECTRIC	P	0.30	N.D.	0.96	0.76	5.92	0.87	10.1	10.2	3.47	15.4	10.1	N.D.	4.33	N.D.	N.D.
NEWPORT	P	4.97	N.D.	10.2	20.1	192	N.D.	138	154	74.5	64.7	0.00	N.D.	N.D.	N.D.	N.D.
WARREN	P	17.9	N.D.	N.D.	N.D.	46.0	N.D.	50.9	93.3	14.9	36.5	72.8	N.D.	N.D.	N.D.	N.D.
JAMESTOWN	P	6.04	N.D.	N.D.	N.D.	69.4	N.D.	73.0	91.7	16.5	22.5	32.3	19.9	12.3	N.D.	N.D.
QUONSET POINT	P	10.6	N.D.	N.D.	N.D.	87.7	N.D.	112	113	43.8	52.6	39.9	N.D.	N.D.	N.D.	N.D.

P= Particulate S= Soluble

N.D.= Not detected

Table A-10. Concentrations of organics in rivers and point sources discharging into Narragansett Bay (November 18-21, 1985).

RIVERS		BZTs (NG/L)			Phthalates (UG/L)				Sterols (UG/L)
		C10	CL	C1	DBP	BBP	DEHP	DOP	Cop
PAWTUXET	P	18.0	1.71	700	N.D.	N.D.	3.13	N.D.	2.22
	S	N.D.	N.D.	5310	N.D.	N.D.	0.34	1.09	0.12
MOSHASSUCK	P	N.D.	N.D.	190	N.D.	N.D.	1.56	N.D.	2.63
WOONASQUATUCKET	P	N.D.	N.D.	N.D.	N.D.	1.73	0.61	0.22	2.10
BLACKSTONE	P	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.04
	S	N.D.	N.D.	N.D.	N.D.	0.26	2.60	5.03	0.53
TAUNTON	P	N.D.	N.D.	N.D.	N.D.	0.12	5.14	N.D.	0.30
	S	N.D.	N.D.	N.D.	N.D.	0.04	0.85	0.24	N.D.

POINT SOURCES		BZTs (NG/L)			Phthalates (UG/L)				Sterols (UG/L)
		C10	CL	C1	DBP	BBP	DEHP	DOP	Cop
BRISTOL	P	N.D.	N.D.	N.D.	N.D.	56.7	72.0	N.D.	281
BLACKSTONE VAL.	P	N.D.	N.D.	N.D.	N.D.	5.38	29.9	2.17	22.3
	S	N.D.	N.D.	N.D.	N.D.	0.07	0.06	N.D.	0.06
EAST GREENWICH	P	N.D.	N.D.	N.D.	N.D.	59.1	72.4	N.D.	137
	S	N.D.	N.D.	N.D.	N.D.	0.69	4.79	0.67	1.53
EAST PROVIDENCE	P	N.D.	N.D.	1220	N.D.	N.D.	37.4	0.14	5.33
FIELD'S POINT	P	N.D.	N.D.	N.D.	N.D.	9.34	48.4	N.D.	32.6
	S	N.D.	N.D.	N.D.	N.D.	2.28	3.12	2.11	0.46
FALL RIVER	P	N.D.	N.D.	N.D.	N.D.	5.07	16.0	N.D.	11.3
NARR. ELECTRIC	P	N.D.	N.D.	150	N.D.	0.17	21.3	N.D.	0.49
NEWPORT	P	N.D.	N.D.	N.D.	N.D.	90.6	44.7	N.D.	355
WARREN	P	N.D.	N.D.	N.D.	N.D.	7.18	24.6	0.45	27.7
JAMESTOWN	P	N.D.	N.D.	N.D.	N.D.	N.D.	7.45	N.D.	7.69
QUONSET POINT	P	N.D.	N.D.	N.D.	N.D.	N.D.	40.5	N.D.	171

P= Particulate S= Soluble

N.D.= Not detected

Table A-11. Concentrations of organics in rivers and point sources discharging into Narragansett Bay (April 7-10, 1986).

RIVERS		SS (MG/L)	PCBs (NG/L) Ar 1242	Ar 1254	Ar 1260	Total
PAWTUXET	P	7.25	N.D.	3.23	1.46	4.69
	S		N.D.	N.D.	N.D.	N.D.
MOSHASSUCK	P	13.20	N.D.	13.6	N.D.	13.6
	S		28.6	11.6	N.D.	40.2
WOONASQUATUCKET	P	9.79	N.D.	13.80	7.01	20.8
BLACKSTONE	P	4.31	N.D.	4.86	5.37	10.2
	S		0.35	0.25	N.D.	0.60
TAUNTON	P	5.50	N.D.	3.08	N.D.	3.08
	S		N.D.	N.D.	N.D.	N.D.

POINT SOURCES		SS (MG/L)	PCBs (NG/L) Ar 1242	Ar 1254	Ar 1260	Total
BRISTOL	P	47.50	N.D.	47.2	N.D.	47.2
BLACKSTONE VAL.	P	40.00	N.D.	37.8	N.D.	37.8
	S		8.90	N.D.	N.D.	8.90
EAST GREENWICH	P	134.00	N.D.	64.0	N.D.	64.0
EAST PROVIDENCE	P	12.50	N.D.	11.3	N.D.	11.3
FIELD'S POINT	P	30.00	N.D.	N.D.	N.D.	N.D.
	S		N.D.	N.D.	N.D.	N.D.
FALL RIVER	P	23.90	N.D.	N.D.	N.D.	N.D.
	S		N.D.	N.D.	N.D.	N.D.
NARR. ELECTRIC	P	2.38	N.D.	4.40	N.D.	4.40
NEWPORT	P	71.90	N.D.	N.D.	N.D.	N.D.
WARREN	P	42.20	N.D.	N.D.	N.D.	N.D.
JAMESTOWN	P	6.42	N.D.	4.72	N.D.	4.72
QUONSET POINT	P	56.30	N.D.	70.0	N.D.	70.0

P= Particulate S= Soluble

N.D.= Not detected

Table A-12 Concentrations of organics in rivers and point sources discharging into Narragansett Bay (April 7-10, 1986).

RIVERS		PCB Congeners (NG/L)									
		101	151	153	138	180	170	201	195	194	209
PAWTUXET	P	0.667	0.206	0.000	0.153	0.586	0.142	0.338	0.144	0.060	0.104
	S	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
MOSHASSUCK	P	0.827	0.233	0.477	0.918	0.466	0.545	0.309	0.104	0.128	0.153
	S	1.847	0.641	0.552	0.718	0.204	N.D.	N.D.	N.D.	N.D.	N.D.
WOONASQUATUCKET	P	1.145	0.319	0.762	1.199	0.698	0.371	0.403	0.122	0.126	0.102
BLACKSTONE	P	0.415	0.208	0.362	0.504	0.497	0.190	0.473	0.151	0.199	0.078
	S	0.031	0.007	0.013	0.014	0.008	0.003	0.006	0.002	0.003	0.002
TAUNTON	P	0.373	N.D.	N.D.	N.D.	0.377	0.092	0.194	0.092	0.036	0.067
	S	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.

POINT SOURCES		PCB Congeners (NG/L)									
		101	151	153	138	180	170	201	195	194	209
BRISTOL	P	5.278	2.582	N.D.	1.966	N.D.	N.D.	1.139	N.D.	N.D.	N.D.
BLACKSTONE VAL.	P	8.145	N.D.	N.D.	N.D.	3.284	N.D.	N.D.	N.D.	N.D.	N.D.
	S	0.230	N.D.	0.313	0.236	0.237	0.067	0.277	0.029	0.034	N.D.
EAST GREENWICH	P	6.201	1.845	3.660	5.228	1.729	0.797	2.289	N.D.	N.D.	N.D.
EAST PROVIDENCE	P	1.172	0.391	0.570	0.761	0.393	0.134	0.909	0.293	0.141	0.079
FIELD'S POINT	P	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	S	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
FALL RIVER	P	1.602	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	S	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
NARR. ELECTRIC	P	0.420	0.142	0.227	0.348	0.258	0.084	0.434	0.140	0.064	0.049
NEWPORT	P	N.D.	N.D.	N.D.	N.D.	4.622	N.D.	N.D.	N.D.	N.D.	N.D.
WARREN	P	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
JAMESTOWN	P	0.429	0.163	0.248	0.344	0.170	0.055	0.274	0.090	0.058	N.D.
QUONSET POINT	P	6.862	4.966	3.547	17.857	2.344	1.015	2.084	N.D.	N.D.	N.D.

P= Particulate S= Soluble

N.D.= Not detected

Table A-13 Concentrations of organics in rivers and point sources discharging into Narragansett Bay (April 7-10, 1986).

RIVERS		HCHs (NG/L)				Hydrocarbons (UG/L)		
		a	b	g	Total	F1-UCM	F1-RES	Tot F1
PAWTUXET	P	N/A	N/A	N/A	N/A	64.3	3.90	68.2
	S	0.587	N.D.	1.219	1.806	1.89	0.12	2.01
MOSHASSUCK	P	N/A	N/A	N/A	N/A	180	7.70	188
	S	0.547	N.D.	0.210	0.757	4.21	0.44	4.66
WOONASQUATUCKET	P	N/A	N/A	N/A	N/A	135	5.55	141
BLACKSTONE	P	N/A	N/A	N/A	N/A	34.9	1.89	36.8
	S	N/A	N/A	N/A	N/A	2.05	0.06	2.11
TAUNTON	P	N/A	N/A	N/A	N/A	22.6	1.44	24.0
	S	0.382	N.D.	0.611	0.993	0.20	1.75	1.94

POINT SOURCES		HCHs (NG/L)				Hydrocarbons (UG/L)		
		a	b	g	Total	F1-UCM	F1-RES	Tot F1
BRISTOL	P	N/A	N/A	N/A	N/A	660	108.2	768
BLACKSTONE VAL.	P	N/A	N/A	N/A	N/A	435	24.6	459
	S	N.D.	N.D.	2.932	2.932	26.7	N.D.	26.7
EAST GREENWICH	P	N/A	N/A	N/A	N/A	4142	176.0	4318
EAST PROVIDENCE	P	N/A	N/A	N/A	N/A	113	3.65	116
FIELD'S POINT	P	N/A	N/A	N/A	N/A	751	38.8	790
	S	N.D.	N.D.	3.150	3.150	41.9	12.1	54.1
FALL RIVER	P	N/A	N/A	N/A	N/A	361	21.0	382
	S	0.556	N.D.	3.318	3.874	100	15.70	115
NARR. ELECTRIC	P	N/A	N/A	N/A	N/A	12.1	1.70	13.8
NEWPORT	P	N/A	N/A	N/A	N/A	533	78.4	611
WARREN	P	N/A	N/A	N/A	N/A	230	16.0	246
JAMESTOWN	P	N/A	N/A	N/A	N/A	35.2	1.64	36.9
QUONSET POINT	P	N/A	N/A	N/A	N/A	610	43.1	653

N.D.= Not detected
P= Particulate S= Soluble
N/A= Not analyzed

Table A-14 Concentrations of organics in rivers and point sources discharging into Narragansett Bay (April 7-10, 1986).

RIVERS		PAHs (NG/L)														
		Nap	AcL	Acn	Flu	Phe	Ane	Flr	Pyr	BaA	Chr	B(b+k)F	BaP	InP	DbA	Bpr
PAWTUXET	P	1.80	N.D.	1.52	1.88	28.6	3.41	54.5	49.7	17.4	35.3	43.0	13.8	13.8	5.02	25.9
	S	65.1	N.D.	N.D.	25.4	64.4	N.D.	31.8	27.1	N.D.	N.D.	N.D.	N.D.	1.40	N.D.	N.D.
MOSHASSUCK	P	8.06	N.D.	7.5	8.47	119	12.9	251	219	85.0	122	174	64.2	47.0	14.3	71.1
	S	7.88	N.D.	11.9	14.4	33.8	5.41	63.8	54.4	2.9	10.8	6.63	N.D.	N.D.	N.D.	N.D.
WOONASQUATUCKET	P	4.32	2.49	4.11	4.31	62.9	7.65	157	119	57.5	74.9	129.0	49.5	48.8	13.2	29.1
BLACKSTONE	P	2.28	N.D.	N.D.	1.62	16.2	2.95	29.7	28.1	12.3	19.6	25.1	9.61	7.11	2.64	12.4
	S	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	10.8	17.2	N.D.	11.2	N.D.	N.D.	N.D.	N.D.	N.D.
TAUNTON	P	N.D.	N.D.	N.D.	1.36	13.9	N.D.	28.9	24.3	10.3	15.1	21.3	6.60	6.74	2.75	13
	S	21.4	N.D.	15.2	5.9	9.7	N.D.	11.2	13.9	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N

POINT SOURCES		PAHs (NG/L)														
		Nap	AcL	Acn	Flu	Phe	Ane	Flr	Pyr	BaA	Chr	B(b+k)F	BaP	InP	DbA	Bpr
BRISTOL	P	N.D.	N.D.	N.D.	N.D.	85.0	N.D.	97.4	122	72.5	104	32.1	N.D.	9.24	N.D.	N.D.
BLACKSTONE VAL.	P	7.79	N.D.	N.D.	N.D.	31.6	N.D.	99.2	93.2	21.4	49.3	54.0	25.8	15.3	N.D.	N.D.
	S	58.8	N.D.	N.D.	N.D.	44.9	N.D.	57.4	66.1	N.D.	N.D.	458	N.D.	N.D.	N.D.	N.D.
EAST GREENWICH	P	23.7	N.D.	32.5	N.D.	294	N.D.	189	282	93.8	103	158	N.D.	48.8	N.D.	N.D.
EAST PROVIDENCE	P	4.1	N.D.	N.D.	N.D.	11.3	N.D.	25.3	29.1	3.82	19.7	31.0	N.D.	5.11	N.D.	N.D.
FIELDS POINT	P	12.2	N.D.	N.D.	N.D.	253	N.D.	220	208	38.0	94.3	68.4	26.7	21.5	N.D.	N.D.
	S	1339	N.D.	655	813	816	90.6	152	99.0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
FALL RIVER	P	296	N.D.	9.26	27.0	109	13.5	60.8	65.8	22.6	34.7	38.1	19.0	29.4	N.D.	N.D.
	S	2840	N.D.	250	321	398	113	71.1	66.1	35.8	N.D.	55.4	N.D.	N.D.	N.D.	N.D.
NARR. ELECTRIC	P	N.D.	N.D.	1.52	N.D.	6.74	N.D.	10.3	12.0	N.D.	4.32	3.64	N.D.	N.D.	N.D.	N.D.
NEWPORT	P	5.16	N.D.	5.31	11.7	101	11.5	73.2	86.7	108	49.5	N.D.	N.D.	N.D.	N.D.	N.D.
WARREN	P	54.8	N.D.	N.D.	N.D.	127	10.7	84.1	88.2	N.D.	23.8	44.5	N.D.	N.D.	N.D.	N.D.
JAMESTOWN	P	2.29	N.D.	N.D.	N.D.	34.2	N.D.	47.2	38.0	8.05	36.8	51.9	N.D.	N.D.	N.D.	N.D.
QUONSET POINT	P	12.5	N.D.	N.D.	12.2	130	N.D.	893	236	65.5	85.9	122	62.1	39.2	N.D.	N.D.

P= Particulate S= Soluble

N.D.= Not detected

TableA-15 Concentrations of organics in rivers and point sources discharging into Narragansett Bay (April 7-10, 1986).

RIVERS		BZTs (NG/L)			Phthalates (UG/L)				Sterols (UG/L)
		C10	CL	C1	DBP	BBP	DEHP	DOP	Cop
PAWTUXET	P	N.D.	N.D.	N.D.	N.D.	0.07	0.37	N.D.	5.96
	S	N.D.	N.D.	N.D.	N.D.	0.24	0.21	0.08	0.28
MOSHASSUCK	P	N.D.	N.D.	N.D.	N.D.	N.D.	0.43	N.D.	1.06
	S	N.D.	N.D.	N.D.	N.D.	0.18	0.21	N.D.	0.10
WOONASQUATUCKET	P	N.D.	N.D.	N.D.	N.D.	0.06	0.50	N.D.	3.63
BLACKSTONE	P	N.D.	N.D.	N.D.	N.D.	N.D.	0.37	N.D.	0.61
	S	N.D.	N.D.	N.D.	N.D.	0.12	0.37	N.D.	0.07
TAUNTON	P	N.D.	N.D.	N.D.	N.D.	N.D.	0.15	N.D.	0.53
	S	N.D.	N.D.	N.D.	N.D.	0.06	0.22	0.20	0.14

POINT SOURCES		BZTs (NG/L)			Phthalates (UG/L)				Sterols (UG/L)
		C10	CL	C1	DBP	BBP	DEHP	DOP	Cop
BRISTOL	P	N.D.	N.D.	N.D.	N.D.	10.8	5.97	2.39	106
BLACKSTONE VAL.	P	N.D.	N.D.	N.D.	N.D.	2.35	2.32	0.56	6.08
	S	N.D.	N.D.	N.D.	N.D.	2.34	3.60	0.94	1.37
EAST GREENWICH	P	N.D.	N.D.	N.D.	N.D.	N.D.	23.6	N.D.	101
EAST PROVIDENCE	P	N.D.	N.D.	N.D.	N.D.	0.19	0.18	N.D.	5.28
FIELD'S POINT	P	N.D.	N.D.	N.D.	N.D.	1.23	1.84	3.07	15.3
	S	N.D.	N.D.	N.D.	N.D.	8.29	2.81	N.D.	2.92
FALL RIVER	P	N.D.	N.D.	N.D.	N.D.	1.87	4.67	N.D.	11.0
	S	N.D.	N.D.	N.D.	N.D.	1.24	1.96	N.D.	1.82
NARR. ELECTRIC	P	N.D.	N.D.	N.D.	1.79	N.D.	14.2	N.D.	0.30
NEWPORT	P	N.D.	N.D.	N.D.	N.D.	3.54	18.98	N.D.	133
WARREN	P	N.D.	N.D.	N.D.	N.D.	N.D.	1.84	N.D.	16.7
JAMESTOWN	P	N.D.	N.D.	360	N.D.	0.14	0.23	N.D.	3.55
QUONSET POINT	P	N.D.	N.D.	N.D.	N.D.	4.03	2.99	N.D.	126

P= Particulate S= Soluble

N.D.= Not detected

Table A-16 Concentrations of organics in rivers and point sources discharging into Narragansett Bay (May 19-22, 1986).

RIVERS		SS (MG/L)	PCBs (NG/L) Ar 1242	Ar 1254	Ar 1260	Total
PAWTUXET A-C	P	5.89	N.D.	5.51	N.D.	5.51
	S		0.46	N.D.	N.D.	0.46
PAWTUXET D	P	67.6	30.1	66.7	27.4	124
	S		N.D.	N.D.	N.D.	N.D.
MOSHASSUCK A-C	P	7.23	4.38	9.54	N.D.	13.9
MOSHASSUCK D	P	88.1	52.9	179	179	410
WOONASQUA A-C	P	7.82	4.57	12.5	10.6	27.7
WOONASQUA D	P	45.0	5.37	15.6	9.94	30.9
BLACKSTONE A-C	P	6.89	5.48	16.7	8.34	30.5
	S		0.30	0.54	N.D.	0.84
BLACKSTONE D	P	13.8	N.D.	20.9	N.D.	20.9
	S		0.68	0.46	N.D.	1.14
TAUNTON	P	6.12	2.16	3.28	N.D.	5.44

POINT SOURCES		SS (MG/L)	PCBs (NG/L) Ar 1242	Ar 1254	Ar 1260	Total
BRISTOL	P	80.8	N.D.	60.9	N.D.	61
BLACKSTONE VAL.	P	109	112	74.9	N.D.	187
	S		N.D.	N.D.	N.D.	N.D.
EAST GREENWICH	P	78.7	N.D.	N.D.	N.D.	N.D.
	S		N.D.	N.D.	N.D.	N.D.
EAST PROVIDENCE	P	20.0	N.D.	15.0	N.D.	15.0
FIELD'S POINT	P	59.2	-	-	-	-
	S		N.D.	N.D.	N.D.	N.D.
FALL RIVER	P	34.4	N.D.	N.D.	N.D.	N.D.
NARR. ELECTRIC	P	5.77	3.22	7.86	N.D.	11.1
NEWPORT	P	145	N.D.	65.0	N.D.	65.0
WARREN	P	58.9	N.D.	39.1	N.D.	39.1
JAMESTOWN	P	9.36	N.D.	10.6	N.D.	10.6
QUONSET POINT	P	67.7	94.1	104	N.D.	198

- = Sample lost   P= Particulate S= Soluble
N.D.= Not detected

Table A-17 Concentrations of organics in rivers and point sources discharging into Narragansett Bay (May 19-22, 1986).

RIVERS		PCB Congeners (NG/L)									
		101	151	153	138	180	170	201	195	194	209
PAWTUXET A-C	P	0.425	0.158	0.229	0.318	0.137	0.067	0.257	0.094	0.051	0.092
	S	0.031	0.006	0.006	0.009	0.001	N.D.	0.001	N.D.	N.D.	N.D.
PAWTUXET D	P	4.682	1.874	2.835	4.086	2.691	1.350	1.795	0.617	0.570	1.067
	S	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
MOSHASSUCK A-C	P	0.887	0.305	0.479	0.687	0.137	0.139	0.367	0.113	0.072	0.055
MOSHASSUCK D	P	15.881	4.552	7.492	12.264	3.140	2.174	2.023	0.528	0.681	0.741
WOONASQUA A-C	P	1.319	0.629	1.257	1.633	0.930	0.548	0.496	0.144	0.157	0.088
WOONASQUA D	P	1.377	0.513	1.164	1.595	0.805	0.508	0.308	0.071	0.151	0.081
BLACKSTONE A-C	P	1.349	0.533	0.768	1.029	0.655	0.275	0.579	0.150	0.186	0.210
	S	0.050	0.011	0.015	0.016	0.005	0.003	0.002	N.D.	0.001	0.001
BLACKSTONE D	P	1.842	0.549	1.053	1.283	N.D.	N.D.	N.D.	0.230	0.208	N.D.
	S	0.034	0.005	0.008	0.010	0.006	0.004	0.001	0.000	0.001	0.005
TAUNTON	P	0.407	0.142	0.181	0.212	0.113	0.042	0.275	0.093	0.041	0.040

POINT SOURCES		PCB Congeners (NG/L)									
		101	151	153	138	180	170	201	195	194	209
BRISTOL	P	4.87	1.64	3.08	4.24	1.790	0.880	1.621	0.347	0.812	N.D.
BLACKSTONE VAL.	P	5.92	2.199	2.638	4.46	1.70	0.733	1.524	0.357	0.864	N.D.
	S	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
EAST GREENWICH	P	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	S	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
EAST PROVIDENCE	P	1.454	0.427	0.704	0.903	0.332	0.127	0.435	0.128	0.130	N.D.
FIELD'S POINT	P										
	S	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
FALL RIVER	P	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
NARR. ELECTRIC	P	0.663	0.216	0.438	0.538	0.312	0.136	0.305	0.113	0.094	0.08
NEWPORT	P	6.45	2.04	3.52	4.83	2.815	0.817	2.44	0.760	3.023	0.63
WARREN	P	4.01	1.098	1.668	2.27	0.879	0.299	0.981	0.348	0.368	N.D.
JAMESTOWN	P	0.900	0.300	0.450	0.700	0.237	0.043	0.400	0.168	0.133	0.06
QUONSET POINT	P	9.29	3.068	3.79	6.04	2.79	1.15	2.35	0.58	1.01	0.16

P= Particulate S= Soluble

N.D.= Not detected

TableA-13. Concentrations of organics in rivers and point sources discharging into Narragansett Bay (May 19-22, 1986).

RIVERS		HCHs (NG/L)				Hydrocarbons (UG/L)		
		a	b	g	Total	F1-UCM	F1-RES	Tot F1
PAWTUXET A-C	P	N/A	N/A	N/A	N/A	39.5	1.73	41.2
	S	N.D.	N.D.	0.443	0.443	1.90	0.41	2.31
PAWTUXET D	P	N/A	N/A	N/A	N/A	806	15.1	821
	S	0.388	N.D.	1.483	1.871	1.88	0.18	2.06
MOSHASSUCK A-C	P	N/A	N/A	N/A	N/A	37.7	1.61	39.3
MOSHASSUCK D	P	N/A	N/A	N/A	N/A	999	31.8	1031
WOONASQUA A-C	P	N/A	N/A	N/A	N/A	25.8	1.12	26.9
WOONASQUA D	P	N/A	N/A	N/A	N/A	932	21.3	953
BLACKSTONE A-C	P	N/A	N/A	N/A	N/A	44.9	0.61	45.5
	S	0.537	0.086	1.617	2.240	0.71	0.01	0.72
BLACKSTONE D	P	N/A	N/A	N/A	N/A	308	10.3	318
	S	0.518	0.089	1.587	2.194	3.83	0.02	3.85
TAUNTON	P	N/A	N/A	N/A	N/A	20.6	1.38	22.0

POINT SOURCES		HCHs (NG/L)				Hydrocarbons (UG/L)		
		a	b	g	Total	F1-UCM	F1-RES	Tot F1
BRISTOL	P	N/A	N/A	N/A	N/A	3033	146.0	3179
BLACKSTONE VAL.	P	N/A	N/A	N/A	N/A	2109	97.3	2206
	S	N.D.	N.D.	4.92	4.92	2.78	0.06	2.84
EAST GREENWICH	P	N/A	N/A	N/A	N/A	888	26.5	915
	S	N.D.	N.D.	1.10	1.10	19.7	0.47	20.2
EAST PROVIDENCE	P	N/A	N/A	N/A	N/A	194	4.84	199
FIELD'S POINT	P	N/A	N/A	N/A	N/A	1440	52.9	1493
	S	N.D.	N.D.	13.4	13.4	36.0	2.38	38.4
FALL RIVER	P	N/A	N/A	N/A	N/A	900	23.6	924
NARR. ELECTRIC	P	N/A	N/A	N/A	N/A	59.0	0.23	59.2
NEWPORT	P	N/A	N/A	N/A	N/A	1484	133	1617
WARREN	P	N/A	N/A	N/A	N/A	342	10.4	352
JAMESTOWN	P	N/A	N/A	N/A	N/A	62.3	1.94	64
QUONSET POINT	P	N/A	N/A	N/A	N/A	800	37.2	837

N/A= Not analyzed P= Particulate S= Soluble
N.D.= Not detected

TableA-19. Concentrations of organics in rivers and point sources discharging into Narragansett Bay (May 19-22, 1986).

RIVERS		PAHs (NG/L)														
		Nap	AcL	Acn	Flu	Phe	Ane	Flr	Pyr	BaA	Chr	B(b+k)F	BaP	InP	DbA	Bpr
PAWTUXET A-C	P	N.D.	N.D.	N.D.	N.D.	5.19	N.D.	14.5	31.6	27.3	63.3	146	49.1	N.D.	N.D.	69.6
	S	N.D.	N.D.	N.D.	N.D.	12.0	N.D.	22.0	26.8	N.D.	3.09	10.40	N.D.	N.D.	N.D.	N.D.
PAWTUXET D	P	N.D.	N.D.	N.D.	N.D.	274	305	603	575	167	379	758	332	255	62.3	26.6
	S	N.D.	N.D.	N.D.	N.D.	88.5	N.D.	48.8	37.0	N.D.	61.2	191	N.D.	N.D.	N.D.	N.D.
MOSHASSUCK A-C	P	N.D.	N.D.	N.D.	N.D.	28.3	N.D.	57.8	51.2	22.3	48.1	90.8	36.3	42.7	N.D.	58.0
MOSHASSUCK D	P	D.	N.D.	N.D.	N.D.	644	89.2	1196	983	355	721	1232	533	429	96.5	583
WOONASQUA A-C	P	N.D.	N.D.	N.D.	N.D.	10.4	N.D.	19.2	14.8	6.33	12.9	26.7	11.3	7.70	N.D.	10.3
WOONASQUA D	P	N.D.	N.D.	N.D.	N.D.	241	19.6	431	391	162	308	453	185	156	42.0	133
BLACKSTONE A-C	P	N.D.	N.D.	N.D.	N.D.	24.7	N.D.	13.1	10.0	7.93	17.1	13.2	N.D.	N.D.	N.D.	N.D.
	S	3.45	N.D.	N.D.	10.1	17.1	N.D.	19.9	15.2	N.D.	11.2	23.0	N.D.	N.D.	N.D.	N.D.
BLACKSTONE D	P	N.D.	N.D.	N.D.	N.D.	81.6	N.D.	238	251	153	304	548	254	249	165	235
	S	N.D.	N.D.	N.D.	N.D.	139	N.D.	95.4	49.7	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
TAUNTON	P	N.D.	N.D.	N.D.	N.D.	32.5	2.12	6.04	9.63	3.23	12.5	21.6	5.26	N.D.	N.D.	N.D.

POINT SOURCES		PAHs (NG/L)														
		Nap	AcL	Acn	Flu	Phe	Ane	Flr	Pyr	BaA	Chr	B(b+k)F	BaP	InP	DbA	Bpr
BRISTOL	P	N.D.	N.D.	18.3	6.14	192	N.D.	243	366	99.0	159	278	N.D.	N.D.	N.D.	N.D.
BLACKSTONE VAL.	P	N.D.	N.D.	N.D.	N.D.	123	39.3	157	375	51.5	90.1	166	N.D.	N.D.	N.D.	N.D.
	S	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	10.1	10.1	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
EAST GREENWICH	P	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	62.3	N.D.	72.7	N.D.	N.D.	N.D.	N.D.
	S	22.4	N.D.	N.D.	N.D.	70.0	21.5	29.2	27.6	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
EAST PROVIDENCE	P	7.97	N.D.	3.27	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	50.0	81.3	N.D.	N.D.	N.D.	N.D.
FIELDS POINT	P	N.D.	N.D.	N.D.	N.D.	167	N.D.	190	269	N.D.	118	210	N.D.	N.D.	N.D.	N.D.
	S	519	N.D.	N.D.	N.D.	214	N.D.	63.3	30.0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
FALL RIVER	P	356	N.D.	N.D.	N.D.	244	N.D.	66.9	208	N.D.	29.2	48.2	N.D.	N.D.	N.D.	N.D.
NARR. ELECTRIC	P	N.D.	N.D.	N.D.	N.D.	11.7	N.D.	21.8	21.0	6.82	23.7	56.0	10.8	N.D.	N.D.	N.D.
NEWPORT	P	N.D.	N.D.	N.D.	N.D.	253	16.0	265	215	81.5	106	207	N.D.	N.D.	N.D.	N.D.
WARREN	P	58.4	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	111	N.D.	55.2	64.2	N.D.	N.D.	N.D.	N.D.
JAMESTOWN	P	1.46	N.D.	N.D.	N.D.	19.6	N.D.	22.0	34.0	6.84	27	81.9	9.75	N.D.	N.D.	N.D.
QUONSET POINT	P	N.D.	N.D.	29.5	N.D.	260	N.D.	253	346	122	193	319	N.D.	N.D.	N.D.	N.D.

P= Particulate S= Soluble

N.D.= Not detected

TableA-20. Concentrations of organics in rivers and point sources discharging into Narragansett Bay (May 19-22, 1986).

RIVERS		BZTs (NG/L)			Phthalates (UG/L)				Sterols(UG/L)
		C10	CL	C1	DBP	BBP	DEHP	DOP	Cop
PAWTUXET A-C	P	74.5	N.D.	N.D.	N.D.	0.03	0.67	N.D.	3.30
	S	N.D.	N.D.	9440	N.D.	0.48	0.15	N.D.	0.12
PAWTUXET D	P	N.D.	N.D.	1640	N.D.	N.D.	3.04	N.D.	7.99
	S	N.D.	N.D.	2270	N.D.	0.07	N.D.	N.D.	0.10
MOSHASSUCK A-C	P	N.D.	N.D.	N.D.	N.D.	N.D.	0.60	N.D.	0.34
MOSHASSUCK D	P	N.D.	N.D.	N.D.	N.D.	N.D.	1.59	N.D.	3.29
WOONASQUA A-C	P	N.D.	N.D.	N.D.	N.D.	N.D.	0.44	N.D.	1.40
WOONASQUA D	P	N.D.	N.D.	N.D.	N.D.	0.32	1.17	N.D.	4.86
BLACKSTONE A-C	P	N.D.	N.D.	N.D.	N.D.	0.04	0.17	N.D.	0.17
	S	N.D.	N.D.	N.D.	N.D.	0.04	0.10	N.D.	0.03
BLACKSTONE D	P	N.D.	N.D.	N.D.	N.D.	0.13	1.59	N.D.	4.62
	S	N.D.	N.D.	N.D.	N.D.	0.13	0.07	0.02	0.06
TAUNTON	P	N.D.	N.D.	N.D.	N.D.	N.D.	0.28	N.D.	0.43

POINT SOURCES		BZTs (NG/L)			Phthalates (UG/L)				Sterols(UG/L)
		C10	CL	C1	DBP	BBP	DEHP	DOP	Cop
BRISTOL	P	N.D.	N.D.	N.D.	N.D.	5.83	17.4	N.D.	368
BLACKSTONE VAL.	P	N.D.	N.D.	N.D.	N.D.	2.14	13.5	N.D.	75.7
	S	N.D.	N.D.	N.D.	N.D.	0.21	0.05	0.03	0.31
EAST GREENWICH	P	N.D.	N.D.	N.D.	N.D.	N.D.	43.5	N.D.	132
	S	N.D.	N.D.	340	N.D.	1.57	1.19	0.25	0.89
EAST PROVIDENCE	P	N.D.	N.D.	N.D.	N.D.	2.34	3.62	N.D.	25.0
FIELD'S POINT	P	N.D.	N.D.	N.D.	N.D.	N.D.	7.94	N.D.	64.8
	S	N.D.	N.D.	N.D.	N.D.	3.31	0.01	0.15	5.14
FALL RIVER	P	N.D.	N.D.	N.D.	N.D.	N.D.	3.25	N.D.	13.8
NARR. ELECTRIC	P	N.D.	N.D.	N.D.	N.D.	0.11	3.33	N.D.	0.66
NEWPORT	P	N.D.	N.D.	N.D.	N.D.	5.47	24.0	N.D.	945
WARREN	P	N.D.	N.D.	N.D.	N.D.	N.D.	3.11	N.D.	20.3
JAMESTOWN	P	N.D.	N.D.	N.D.	N.D.	N.D.	0.80	N.D.	3.07
QUONSET POINT	P	N.D.	N.D.	N.D.	N.D.	N.D.	5.95	N.D.	213

P= Particulate S= Soluble

N.D.= Not detected

APPENDIX B.

Concentrations of components in Narragansett Bay water column samples.

Table 3-1. Concentrations of organics in the waters of Narragansett Bay (October 21-25, 1985).

SAMPLE CODE NUMBER		PCBs (NG/L)			
		Ar 1242	Ar 1254	Ar 1260	Total
STATION 2					
B-02-0.4-0-10/85	P	N.D.	3.09	1.99	5.08
B-02-2.5-0-10/85	P	2.64	5.33	6.09	14.1
	S	1.13	1.00	N.D.	2.13
B-02-5.6-0-10/85	P	2.88	8.39	6.17	17.4
	S	N.D.	N.D.	N.D.	N.D.
B-02-12.5-0-10/85	P	0.69	1.53	1.23	3.45
STATION 4					
B-04-0.3-0-10/85	P	2.37	2.75	1.36	6.48
B-04-3.3-0-10/85	P	1.32	1.56	1.06	3.94
B-04-9.9-0-10/85	P	0.89	1.53	1.19	3.61
STATION 7					
B-07-0.5-0-10/85	P	0.97	1.32	0.89	3.18
B-07-2.9-0-10/85	P	0.88	1.37	0.94	3.19
B-07-5.0-0-10/85	P	1.17	1.40	1.06	3.63
STATION 12					
B-12-0.3-0-10/85	P	2.85	2.40	1.35	6.60
B-12-7.2-0-10/85	P	0.99	1.29	0.83	3.11
B-12-15.0-0-10/85	P	0.62	0.98	0.76	2.36
B-12-25.4-0-10/85	P	0.95	1.08	0.87	2.90

N.D.= Not detected P= Particulate S= Soluble

Table B-2. Concentrations of organics in the waters of Narragansett Bay (October 21-25, 1985).

SAMPLE CODE NUMBER		PCB Congeners (NG/L)									
		101	151	153	138	180	170	201	195	194	209
STATION 2											
B-02-0.4-0-10/85	P	0.365	0.136	0.248	0.344	0.190	0.088	0.274	0.090	0.055	0.056
B-02-2.5-0-10/85	P	0.610	0.286	0.579	0.744	0.613	0.290	0.392	0.065	0.119	0.077
	S	0.102	0.024	0.035	0.042	0.006	0.009	0.023	0.009	0.005	0.005
B-02-5.6-0-10/85	P	0.646	0.252	0.606	0.886	0.646	0.298	0.433	0.134	0.176	0.202
	S	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
B-02-12.5-0-10/85	P	0.141	0.057	0.114	0.163	0.109	0.048	0.151	0.054	0.036	0.043
STATION 4											
B-04-0.3-0-10/85	P	0.339	0.114	0.146	0.211	0.097	0.034	0.250	0.089	0.034	0.037
B-04-3.3-0-10/85	P	0.196	0.067	0.093	0.136	0.072	0.027	0.230	0.081	0.030	0.034
B-04-9.9-0-10/85	P	0.162	0.058	0.115	0.161	0.093	0.035	0.227	0.090	0.030	0.067
STATION 7											
B-07-0.5-0-10/85	P	0.162	0.057	0.085	0.102	0.046	0.017	0.212	0.080	0.028	0.032
B-07-2.9-0-10/85	P	0.163	0.058	0.087	0.110	0.066	0.018	0.217	0.082	0.029	0.046
B-07-5.0-0-10/85	P	0.166	0.062	0.097	0.118	0.075	0.022	0.253	0.102	0.034	0.046
STATION 12											
B-12-0.3-0-10/85	P	0.364	0.120	0.114	0.149	0.076	0.019	0.327	0.114	0.036	0.040
B-12-7.2-0-10/85	P	0.132	0.054	0.058	0.076	0.037	0.014	0.205	0.078	0.025	0.026
B-12-15.0-0-10/85	P	0.097	0.037	0.056	0.073	0.049	0.015	0.181	0.068	0.025	0.035
B-12-25.4-0-10/85	P	0.114	0.042	0.061	0.085	0.056	0.019	0.200	0.081	0.030	0.051

N.D.= Not detected **P= Particulate S= Soluble**

Table 3-3. Concentrations of organics in the waters of Narragansett Bay (October 21-25, 1985).

SAMPLE CODE NUMBER		HCHs (NG/L)				Hydrocarbons (UG/L)		
		a	b	g	Total	F1-UCM	F1-RES	Tot F1
STATION 2								
B-02-0.4-0-10/85	P	N.D.	N.D.	N.D.	N.D.	10.1	0.64	10.7
B-02-2.5-0-10/85	P	N.D.	N.D.	N.D.	N.D.	8.81	2.3	11.1
	S	1.780	0.384	0.960	3.124	0.24	0.02	0.26
B-02-5.6-0-10/85	P	N.D.	N.D.	N.D.	N.D.	37.9	3.22	41.1
	S	1.100	N.D.	0.450	1.550	1.23	0.07	1.30
B-02-12.5-0-10/85	P	N.D.	N.D.	N.D.	N.D.	5.47	1.02	6.49
STATION 4								
B-04-0.3-0-10/85	P	N.D.	N.D.	N.D.	N.D.	4.42	0.74	5.16
B-04-3.3-0-10/85	P	N.D.	N.D.	N.D.	N.D.	4.23	0.30	4.52
B-04-9.9-0-10/85	P	N.D.	N.D.	N.D.	N.D.	6.57	1.15	7.72
STATION 7								
B-07-0.5-0-10/85	P	N.D.	N.D.	N.D.	N.D.	1.58	0.27	1.85
B-07-2.9-0-10/85	P	0.011	0.034	0.014	0.059	2.21	0.22	2.43
B-07-5.0-0-10/85	P	N.D.	N.D.	N.D.	N.D.	2.03	0.18	2.21
STATION 12								
B-12-0.3-0-10/85	P	N.D.	N.D.	N.D.	N.D.	1.89	0.31	2.20
B-12-7.2-0-10/85	P	N.D.	N.D.	N.D.	N.D.	1.63	0.24	1.87
B-12-15.0-0-10/85	P	N.D.	N.D.	N.D.	N.D.	1.73	0.13	1.86
B-12-25.4-0-10/85	P	N.D.	N.D.	N.D.	N.D.	1.88	0.20	2.08

N.D.= Not detected **P= Particulate S= Soluble**

Table 3-4. Concentrations of organics in the waters of Narragansett Bay (October 21-25, 1985).

SAMPLE CODE NUMBER		PAHs (NG/L)														
		Nap	AcL	Acn	Flu	Phe	Ane	Flr	Pyr	BaA	Chr	B(b+k)F	BaP	InP	DbA	Bpr
STATION 2																
B-02-0.4-0-10/85	P	0.67	N.D.	N.D.	0.64	8.21	1.50	9.24	6.89	3.37	48.8	6.93	N.D.	3.11	N.D.	N.D.
B-02-2.5-0-10/85	P	0.86	0.29	0.61	0.62	9.66	0.85	14.6	15.4	3.05	14.5	10.6	5.79	3.37	1.58	14.7
	S	0.76	N.D.	6.25	2.05	4.32	N.D.	16.7	17.7	1.71	3.85	1.91	N.D.	N.D.	N.D.	N.D.
B-02-5.6-0-10/85	P	2.95	2.12	2.25	3.46	20.5	7.31	51.0	43.2	22.1	31.4	53.0	23.5	17.4	6.66	26.8
	S	0.09	0.47	4.23	2.28	4.45	2.51	24.3	24.9	1.85	4.26	1.27	N.D.	N.D.	N.D.	N D.
B-02-12.5-0-10/85	P	0.54	N.D.	N.D.	0.42	2.25	0.86	4.37	4.46	2.50	5.11	6.51	3.61	3.12	2.01	6.70
STATION 4																
B-04-0.3-0-10/85	P	0.89	N.D.	N.D.	N.D.	1.32	1.05	2.71	2.25	0.69	1.61	2.21	2.14	0.96	N.D.	N.D.
B-04-3.3-0-10/85	P	0.52	N.D.	N.D.	N.D.	1.44	0.52	4.40	3.21	1.37	1.76	2.62	2.12	0.98	N.D.	N.D.
B-04-9.9-0-10/85	P	0.61	N.D.	N.D.	N.D.	2.83	0.68	7.61	5.90	2.65	4.16	7.72	4.38	3.20	1.54	7.24
STATION 7																
B-07-0.5-0-10/85	P	0.51	N.D.	0.29	0.27	0.80	0.65	2.03	0.82	0.55	1.32	1.08	N.D.	N.D.	N.D.	N.D.
B-07-2.9-0-10/85	P	0.46	N.D.	0.15	0.20	0.89	0.59	0.70	0.63	0.50	0.74	1.28	1.06	0.63	N.D.	N.D.
B-07-5.0-0-10/85	P	0.62	0.21	0.26	0.38	1.36	0.20	2.66	1.72	0.65	1.21	3.02	2.01	2.67	N.D.	N.D.
STATION 12																
B-12-0.3-0-10/85	P	0.36	N.D.	N.D.	0.15	0.81	0.56	1.38	1.35	0.57	0.97	1.01	0.92	0.50	N.D.	N.D.
B-12-7.2-0-10/85	P	0.26	N.D.	N.D.	0.12	0.65	0.19	1.35	1.71	0.27	0.50	0.77	0.88	0.52	N.D.	N.D.
B-12-15.0-0-10/85	P	0.40	0.15	0.24	0.21	1.15	0.25	3.39	3.21	1.05	1.43	2.72	1.85	1.26	N.D.	N.D.
B-12-25.4-0-10/85	P	0.40	N.D.	N.D.	N.D.	1.43	0.55	3.03	3.79	1.19	2.12	2.48	1.94	0.91	N.D.	N.D.

N.D.= Not detected P= Particulate S= Soluble

Table B-5. Concentrations of organics in the waters of Narragansett Bay (October 21-25, 1985).

SAMPLE CODE NUMBER		BZTs (NG/L)			Phthalates (UG/L)				Sterols (UG/L)	
		C10	CL	C1	DBP	BBP	DEHP	DOP	Cop	Chol
STATION 2										
B-02-0.4-0-10/85	P	N.D.	N.D.	N.D.	N.D.	0.03	0.54	N.D.	0.33	0.74
B-02-2.5-0-10/85	P	N.D.	N.D.	N.D.	N.D.	N.D.	12.6	N.D.	3.99	26.6
	S	N.D.	N.D.	N.D.	N.D.	N.D.	0.00	N.D.	N.D.	0.11
B-02-5.6-0-10/85	P	N.D.	N.D.	N.D.	N.D.	N.D.	0.70	N.D.	0.34	1.06
	S	N.D.	N.D.	N.D.	N.D.	N.D.	0.08	N.D.	N.D.	0.03
B-02-12.5-0-10/85	P	N.D.	N.D.	N.D.	N.D.	0.01	0.16	N.D.	0.06	0.27
STATION 4										
B-04-0.3-0-10/85	P	N.D.	N.D.	N.D.	N.D.	N.D.	4.72	N.D.	0.19	1.46
B-04-3.3-0-10/85	P	N.D.	N.D.	N.D.	N.D.	0.04	0.12	N.D.	0.07	0.69
B-04-9.9-0-10/85	P	N.D.	N.D.	N.D.	N.D.	N.D.	0.05	N.D.	N.D.	0.36
STATION 7										
B-07-0.5-0-10/85	P	N.D.	N.D.	N.D.	N.D.	0.03	N.D.	N.D.	N.D.	0.50
B-07-2.9-0-10/85	P	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.56
B-07-5.0-0-10/85	P	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.43
STATION 12										
B-12-0.3-0-10/85	P	N.D.	N.D.	N.D.	N.D.	0.15	0.72	N.D.	0.07	0.79
B-12-7.2-0-10/85	P	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.07	0.40
B-12-15.0-0-10/85	P	N.D.	N.D.	N.D.	N.D.	0.03	0.18	N.D.	0.03	0.29
B-12-25.4-0-10/85	P	N.D.	N.D.	N.D.	N.D.	0.02	N.D.	N.D.	0.03	0.77

N.D.= Not detected **P= Particulate S= Soluble**

Table 3-6. Concentrations of organics in the waters of Narragansett Bay (November 18-21, 1985).

SAMPLE CODE NUMBER		SS	PCBs (NG/L)			
		(MG/L)	Ar 1242	Ar 1254	Ar 1260	Total
STATION 2						
B-02-0.4-0-11/85	P	2.84	N.D.	2.74	2.67	5.41
B-02-2.1-0-11/85	P	2.01	N.D.	2.23	1.51	3.74
B-02-4.4-0-11/85	P	2.19	N.D.	1.85	1.38	3.23
B-02-10.7-0-11/85	P	4.04	N.D.	2.65	1.59	4.24
STATION 4						
B-04-0.7-0-11/85	P	1.89	N.D.	1.90	1.32	3.22
B-04-4.7-0-11/85	P	4.58	N.D.	1.86	N.D.	1.86
B-04-11.1-0-11/85	P	33.6	N.D.	5.35	2.96	8.31
	S		N.D.	N.D.	N.D.	N.D.
STATION 7						
B-07-0.9-0-11/85	P	2.19	N.D.	N.D.	N.D.	N.D.
B-07-3.1-0-11/85	P	3.17	N.D.	1.45	1.01	2.46
B-07-5.0-0-11/85	P	2.92	N.D.	1.15	N.D.	1.15
STATION 12						
B-12-0.6-0-11/85	P	1.16	N.D.	0.93	N.D.	0.93
B-12-7.5-0-11/85	P	1.68	N.D.	N.D.	N.D.	N.D.
B-12-21.8-0-11/85	P	3.15	N.D.	0.66	N.D.	0.66

N.D.= Not detected P= Particulate S= Soluble

Table B-7. Concentrations of organics in the waters of Narragansett Bay (November 18-21, 1985).

SAMPLE CODE NUMBER		PCB Congeners (NG/L)									
		101	151	153	138	180	170	201	195	194	209
STATION 2											
B-02-0.4-0-11/85	P	0.292	0.093	0.158	0.251	0.148	0.071	0.223	0.080	0.050	0.062
B-02-2.1-0-11/85	P	0.186	0.065	0.137	0.202	0.148	0.062	0.263	0.104	0.056	0.06
B-02-4.4-0-11/85	P	0.166	0.054	0.107	0.160	0.085	0.047	0.194	0.080	0.038	0.056
B-02-10.7-0-11/85	P	0.211	0.070	0.163	0.247	0.156	0.074	0.160	0.065	[illegible]	0.098
STATION 4											
B-04-0.7-0-11/85	P	0.164	0.061	0.110	0.153	0.068	0.060	0.204	0.088	[illegible]	0.047
B-04-4.7-0-11/85	P	0.184	0.050	0.089	0.138	0.082	0.033	0.213	0.087	[illegible]	0.061
B-04-11.1-0-11/85	P	0.462	0.146	0.343	0.514	0.274	0.128	0.364	0.153	[illegible]	[illegible]
	S	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
STATION 7											
B-07-0.9-0-11/85	P	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
B-07-3.1-0-11/85	P	0.140	0.032	0.015	0.089	N.D.	0.030	0.187	0.076	0.024	0.034
B-07-5.0-0-11/85	P	0.126	0.032	0.042	0.073	N.D.	0.026	0.140	0.064	0.018	[illegible]
STATION 12											
B-12-0.6-0-11/85	P	0.079	0.022	0.032	0.053	0.026	0.015	0.101	0.039	0.015	0.020
B-12-7.5-0-11/85	P	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
B-12-21.8-0-11/85	P	0.066	N.D.	0.028	0.049	0.022	0.017	0.069	0.029	0.013	0.027

N.D. = Not detected P = Particulate S = Soluble

Table B-8. Concentrations of organics in the waters of Narragansett Bay (November 18-21, 1985)

SAMPLE CODE NUMBER		HCHs (NG/L) a	b	g	Total	Hydrocarbons (UG/L) F1-UCM	F1-RES	Tot F1
STATION 2								
B-02-0.4-0-11/85	P	N.D.	N.D.	N.D.	N.D.	10.4	0.67	11.0
B-02-2.1-0-11/85	P	N.D.	N.D.	N.D.	N.D.	7.42	0.27	7.69
B-02-4.4-0-11/85	P	N.D.	N.D.	N.D.	N.D.	6.17	0.18	6.35
B-02-10.7-0-11/85	P	N.D.	N.D.	N.D.	N.D.	25.3	0.82	26.1
STATION 4								
B-04-0.7-0-11/85	P	N.D.	N.D.	N.D.	N.D.	10.5	0.47	11.0
B-04-4.7-0-11/85	P	N.D.	N.D.	N.D.	N.D.	6.64	0.40	7.04
B-04-11.1-0-11/85	P	N.D.	N.D.	N.D.	N.D.	27.1	1.20	28.3
	S	0.793	N.D.	0.202	0.995	0.13	0.08	0.21
STATION 7								
B-07-0.9-0-11/85	P	N.D.	N.D.	N.D.	N.D.	3.24	0.39	3.63
B-07-3.1-0-11/85	P	N.D.	N.D.	N.D.	N.D.	3.06	0.28	3.34
B-07-5.0-0-11/85	P	N.D.	N.D.	N.D.	N.D.	2.53	0.22	2.75
STATION 12								
B-12-0.6-0-11/85	P	N.D.	N.D.	N.D.	N.D.	3.10	0.23	3.33
B-12-7.5-0-11/85	P	N.D.	N.D.	N.D.	N.D.	2.39	0.20	2.59
B-12-21.8-0-11/85	P	N.D.	N.D.	N.D.	N.D.	2.93	0.38	3.31

N.D. = Not detected **P= Particulate S= Soluble**

Table 3-9. Concentrations of organics in the waters of Narragansett Bay (November 18-21, 1985).

SAMPLE CODE NUMBER		PAHs (NG/L)														
		Nap	AcL	Acn	Flu	Phe	Ane	Flr	Pyr	BaA	Chr	B(b+k)F	BaP	InP	DbA	Bpr
STATION 2																
B-02-0.4-0-11/85	P	0.57	N.D.	N.D.	N.D.	3.25	N.D.	5.53	5.44	2.68	4.94	6.80	3.13	2.02	N.D.	4.02
B-02-2.1-0-11/85	P	N.D.	N.D.	N.D.	N.D.	2.81	0.68	6.36	5.68	2.53	4.45	8.58	5.61	2.61	1.14	4.22
B-02-4.4-0-11/85	P	N.D.	N.D.	N.D.	N.D.	2.32	0.32	6.94	5.04	2.50	3.22	5.27	2.42	2.05	1.11	6.63
B-02-10.7-0-11/85	P	0.90	N.D.	N.D.	N.D.	1.64	N.D.	5.12	4.71	4.59	6.67	16.30	4.46	3.29	0.86	N.D.
STATION 4																
B-04-0.7-0-11/85	P	0.19	N.D.	N.D.	N.D.	2.23	N.D.	4.48	3.80	1.13	2.53	5.69	2.07	2.17	N.D.	4.81
B-04-4.7-0-11/85	P	1.15	N.D.	N.D.	N.D.	4.65	N.D.	6.72	5.52	2.14	3.89	7.65	2.90	3.10	N.D.	4.67
B-04-11.1-0-11/85	P	4.73	N.D.	0.75	2.23	13.1	3.14	22.9	22.0	8.28	14.5	30.0	12.8	9.63	3.12	19.2
	S	1.62	N.D.	N.D.	0.29	0.95	N.D.	3.12	3.01	N.D.	7.71	N.D.	N.D.	N.D.	N.D.	N.D.
STATION 7																
B-07-0.9-0-11/85	P	0.59	N.D.	N.D.	N.D.	2.24	N.D.	3.36	3.93	0.80	1.36	1.61	0.93	1.22	N.D.	2.00
B-07-3.1-0-11/85	P	0.00	N.D.	N.D.	0.24	2.04	N.D.	3.81	4.59	0.78	1.60	1.87	1.12	0.75	0.45	1.84
B-07-5.0-0-11/85	P	0.48	N.D.	0.82	N.D.	1.27	0.50	2.14	3.45	0.47	0.98	1.20	1.01	0.54	N.D.	N.D.
STATION 12																
B-12-0.6-0-11/85	P	N.D.	N.D.	0.28	N.D.	1.36	N.D.	2.71	3.00	0.53	1.21	1.47	1.02	0.75	N.D.	N.D.
B-12-7.5-0-11/85	P	1.10	N.D.	1.20	1.78	3.16	N.D.	4.23	3.35	1.88	2.26	4.02	3.13	3.38	N.D.	N.D.
B-12-21.8-0-11/85	P	0.24	N.D.	0.22	0.64	1.88	0.90	3.08	3.22	1.13	2.84	3.01	2.33	1.03	N.D.	N.D.

N.D.= Not detected **P= Particulate S= Soluble**

Table B-10 Concentrations of organics in the waters of Narragansett Bay (November 18-21, 1985).

SAMPLE CODE NUMBER		BZTs (NG/L)			Phthalates (UG/L)				Sterols (UG/L)	
		C10	CL	C1	DBP	BBP	DEHP	DOP	Cop	Chol
STATION 2										
B-02-0.4-0-11/85	P	N.D.	N.D.	N.D.	N.D.	0.14	0.30	N.D.	0.06	0.10
B-02-2.1-0-11/85	P	N.D.	N.D.	N.D.	N.D.	0.10	N.D.	N.D.	N.D.	0.30
B-02-4.4-0-11/85	P	N.D.	N.D.	30.0	N.D.	0.05	N.D.	0.02	0.06	0.23
B-02-10.7-0-11/85	P	N.D.	N.D.	N.D.	N.D.	0.04	N.D.	0.15	N.D.	0.39
STATION 4										
B-04-0.7-0-11/85	P	N.D.	N.D.	130	N.D.	0.08	1.88	0.05	0.10	0.30
B-04-4.7-0-11/85	P	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.10	N.D.	1.61
B-04-11.1-0-11/85	P	13.9	4.49	N.D.	N.D.	0.17	N.D.	0.17	N.D.	0.83
	S	N.D.	N.D.	20.0	N.D.	0.04	0.31	0.24	N.D.	0.01
STATION 7										
B-07-0.9-0-11/85	P	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.15	N.D.	0.23
B-07-3.1-0-11/85	P	N.D.	N.D.	50.0	N.D.	0.27	N.D.	0.12	N.D.	0.30
B-07-5.0-0-11/85	P	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.39
STATION 12										
B-12-0.6-0-11/85	P	N.D.	N.D.	N.D.	N.D.	0.17	N.D.	N.D.	N.D.	0.14
B-12-7.5-0-11/85	P	N.D.	N.D.	N.D.	N.D.	0.05	N.D.	N.D.	N.D.	0.14
B-12-21.8-0-11/85	P	N.D.	N.D.	N.D.	N.D.	N.D.	0.67	0.46	N.D.	1.54

N.D.= Not detected **P= Particulate S= Soluble**

TableB-11. Concentrations of organics in the waters of Narragansett Bay (April 7-10, 1986).

SAMPLE CODE NUMBER		SS (MG/L)	PCBs (NG/L) Ar 1242	Ar 1254	Ar 1260	Total
STATION 2						
B-02-0.1-0-4/86	P	3.96	N.D.	1.56	1.00	2.56
B-02-1.7-0-4/86	P	4.05	N.D.	3.59	N.D.	3.59
B-02-13-0-4/86	P	2.27	N.D.	1.24	0.52	1.76
STATION 4						
B-04-0.3-0-4/86	P	3.84	N.D.	3.94	N.D.	3.94
B-04-2.2-0-4/86	P	4.04	N.D.	1.05	1.06	2.11
B-04-13.6-0-4/86	P	3.42	N.D.	N.D.	N.D.	N.D.
STATION 7						
B-07-0.5-0-4/86	P	2.00	N.D.	1.40	N.D.	N.D.
B-07-4.3-0-4/86	P	1.81	N.D.	N.D.	N.D.	N.D.
B-07-6.1-0-4/86	P	2.79	N.D.	2.13	N.D.	2.13
STATION 12						
B-12-0.3-0-4/86	P	1.67	N.D.	1.81	0.58	2.39
B-12-11.3-0-4/86	P	1.89	N.D.	0.72	0.25	0.12
B-12-14.8-0-4/86	P	2.11	N.D.	0.44	N.D.	0.44

N.D.= Not detected **P= Particulate**

TableB-12. Concentrations of organics in the waters of Narragansett Bay (April 7-10, 1986).

SAMPLE CODE NUMBER		PCB Congeners (NG/L)									
		101	151	153	138	180	170	201	195	194	209
STATION 2											
B-02-0.1-0-4/86	P	0.150	0.050	0.079	0.116	0.074	0.031	0.062	0.020	0.015	0.015
B-02-1.7-0-4/86	P	0.366	0.009	0.169	0.268	0.148	0.062	0.131	0.084	0.033	0.050
B-02-13-0-4/86	P	0.212	0.041	0.079	0.146	0.085	N.D.	0.109	0.066	0.016	0.028
STATION 4											
B-04-0.3-0-4/86	P	0.471	0.292	0.130	0.231	0.111	0.046	0.137	0.073	0.025	0.033
B-04-2.2-0-4/86	P	0.298	N.D.	N.D.	0.186	0.087	0.037	0.082	0.051	0.018	0.029
B-04-13.6-0-4/86	P	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
STATION 7											
B-07-0.5-0-4/86	P	N.D.	N.D.	N.D.	N.D.	0.109	N.D.	0.286	0.091	N.D.	N.D.
B-07-4.3-0-4/86	P	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
B-07-6.1-0-4/86	P	0.210	0.067	0.086	0.100	0.064	N.D.	0.100	0.033	N.D.	0.001
STATION 12											
B-12-0.3-0-4/86	P	0.172	0.044	0.050	0.091	0.046	0.015	0.070	0.021	0.006	0.007
B-12-11.3-0-4/86	P	0.116	N.D.	N.D.	N.D.	0.037	N.D.	0.065	0.050	0.006	0.019
B-12-14.8-0-4/86	P	0.159	N.D.	N.D.	N.D.	N.D.	N.D.	0.062	0.044	N.D.	0.021

N.D.= Not detected P= Particulate

TableB-13 Concentrations of organics in the waters of Narragansett Bay (April 7-10, 1986).

SAMPLE CODE NUMBER		HCHs (NG/L)				Hydrocarbons (UG/L)		
		a	b	g	Total	F1-UCM	F1-RES	Tot F1
STATION 2								
B-02-0.1-0-4/86	P	N/A	N/A	N/A	N/A	20.2	1.40	21
B-02-1.7-0-4/86	P	N/A	N/A	N/A	N/A	16.3	0.94	17.2
B-02-13-0-4/86	P	N/A	N/A	N/A	N/A	5.77	0.39	6.16
STATION 4								
B-04-0.3-0-4/86	P	N/A	N/A	N/A	N/A	13.6	1.09	14.7
B-04-2.2-0-4/86	P	N/A	N/A	N/A	N/A	12.3	1.54	13.
B-04-13.6-0-4/86	P	N/A	N/A	N/A	N/A	5.00	0.71	5.71
STATION 7								
B-07-0.5-0-4/86	P	N/A	N/A	N/A	N/A	4.28	0.42	4.70
B-07-4.3-0-4/86	P	N/A	N/A	N/A	N/A	4.55	0.40	4.95
B-07-6.1-0-4/86	P	N/A	N/A	N/A	N/A	3.90	0.37	4.27
STATION 12								
B-12-0.3-0-4/86	P	N/A	N/A	N/A	N/A	5.98	0.55	6.53
B-12-11.3-0-4/86	P	N/A	N/A	N/A	N/A	3.90	0.48	4.38
B-12-14.8-0-4/86	P	N/A	N/A	N/A	N/A			

N.D.= Not detected P= Particulate N/A= Not analyzed

Table B-14. Concentrations of organics in the waters of Narragansett Bay (April 7-10, 1986).

SAMPLE CODE NUMBER		PAHs (NG/L) Nap	AcL	Acn	Flu	Phe	Ane	Flr	Pyr	BaA	Chr	B(b+k)F	BaP	InP	DbA	Bpr
STATION 2																
B-02-0.1-0-4/86	P	1.76	N.D.	0.70	N.D.	9.87	1.85	10.3	7.81	2.24	4.99	6.79	3.84	2.43	N.D.	N.D.
B-02-1.7-0-4/86	P	N.D.	N.D.	N.D.	0.67	5.45	N.D.	9.24	8.51	2.29	5.50	6.67	3.09	1.44	1.72	3.41
B-02-13-0-4/86	P	0.61	N.D.	N.D.	0.48	3.13	N.D.	4.70	4.01	0.93	2.20	3.62	1.47	1.07	0.67	1.42
STATION 4																
B-04-0.3-0-4/86	P	N.D.	N.D.	0.50	0.72	3.75	N.D.	6.70	5.24	1.31	2.85	5.82	2.16	1.34	0.39	N.D.
B-04-2.2-0-4/86	P	0.73	N.D.	0.31	N.D.	2.59	N.D.	3.04	3.51	0.80	2.05	4.20	1.58	1.05	N.D.	N.D.
B-04-13.6-0-4/86	P	0.70	N.D.	0.27	0.59	3.64	N.D.	4.83	5.81	0.64	1.55	4.1	1.18	N.D.	N.D.	N.D.
STATION 7																
B-07-0.5-0-4/86	P	N.D.	N.D.	0.54	N.D.	0.78	N.D.	1.78	1.02	N.D.	0.80	0.81	N.D.	N.D.	N.D.	N.D.
B-07-4.3-0-4/86	P	N.D.	N.D.	0.36	N.D.	1.48	N.D.	2.81	3.89	N.D.	4.13	1.28	N.D.	N.D.	N.D.	N.D.
B-07-6.1-0-4/86	P	N.D.	N.D.	0.46	0.21	1.84	N.D.	4.18	3.11	N.D.	2.88	1.78	N.D.	N.D.	N.D.	N.D.
STATION 12																
B-12-0.3-0-4/86	P	N.D.	N.D.	0.40	N.D.	1.31	N.D.	1.83	2.40	N.D.	1.50	2.28	N.D.	N.D.	N.D.	N.D.
B-12-11.3-0-4/86	P	0.64	N.D.	0.25	0.29	1.41	N.D.	2.47	3.69	N.D.	1.46	3.39	N.D.	N.D.	N.D.	N.D.
B-12-14.8-0-4/86	P	0.41	N.D.	0.24	N.D.	2.04	N.D.	3.12	5.15	N.D.	1.06	2.10	N.D.	N.D.	N.D.	N.D.

N.D.= Not detected **P= Particulate**

Table B-15 Concentrations of organics in the waters of Narragansett Bay (April 7-10, 1986).

SAMPLE CODE NUMBER		BZTs (NG/L)			Phthalates (UG/L)				Sterols
		C10	CL	C1	DBP	BBP	DEHP	DOP	Cop
STATION 2									
B-02-0.1-0-4/86	P	N.D.	N.D.	N.D.	N.D.	0.07	N.D.	N.D.	0.26
B-02-1.7-0-4/86	P	N.D.	N.D.	70.0	N.D.	0.07	0.04	N.D.	0.30
B-02-13-0-4/86	P	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.22
STATION 4									
B-04-0.3-0-4/86	P	N.D.	N.D.	N.D.	N.D.	0.09	0.04	N.D.	0.30
B-04-2.2-0-4/86	P	N.D.	N.D.	N.D.	N.D.	0.13	0.10	N.D.	0.22
B-04-13.6-0-4/86	P	N.D.	N.D.	N.D.	N.D.	0.02	0.02	N.D.	0.13
STATION 7									
B-07-0.5-0-4/86	P	N.D.	N.D.	260	N.D.	0.06	N.D.	N.D.	0.11
B-07-4.3-0-4/86	P	N.D.	N.D.	210	N.D.	0.07	0.02	0.02	0.03
B-07-6.1-0-4/86	P	N.D.	N.D.	160	N.D.	0.05	0.02	N.D.	0.10
STATION 12									
B-12-0.3-0-4/86	P	N.D.	N.D.	N.D.	N.D.	0.02	0.03	N.D.	0.24
B-12-11.3-0-4/86	P	N.D.	N.D.	N.D.	N.D.	0.03	0.03	N.D.	0.11
B-12-14.8-0-4/86	P	N.D.	N.D.	N.D.	N.D.	0.03	0.04	N.D.	0.12

N.D.= Not detected P= Particulate

TableB-16 Concentrations of organics in the waters of Narragansett Bay (May 19-22, 1986).

SAMPLE CODE NUMBER		SS	PCBs (NG/L)			
		(MG/L)	Ar 1242	Ar 1254	Ar 1260	Total
STATION 2						
B-02-0.4-0-5/86	P	6.57	N.D.	10.40	5.45	15.85
B-02-4.4-0-5/86	P	4.40	N.D.	4.62	2.64	7.26
B-02-11.8-0-5/86	P	3.48	N.D.	4.20	N.D.	4.20
STATION 4						
B-04-0.5-0-5/86	P	5.72	N.D.	3.56	1.49	5.05
B-04-5.5-0-5/86	P	5.81	N.D.	2.73	N.D.	2.73
B-04-15.3-0-5/86	P	16.2	N.D.	5.13	2.24	7.37
STATION 7						
B-07-0.5-0-5/86	P	2.31	N.D.	0.30	N.D.	0.30
B-07-5.9-0-5/86	P	3.99	N.D.	1.69	1.01	2.70
STATION 12						
B-12-0.5-0-5/86	P	1.84	N.D.	1.63	0.72	2.35
B-12-10.4-0-5/86	P	2.54	1.37	1.80	0.77	3.94
B-12-15.1-0-5/86	P	3.66	1.06	1.98	0.96	4.00

N.D.= Not detected **P= Particulate**

Table B-17. Concentrations of organics in the waters of Narragansett Bay (May 19-22, 1986).

SAMPLE CODE NUMBER		PCB Congeners (NG/L)									
		101	151	153	138	180	170	201	195	194	209
STATION 2											
B-02-0.4-0-5/86	P	0.857	0.351	0.589	0.769	0.413	0.207	0.380	0.111	0.114	0.101
B-02-4.4-0-5/86	P	0.355	0.152	0.248	0.338	0.165	0.077	0.272	0.094	0.055	0.063
B-02-11.8-0-5/86	P	0.319	N.D.	0.238	0.298	N.D.	0.073	0.245	0.062	0.010	0.067
STATION 4											
B-04-0.5-0-5/86	P	0.341	0.118	0.176	0.229	0.095	0.046	0.120	0.039	0.026	0.032
B-04-5.5-0-5/86	P	0.232	0.088	0.151	0.196	0.072	0.030	0.177	0.059	0.025	0.039
B-04-15.3-0-5/86	P	0.444	0.171	0.276	0.373	0.162	0.07	0.245	0.087	0.047	0.096
STATION 7											
B-07-0.5-0-5/86	P	0.012	0.005	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
B-07-5.9-0-5/86	P	0.142	0.067	0.079	0.103	0.054	0.015	0.161	0.059	0.021	0.033
STATION 12											
B-12-0.5-0-5/86	P	0.152	0.061	0.059	0.073	0.023	0.004	0.132	0.046	0.012	0.017
B-12-10.4-0-5/86	P	0.183	0.071	0.065	0.080	0.018	0.005	0.139	0.047	0.012	0.020
B-12-15.1-0-5/86	P	0.178	0.079	0.081	0.102	0.041	0.010	0.189	0.070	0.019	0.032

N.D.= Not detected **P= Particulate**

Table B-18 Concentrations of organics in the waters of Narragansett Bay (May 19-22, 1986).

SAMPLE CODE NUMBER		HCHs (NG/L)				Hydrocarbons (UG/L)		
		a	b	g	Total	F1-UCM	F1-RES	Tot F1
STATION 2								
B-02-0.4-0-5/86	P	N/A	N/A	N/A	N/A	58.0	2.09	60.1
B-02-4.4-0-5/86	P	N/A	N/A	N/A	N/A	14.9	0.69	15.6
B-02-11.8-0-5/86	P	N/A	N/A	N/A	N/A	13.9	0.52	14.4
STATION 4								
B-04-0.5-0-5/86	P	N/A	N/A	N/A	N/A	18.9	0.78	19.7
B-04-5.5-0-5/86	P	N/A	N/A	N/A	N/A	8.34	0.24	8.58
B-04-15.3-0-5/86	P	N/A	N/A	N/A	N/A	16.7	0.66	17.4
STATION 7								
B-07-0.5-0-5/86	P	N/A	N/A	N/A	N/A	4.39	0.24	4.63
B-07-5.9-0-5/86	P	N/A	N/A	N/A	N/A	5.58	0.75	6.33
STATION 12								
B-12-0.5-0-5/86	P	N/A	N/A	N/A	N/A	3.70	0.24	3.94
B-12-10.4-0-5/86	P	N/A	N/A	N/A	N/A	4.15	0.27	4.42
B-12-15.1-0-5/86	P	N/A	N/A	N/A	N/A	3.43	0.18	3.61

N.D. = Not detected **P= Particulate N/A = Not analyzed**

Table B-19. Concentrations of organics in the waters of Narragansett Bay (May 19-22, 1986).

SAMPLE CODE NUMBER		PAHs (NG/L)														
		Nap	AcL	Acn	Flu	Phe	Ane	Flr	Pyr	BaA	Chr	B(b+k)F	BaP	InP	DbA	Bpr
STATION 2																
B-02-0.4-0-5/86	P	N.D.	N.D.	N.D.	N.D.	9.46	N.D.	22.9	26.7	11.3	24.9	38.40	16.0	10.6	2.96	12.7
B-02-4.4-0-5/86	P	N.D.	N.D.	N.D.	N.D.	4.25	N.D.	6.55	5.38	3.77	8.73	13.50	6.10	4.13	0.00	4.22
B-02-11.8-0-5/86	P	N.D.	N.D.	N.D.	N.D.	5.56	N.D.	8.81	12.0	5.16	9.35	12.50	N.D.	N.D.	N.D.	N.D.
STATION 4																
B-04-0.5-0-5/86	P	N.D.	N.D.	N.D.	N.D.	3.08	N.D.	4.46	7.18	N.D.	12.0	13.70	N.D.	N.D.	N.D.	N.D
B-04-5.5-0-5/86	P	N.D.	N.D.	N.D.	N.D.	3.20	N.D.	3.39	4.63	N.D.	3.44	6.82	N.D.	N.D.	N.D.	N
B-04-15.3-0-5/86	P	N.D.	N.D.	N.D.	N.D.	6.15	N.D.	8.87	9.06	3.64	7.27	13.3	6.25	4.57	N.D.	5.34
STATION 7																
B-07-0.5-0-5/86	P	N.D.	N.D.	N.D.	N.D.	0.89	N.D.	2.97	1.37	N.D.	3.38	3.91	N.D.	N.D.	N.D.	N.D.
B-07-5.9-0-5/86	P	N.D.	N.D.	N.D.	N.D.	0.00	N.D.	2.83	3.02	N.D.	2.62	8.61	N.D.	N.D.	N.D.	N.D.
STATION 12																
B-12-0.5-0-5/86	P	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	2.08	1.36	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
B-12-10.4-0-5/86	P	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	1.63	1.60	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
B-12-15.1-0-5/86	P	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	1.59	2.79	N.D.	N.D.	0.29	N.D.	N.D.	N.D.	N.D.

N.D.= Not detected **P= Particulate**

Table B-20 Concentrations of organics in the waters of Narragansett Bay (May 19-22, 1986).

SAMPLE CODE NUMBER		BZTs (NG/L)			Phthalates (UG/L)				Sterols (UG/L)
		C10	CL	C1	DBP	BBP	DEHP	DOP	Cop
STATION 2									
B-02-0.4-0-5/86	P	N.D.	N.D.	N.D.	N.D.	0.06	0.10	N.D.	0.29
B-02-4.4-0-5/86	P	N.D.	N.D.	N.D.	N.D.	0.07	0.10	0.15	0.39
B-02-11.8-0-5/86	P	N.D.	N.D.	N.D.	N.D.	0.04	0.16	N.D.	0.26
STATION 4									
B-04-0.5-0-5/86	P	N.D.	N.D.	N.D.	N.D.	0.07	0.08	N.D.	0.66
B-04-5.5-0-5/86	P	N.D.	N.D.	N.D.	N.D.	0.02	0.02	N.D.	0.21
B-04-15.3-0-5/86	P	N.D.	N.D.	10.0	N.D.	0.03	0.03	N.D.	0.19
STATION 7									
B-07-0.5-0-5/86	P	N.D.	N.D.	N.D.	N.D.	N.D.	0.03	0.14	0.10
B-07-5.9-0-5/86	P	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.10
STATION 12									
B-12-0.5-0-5/86	P	N.D.	N.D.	N.D.	N.D.	0.01	0.01	N.D.	0.05
B-12-10.4-0-5/86	P	N.D.	N.D.	N.D.	N.D.	0.01	0.05	0.03	N.D.
B-12-15.1-0-5/86	P	N.D.	N.D.	N.D.	N.D.	0.01	0.01	0.02	0.07

N.D. = Not detected P= Particulate

APPENDIX C

Quality Assurance.

WORK/QUALITY ASSURANCE PROJECT PLAN
FOR
THE ANALYSIS OF ARCHIVED ORGANIC CONTAMINANT SAMPLES

Prepared by

The University of Rhode Island

Graduate School of Oceanography

Prepared for

U. S. Environmental Protection Agency

Region 1

Water Management Division

June, 1986

APPROVALS:

James G. Quinn 6/17/86

Dr. James G. Quinn, Principal Investigator Date

Dr. Eva J. Hoffman, Narragansett Bay Project Monitor Date

Mr. Ronald G. Manfredonia, Project Officer Date

Mr. Wayne T. Wirtanen, Region 1 QA Coordinator Date

WORK/QUALITY ASSURANCE PROJECT PLAN

FOR

THE ANALYSIS OF ARCHIVED ORGANIC CONTAMINANT SAMPLES

1. PROJECT NAME: THE ANALYSIS OF ARCHIVED ORGANIC CONTAMINANT SAMPLES
2. PROJECT REQUESTED BY: U. S. EPA REGION 1
3. DATE OF REQUEST: JULY 1, 1986
4. DATE OF PROJECT INITIATION: JULY 1, 1986
5. PROJECT OFFICER: MR. RONALD G. MANFREDONIA

   PROJECT MONITOR: DR. EVA J. HOFFMAN
6. QUALITY ASSURANCE OFFICER: MR. WAYNE T. WIRTANEN

7. PROJECT DESCRIPTION:

A. Objective and Scope Statement.

The objective of this study is to analyze archived water samples collected from treatment plants, rivers and Narragansett Bay during the first year of this project.

B. Data Usage.

Selected samples will be analyzed for organic contaminants and the data will be used, in conjunction with other bay studies, to provide information on the sources, transport and fate of organic pollutants in Narragansett Bay.

C. Monitoring Network and Design.

See Work/Quality Assurance Project Plan for, "The Collection and Archival of Water Samples for Organic Analyses," by James G. Quinn, March, 1986.

D. Monitoring Parameters and Frequency of Collection.

See section C.

E. Parameter Table.

See section C.

8. Project Fiscal Information

This is a one year project (July 1, 1986 to June 30, 1987) at a cost of $63,047.

9. Schedule of Tasks and Products:

(a) Analysis of samples will be completed as of April 1, 1987.

(b) Reduction and interpretation of data will be completed as of June 1, 1987.

(c) Submission of the draft report will be on or before August 1, 1987.

(d) Submission of the final report will be on or before October 1, 1987.

10. Project Organization and Responsibility:

Dr. James G. Quinn is the Principal Investigator for this project. He will be directly responsible to EPA for the quality of the work and the timely completion of the project; he will also be responsible for data interpretation, and for preparation and submission of the final report to EPA. Dr. Quinn will be assisted by Mr. James S. Latimer (Research Associate II) and Mr. John T. Ellis (Research Specialist II).

11. Data Quality Requirements and Assessments.

See attached appendix.

12. Sampling Procedures.

See Section 7.

13. SAMPLE CUSTODY PROCEDURES

The bay samples were collected by the MERL staff, immediately labelled, returned to the laboratory within 12 hours, and filtered, extracted and stored within 72 hours of collection. The point source samples were collected and labelled by Bay Project and/or DEM personnel and returned to the principal investigator or his staff, within 12 hours of collection. They were also filtered, extracted and stored within 72 hours of collection.

All of the organic analyses are conducted in the principal investigator's laboratory, as soon as possible after sample collection. Therefore, the samples never leave the laboratory or the possession of our staff; hence, we always retain control of the samples. It goes without saying that we properly label our samples and keep track of their numbers when they are being analyzed.

14. CALIBRATION PROCEDURES AND PREVENTIVE MAINTENANCE

The key pieces of equipment for this project are four Hewlett Packard glass capillary gas chromatographs (models 5710A[2], 5840A and 5890). These instruments are calibrated on a daily basis and routine maintenance is performed as needed. All records are kept in the laboratories where the instruments are stored. There is no back-up or alternative equipment available.

15. DOCUMENTATION, DATA REDUCTION AND REPORTING

A. Documentation

At the end of the project, we will submit all raw data for entry into the ODES database management system.

B. Data Reduction and Reporting

A detailed example of how the project data will be analyzed and reported can be found in the 1985 report entitled, "A study of the Water Quality of the Pawtuxet River: Chemical Monitoring and Computer Modeling of Pollutants. Volume 1: Chemical Monitoring of Pollutants in the Pawtuxet River" by J. G. Quinn, E. J. Hoffman, J. S. Latimer and C. G. Carey, and Volume II: "Computer Modeling of Toxic Pollutants in the Pawtuxet River" by R. M. Wright and B. J. McCarthy. These reports are available from Mr. Michael Annarummo, Division of Water Resources, Rhode Island Department of Environmental Management.

16. DATA VALIDATION

All data reported for this project will be subject to checks for errors in transcription, calculation or computer input by the principal investigator and/or his staff. In addition, they will review all sample logs and data forms to ensure that all quality assurance procedures have been met.

17. PERFORMANCE AND SYSTEM AUDITS

The principal investigator will act as the QA officer for this project. As such, he holds biweekly meetings of project staff to review, discuss and formulate quality assurance procedures described in this plan, especially Section 11.

18. CORRECTIVE ACTION

Any problems will be identified and corrected in the biweekly meetings described in Section 17. The principal investigator will maintain records of any corrective action that is found to be necessary.

19. REPORTS

The results of this one year project will be reported in the form of a semi-annual report, and as the final report which will be submitted to the Project Monitor at the end of the project.

11. DATA QUALITY REQUIREMENTS AND ASSESSMENTS

A. Accuracy

The accuracy of our procedures is measured as percent recovery of blank samples spiked with a laboratory standard mixture containing petroleum hydrocarbons, PAHs, PCBs, phthalates and coprostanol at concentrations similar to the lower values that we determine in our samples. These fortified blanks are analyzed several times over the course of the project. In most cases, the recoveries are within 80-120 percent of the spike mixture and in many cases, the values are within ± 10% of the mixture. In addition, accuracy is also measured as percent recovery of specific organics in Standard Reference Materials (SRM), including NBS SRM 1649 (Urban Dust-PAHs) and Canadian NRC SRM HS-2 (PCBs in marine sediment), carried through our entire analytical procedure several times over the course of the project. Again, most of the recoveries are within 80-120 percent of the stated values and many are within ± 10% of this value.

In the case of the trace metals, matrix matched standard solutions of the various metals are individually analyzed and the data used to prepare calibration curves for each metal. This procedure is done at least 4 or 5 times on every day the metal samples are analyzed.

B. Precision

The precision of our procedures is measured as the relative standard deviation (RSD) of triplicate analyses carried out on selected samples over the course of the project. In all cases, the RSDs for both the organic and metal analyses are 10% or better.

C. Representativeness

The representativeness of our sample procedures was measured by collecting 12 samples (ca 3 l each) from a river station over a one hour period. The samples were filtered and then the filters and filtrates were individually combined (based on time averaging) to give three equal particulate and dissolved samples. These samples were analyzed and gave average RSDs as follows:

Particulate Components

suspended solids: 5.1%
petroleum hydrocarbons: 8.8%
PAHs: 18%
PCBs: 15%
Phthalates: 28%
Coprostanol: 9.3%
trace metals: 9.6%

Dissolved components

petroleum hydrocarbons: 28%
PAHs: 14%
phthalates: 37%
trace metals: 8.7%

The river sampling locations were carefully chosen in order to provide a representative series of samples; the point source samples were 6 to 24 hour composite samples and should be representative of these particular sources.

D. Comparability

The samples in this study are collected, prepared and analyzed using established procedures that our laboratory has used over the past 15 years. These procedures have been thoroughly tested and used in several successful intra and interlaboratory comparisons. In addition most of these procedures have been reported in over 70 articles which have been published in refereed scientific journals such as Science, Nature, Environmental Science and Technology, Geochimica et Cosmochimica Acta, Organic Geochemistry, Chemical Geology, Marine Chemistry, Marine Biology, Marine Environmental Research, Toxicological and Environmental Chemistry, and The Journal of Water Pollution Control Federation.

E. Completeness

The completeness of the study will be measured as the percentage of total samples collected that were completely analyzed. Since all samples will be analyzed, we anticipate achieving 100 percent completeness. If a sample is lost or destroyed during the analytical procedures, that information will be included in our final report.

F. Limit of Detection

Organics

The detection limits for our FID GC analyses are between 10 and 1 ng/l, depending on which specific component (e.g. individual PAH, individual phthalate, coprostanol) is being measured in a 4 liter sample. Values below these levels are reported as none detected (ND). In the case of ECD GC analyses, the detection limits are between 1 and 0.1 ng/l, depending on the specific component measured.

Metals

The detection limits for the flameless AAS analyses are between 0.1 and 1.0 ug/l, depending on which metal is being measured.

12. SAMPLING AND ANALYTICAL METHODS

A. Sampling Methodology

Rivers

Samples of surface river water (top 30 cm) were collected using a 2-liter Teflon container, which had been acid-leached and rinsed with distilled water and methanol prior to its use in the field. All river samples were collected by URI personnel. Before each sample was collected, the Teflon "bucket" was rinsed with river water at each station. Then, river samples were collected and about 4 liters were transferred to a solvent rinsed amber glass bottle for transportation back to the laboratory. Another portion of the river sample was transferred from the bucket to a water-rinsed Teflon beaker (acid cleaned) to be used for metal determinations; the water was then filtered in the field using acid-washed Millipore filters HA (0.45 um). The filters were stored in plastic filter vials and the filtrate in acid-cleaned polyethylene bottles. Nitric acid (3N) was added to each filtrate to obtain a pH of less than 2 for preservation of these samples. Samples were collected at each river station four times each day, about six hours apart. Although each sample was analysed separately for suspended solids and metals, these four samples were usually composited for the subsequent organic determinations.

Point Sources

Industrial and municipal samples were collected by DEM personnel during the river sampling period and stored in glass and polyethylene containers like those of the river samples.

B. Analytical Methods

Organics (see Figure 3)

Filtration and extraction

Shortly upon return to the laboratory, the water samples were filtered through precombusted and preweighed glass fiber filters (Whatman GF/C, particle size retention of 1.2 um). In the case of municipal and industrial samples, teh amount was about 4 liters and ca 4 filters were used; for the river samples, the volume was usually 12 liters and this also required ca 4 filters. After drying to constant weight at room temperature, the filters were reweighed to determine the amount of suspended solids (particulate components) in each sample and then stored at -20°C.

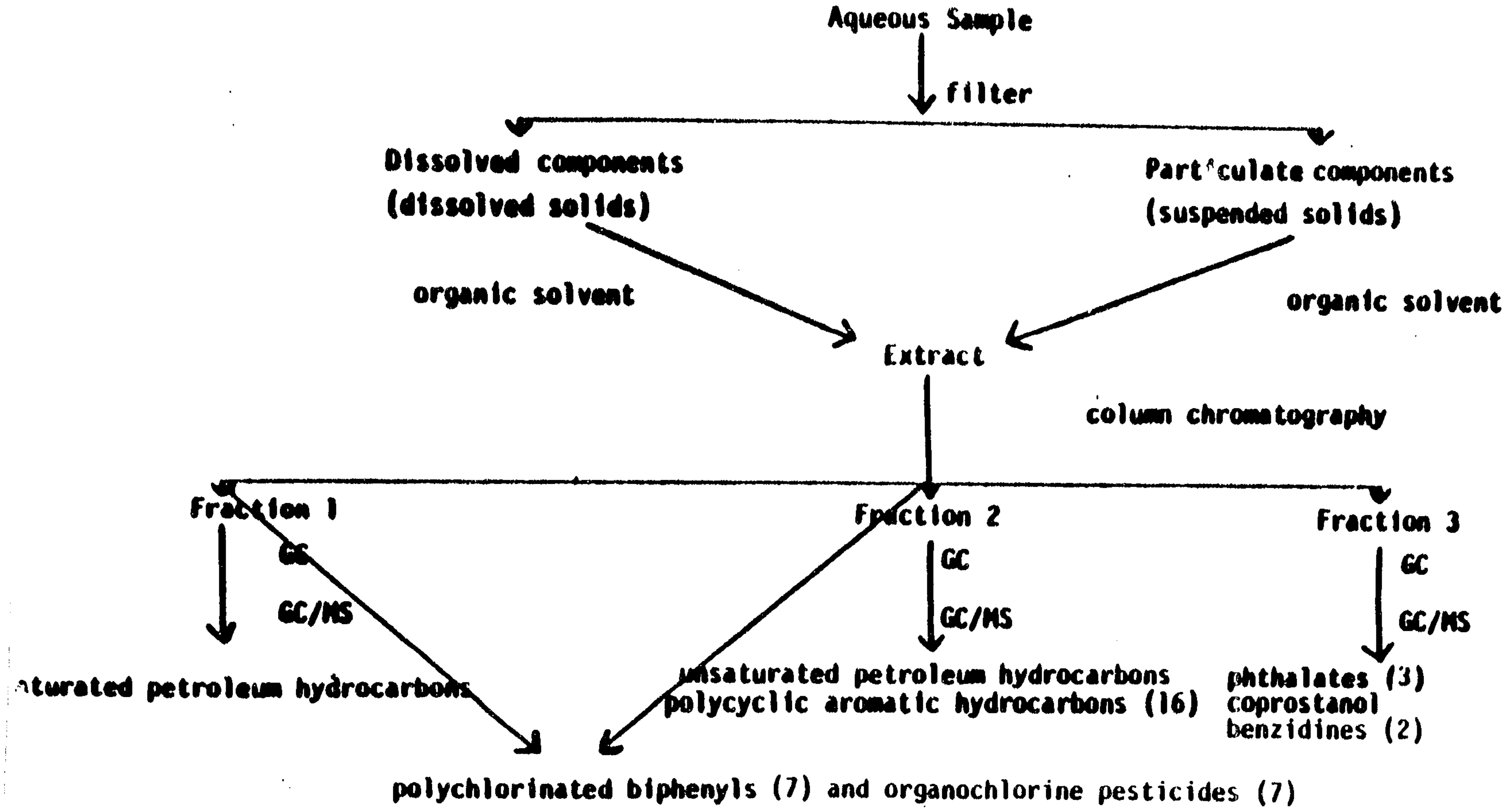

Figure 3. Flow chart for the analyses of organic compounds.

Internal standards were added to each filtrate (dissolved-soluble components) and these solutions were extracted once with a 10% volume of dichloromethane in the original glass sample container. The organic extracts were then isolated, solvent exchanged with hexane and reduced in volume on a rotary evaporator under reduced pressure at <30°C, and stored at room temperature.

The filters for each sample were shredded and transferred to a round bottom flask. Internal standards were then added followed by 50 to 200 ml of methanol, depending on the type and size of the sample. This mixture was refluxed for 2 hrs, cooled, and decanted into a separatory funnel. The sample was rinsed with petroleum ether and the rinse was combined with the filtrate in the separatory funnel which also contained distilled water in a volume equal to or greater than that of the methanol added to the sample. The water:methanol mixture was extracted 3 times with petroleum ether and the extracts were combined and reduced to ca 15 ml using rotary evaporation and stored at room temperature.

Separation

All extracts were separated into three fractions by silica gel chromatography using a method modified from Pruell and Quinn (1985). According to this procedure, the sample was reduced in volume to ca 2 ml and charged to a 0.5 cm x 10 cm column of fully activated silica gel (Grace Grade 922) using nitrogen to produce a flow rate of ca 5 ml/minute. The first fraction (f_1) was eluted with 15 ml of petroleum ether and contains saturated petroleum hydrocarbons. The second fraction (f_2) was then eluted with 15 ml of 80:20 petroleum ether:dichloromethane. This fraction contains unsaturated petroleum hydrocarbons and polycyclic aromatic hydrocarbons (PAHs) with 2-6 fused rings. Phthalic acid esters and coprostanol were eluted into the third fraction (f_3) using 15 ml of 80:20, dichloromethane:ethyl acetate. In addition, the polychlorinated biphenyls (PCBs) were obtained by charging a known amount of sample to a silica gel column and eluting with 80:20 petroleum ether:dichloromethane. In some cases, a second silica gel column (98:2; petroleum ether; dichloromethane) was required to clean up the PCB fraction.

Analyses

Each fraction was concentrated on a rotary evaporator and analyzed on one of several different Hewlett-Packard gas chromatographs (GC). The f_1 was processed using a 5840A GC (FID) equipped with a 0.25mm i.d. x 15 m DB-5 (0.25 um; J & W, Inc.) fused silica capillary column with helium as the carrier gas (ca 1 ml/min) and temperature programmed from 35 to 290°C at 8°C/min. Second fractions (f_2) were analyzed under similar conditions on a 5890 GC. The f_3 was measured on a 5710A GC (FID) using a 30 m DB-1701 (J & W, Inc.) column which was programmed from 150 to 290°C at 4°C/min with a helium flow of ca 1 ml/min. PCBs were analyzed on a 5710A GC (ECD) using a 30 m DB-5 column programmed from 100-290°C at 8°C/min with a helium flow of 1 ml/min.

Resolved peaks were quantified against the internal standards using Hewlett Packard integrators (3388A and 3390A). The unresolved complex mixture (UCM) in f_1 and f_2 was measured by planimetry and its area compared to that of the n-docosane (n-C_{22}) and m-terphenyl internal standards, respectively. Total petroleum hydrocarbons (HC) include the resolved and unresolved components in both fraction 1 (saturated hydrocarbons) and fraction 2 (unsaturated hydrocarbons). The 16 priority pollutant PAHs in f_2 were also quantified against m-terphenyl. Those components in f_3 were measured using the n-tricosanol (n-$C_{23}OH$) internal standard; they included three priority pollutant phthalates, (butyl benzyl-, bis(2-ethylhexyl-), and di-n-octyl-), and corprostanol. The PCBs were quantified against octachloronapnthalene internal standards using 4 peaks from each Aroclor mixture (ie.e 1248, 1254 and 1260). The organochlorine pesticides were also quantified using this internal standard. For purposes of discussion, the saturated and unsaturated HC are summed and called total HC; the 16 PAHs are summed and called total PAHs; the three phthalates are summed and called total phthalate; and the PCB mixtures are summed and called total PCBs.

Several samples were initially analyzed without the addition of internal standards in order to assess the background levels of these compounds. In all cases the background levels were insignificant when compared with the amount of internal standard added. Authentic standards were obtained for all of the compounds analyzed. Peak identification by retention time was confirmed by gas chromatography-mass spectrometry. This instrumentation included a Shimadzu gas chromatograph (Model GC-4 Cm) equipped with a 30 m SE-52 or DB-5 glass capillary column connected to a Finnigan 1015 mass spectrometer with a Systems Industries data system and Riber 400 D-8 software.