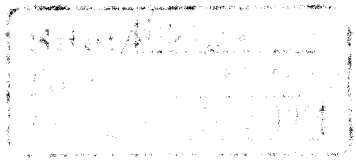

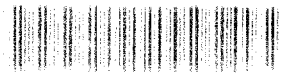

"DRAFT"

POLYCHLORINATED BIPHENYLS IN NEW ENGLAND

1978

Prepared by Susan Santos
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Air & Hazardous Materials Division
EPA, Boston

Comments on these materials are welcome.
Please submit them to:

Pesticides Branch, EPA
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M A S S A C H U S E T T S

MASSACHUSETTS:

Of the six New England states comprising Region I, Massachusetts appears to be the most affected by Polychlorinated Biphenyl (PCB) contamination. Massachusetts has historically expressed concern over the profuse PCB contamination within its borders as it houses four of New England's six major PCB users. As a result of this concern much data has been generated on PCBs at both the State and Federal levels.

Despite the tendency of PCBs to be ubiquitous, contamination within Massachusetts has tended to localize in the vicinity of the state's major PCB users: Sprague Electric Company, North Adams; General Electric Company, Pittsfield; Aerovox Industries Incorporated, New Bedford; and Cornell-Dubilier Electric Company, New Bedford.

North Adams:

North Adams houses one of Massachusetts major PCB users, Sprague Electric Company. Sprague's headquarters are located at their Marshall Street Plant in North Adams. The capacitor manufacturing operation involving PCBs, takes place at their Brown Street Plant (1/2 mile from the Marshall Street Plant).

Sprague Electric Company produces various types of capacitors. Capacitors containing PCBs are sealed in a metal container containing craft paper and aluminum foil.

Sprague mixes the Aroclor they receive from Monsanto Corporation with additives, to produce a compound with better dialectic properties than pure Aroclor. This PCB compound which Sprague calls Clorinal, is then used to impregnate the capacitors they manufacture. Aroclor 1254 was employed by Sprague prior to and including 1971. Aroclor 1242 was used prior to and including 1971 when Aroclor 1016 became available.

As a result of their capacitor manufacturing process, Sprague has been generating PCB contaminated liquid and soil wastes since the early 1950's.

Solid Waste

An on-site inspection of Sprague's facility was conducted by EPA Region I on January 19, 1976. From discussions with plant officials at that time, it was suspected that most if not all the PCB contaminated solid wastes generated by Sprague since the 1950's until the end of 1975 were disposed of in the North Adams landfill. No attempt was made by Sprague to separate the PCB contaminated wastes from other solid waste generated either at the plant or landfill. Sources of solid waste include reject capacitors, diatomaceous earth, absorbent material, wiping rags and gloves.

Since November 1975, Sprague reported that they were storing all their PCB contaminated solid wastes in open 55 gallon drums under cover at their Brown Street Plant. This storage procedure is planned to continue until the State develops a policy for disposal of these PCB wastes.

Sprague reports a capacitor rejection rate equal to 5 per cent of their capacitor production. The estimated amounts (in pounds) of PCBs in reject capacitors were calculated by EPA for Aroclor 1016 from 1971-1976:

Year	Amount
1975	11,609 lbs
1974	46,178 lbs
1973	56,667 lbs
1972	38,445 lbs
1971	36,814 lbs

Liquid Wastes

As with the PCB contaminated solid wastes, it is suspected that significant quantities of liquid PCB wastes generated by Sprague since the 1950's until 1971, were disposed of in the North Adams landfill. Records are not available on either the amounts of liquid PCB wastes generated by Sprague or on the amounts sent to the North Adams landfill during this period. Since 1971, Sprague has had their liquid PCB destroyed in an industrial liquid waste incinerator at the Chem-Trol Pollution Services facility in Model City, New York.

Sprague stores their liquid PCB wastes in sealed 55 gallon drums in an undiked, unpaved area outside their Brown Street plant until the wastes are shipped for incineration. Between 1971 and 1975, Sprague reported that the following amounts of liquid were incinerated:

Year	Type	Amount in lbs
1975	Aroclor 1016	97,185
1974	Aroclor 1016	97,185
1973	Aroclor 1016	150,480
1972	Aroclor 1016	110,160
1971	Aroclor 1016)	
	Aroclor 1254)	150,000
	Aroclor 1242)	

These liquid wastes include:

1. Unreclaimable PCB drippings from capacitors and racks after impregnation and soldering.

2. Drippings from valves and connections.

3. Degreasing sludge from trichloroethlene distillation operation.

4. Discarded samples from quality control lab.

5. Contaminated vacuum pump oil.

Wastewater

Sprague's Brown Street plant has two effluent discharges. One contains industrial wastewater (primarily non-contact cooling water from vacuum pumps); the other contains sanitary wastes. The industrial wastewater discharges to the Hoosic River via an open drainage ditch on plant property. The flow rate averages approximately 760 cubic meters per day (200,000 gpd). Sanitary wastes discharge to the North Adams municipal sewer system. These wastes comprise flows from water closets and hard washings. Showers are not normally used in the Brown Street plant. Flow rate to the municipal sewer system is unknown. Sanitary wastes generated prior to January 1977 were treated in North Adams primary wastewater treatment plant.

Approximately 55,000 tons per year of wet sludge from the digester is generated by the North Adams facility (approximately 1 ton/wk, 6% solids).

Sludge disposal consisted of mixing sludge with soil conditioner at various municipal facilities (athletic field, cemetary, golf course).

Sludge samples from the North Adams Wastewater Treatment Plant were taken on May 11, 1976 and analyzed by EPA's regional laboratory. The results detected PCB in the sludge as: Aroclor 1016 - 28,000 ug/kg (28 ppm) and Aroclor 1254 - 6,400 ug/kg (6.4 ppm). Wastewater from the treatment plant was also analyzed and showed no detectable levels of PCB.

The North Adams Treatment Plant was scheduled to be shut down in December 1976 when a new regional plant in Williamstown became operational. Sludge from that plant will be disposed of in the Williamstown sanitary landfill.

Overall, the situation at Sprague as of the on-site inspection in January 1976 indicated that Sprague's manufacturing operation is physically organized such that they could quite effectively control any PCB losses within their plant. However, during visitation of the facility several places were observed where drippings were not contained, e.g. (1) the drip pan under one of the impregnation tanks was not in its proper place, and (2) a considerable amount of pooled liquid was observed on the floor below the convey or line drip pan prior to the degreaser.

Sprague's two effluent discharges described earlier are both under the jurisdiction of NPDES permits Nos. MA0005924 and MA0005941. It was felt that Sprague justifiably could not meet the final effluent limitations contained in their permit by July 1, 1977 and, therefore, they imitations contained in their permit by July 1, 1977 and therefore, they were issued an Enforcement Compliance Schedule (ECS), included in the appendix of this report. Basically, the ECS for Sprague's Permit No. MA0005924 stipulates that Sprague cease the use of PCBs by July 1, 1977 (which they have done) and that by December 1, 1977 Sprague complete their proposed program to reduce PCB discharge levels. This program includes equipment clean-up within the plant, building maintenance, stopping the inflow to the underfloor reservoir, yard grading and clean-up, piping of the effluent ditch, and any other steps necessary to reach the discharge limitations.

The PCB discharge limitations state that by no later than January 1, 1978 either: (a) Sprague achieves the daily maximum PCB concentration of 10 ppb (0.010 mg/l) as specified in Special Condition A-2 of their permit, or (b) they achieve the daily ounce/day limitation of 0.44 ounces a day specified in Special Condition A-2. Until the January 1, 1978 deadline, Sprague must achieve the daily maximum limitation of 0.63 ounces/day specified in Special Condition A-2 of the permit. Sprague's other discharge (sanitary wastes) fall under the jurisdiction of Permit No. MA0005941. An enforcement compliance schedule was issued for this permit and is included in the appendix of this report.

Effluent from the Brown Street plant was analyzed by EPA in January 1975 and found to contain 41 ppb. This was in Sprague's discharge to the Hoosic River. Samples taken above the plant indicated concentrations of 0.5 ppb while those below the plant showed 1.0 ppb.

In January 1976, EPA Region I performed a PCB survey for industrial sources of PCB in Massachusetts. Results of this survey (contained in Tables 1 and 2) include analysis results for Sprague's two discharges. Sprague's industrial effluent contained PCB levels of 78 and 120 parts per billion (ppb), while the sanitary waste discharge contained 14 ppb of PCB. Influent process cooling water from Tunnel Brook at the plant's entrance was also sampled for PCBs and found to be below the limit of detection for the analysis (0.5 ppb).

Table 3 shows the total amount of PCB coming from each major user and also indicates where these quantities of PCB are released. Results for Sprague indicated that 2.1 and 3.2 ounces of PCB were released on January 21 and 22, respectively.

Finally, table 4 indicates sampling locations and analytical results of the PCB study performed by EPA, Region I in the Hoosic River in September 1975. Figure 1 of this report indicates a sample location map. Although PCBs were found in Sprague's effluent at levels of 57 and 83 ppb (micrograms/liter), water sampled in the Hoosic had less than 0.1 ppb of PCB detected.

Unfortunately, while several water and sediment samples had been ascertained during this study, not all of the water samples and none of the sediment samples were analyzed. This lack of data prohibited any meaningful assessment of the PCB situation within the Hoosic River to be arrived at. Further, as additional sampling and/or analysis for PCBs has not been undertaken since January 1976, it was impossible to characterize the extent of the PCB contamination in and around the vicinity of Sprague and North Adams. Likewise, it is difficult to fully determine what role Sprague plays in providing PCB contamination to the Hoosic.

Selected public water supplies in North Adams were samples for PCBs on January 22, 1976. Water sampled from Broad Brook, James Brook and Williams Reservoir were analyzed and found to contain less than 0.05 ppb PCB which was also the detection limit for the analysis. Thus, the PCB level, if any, in North Adams' public water supplies were below the limit of detection.

The only other available information on the existence of PCBs within the vicinity of North Adams, pertains to the North Adams sanitary landfill (see Figure 2). At the time EPA performed its on-site inspection of Sprague, the Town Sanitarian for North Adams reported that the North Adams landfill which had accepted industrial waste (including liquids) as well as municipal waste, had been operated as an open burning dump until 1971-1972.

The total quantities of PCB wastes disposed of at this site are unknown. Based on available information from Sprague for the period from 1971 through most of 1975, close to 200,000 pounds of PCBs contained in reject capacitors were disposed of in the North Adams landfill. This estimate is not inclusive of any other contaminated solid waste generated (e.g. filter material, etc.). The following information regarding the North Adams landfill was ascertained by EPA in January 1976:

A. General Information

1. Location: E Street (off West Shaft Road) North Adams, MA.
2. Owner/operator: Municipality of North Adams
3. Estimated year site placed in operation - 1935
4. Area of site: 72 acres
5. Area filled to date: 36 acres
6. Approximate quantities of refuse accepted - 20,000 ton/year.
7. Composition - 25% industrial; 75% municipal.

B. Operational Data

1. Engineering report: none prepared to date (3/17/76)
2. Method of filling: fill on surface
3. Current operational status: dump and cover--not in compliance with state standards
4. Leachate control and monitoring: none
5. Leachate discharges: no visible discharges known to exist

C. Geological Conditions

1. Soils: sands and gravel
2. Logs of test pit borings: only source of information--cut in nearby enbankment

D. Hydrological Data

1. Groudwater: 35 feet below surface
2. Proximity to surface water: small stream at edge of site (spring fed)*
3. Proximity of drinking wells: no wells in area
4. Location of flood plains: none
5. Location of wetland: none

Source of Information:

Peter Morekresky, Regional Engineer
Massachusetts Department of Environmental Quality Engineering

George Heisler, Town Sanitarian
Board of Health, Town of North Adams

A map indicating the location of the landfill has also been included in figure 2 of this report.

* Presence of spring fed stream would indicate groundwater may be closer to surface than 35 feet.

TABLE 1

SAMPLING RESULTS - PCB SURVEY
OF
Industrial Sources of PCBs in Massachusetts
January, 1976
(Analysis by EPA Region I - Surveillance & Analysis Division)

Station No.	Date Yr.	Mo.	Day	Time Hr.	Min.	Sample No.	Total PCB (ppb)
AVOX 01	76	01	14	8 hr. Comp.		42100	51
AVOX 02	76	01	14	8 hr. Comp.		42101	400
AVOX 03	76	01	14			42102	2.4
AVOX 01	76	01	15	8 hr. Comp.		42103	29
AVOX 02	76	01	15	8 hr. Comp.		42104	72
CDED 02	76	01	14	8 hr. Comp.		42125	710
CDED 01	76	01	14	09	45	42126	-
CDED 04	76	01	14	8 hr. Comp.		42138	2900
CDED 03	76	01	14	4 hr. Comp.		42139	110
CDED 02	76	01	16	8 hr. Comp.		42127	460
CDED 01	76	01	16	12	45	42128	-
CDED 03	76	01	16	4 hr. Comp.		42147	41
CDED 04	76	01	16	8 hr. Comp.		42146	580
SPRA 01	76	01	21	8 hr. Comp.		42105	120
SPRA 02	76	01	21	13	15	42106	14
SPRA 01	76	01	22	8 hr. Comp.		42107	78
SPRA 03	76	01	22	14	20	42108	-

TABLE 1
Descriptions

Sampling Stations
For
Industrial Sources of PCBs
In
Massachusetts
January, 1976

Aerovox Corporation, New Bedford, Massachusetts

AVOX01	Vacuum pump noncontact, cooling water sampled at North Trough discharge to the Acushnet River.
AVOX02	Sanitary wastes sampled at pump station discharging to municipal sewer system.
AVOX03	Influent municipal water sampled near entrance to the plant.

Cornell-Dubilier Electric Corporation, New Bedford, Massachusetts

CDED01	Influent municipal water supply at chemical mix station for boiler feed water.
CDED02	Groundwater infilltration from basement sumps and some non-contact cooling water sampled at south moat. Discharges to municipal sewer. Company station designation 5S.
CDED03	Primarily vacuum pump non-contact cooling water, boiler blowdown, and drainage from building underdrains sampled at junction with municipal storm sewer. Company station designation serial #001 NPDES #0003930
CDED04	Groundwater infiltration from basement sumps and some non-contact cooling water sampled at north moat. Discharges to municipal sewer. Company station designation 5M.

Sprague Electric Company, North Adams, Massachusetts

SPRA01	Industrial effluent from Brown Street plant at open drainage ditch leading to Hoosic River.
SPRA02	Sanitary sewer from Brown Street plant discharging to municipal sewers. Sampled at manhole in parding area near industrial effluent drainage ditch.
SPRA03	Influent process cooling water from Tunnel Brook. Sampled at entrance to plant.

TABLE 1 -(con't)

Station No.	Date Yr. Mo. Day	Time Hr. Min.	Sample No.	Total PCB (ppb)
GEOS 05	76 01 21	8 hr. Comp.	42129	14
GEOS 06	76 01 21	8 hr. Comp.	42130	10
GEOS 05	76 01 21	8 hr. Comp.	42131	30
GEOS 06	76 01 22	8 hr. Comp.	42132	4.3
SCRU 01	76 01 22	8 hr. Comp.	42133	9.1
SCRU 02	76 01 22	8 hr. Comp.	42134	9.7

TABLE 1 (con't)
Descriptions

General Electric Company, Pittsfield, Massachusetts

GE005	NPDES Permit No. MA0003891, Out fall Serial 005. Effluent from oil/water separator treats groundwater incinerator scrubber water, and flows from power and distribution transformer departments.
GE006	NPDES Permit No. MA0003891, Outfall Serial 006. groundwater, flows from the power transformer department, and runoff from adjacent city areas.
SCRU01	Influent scrubber water from influent end of oil/water separator at Outfall 005.
SCRU02	Effluent scrubber water returned to oil/water separator at Outfall 005.

Table 2
Industrial Sources of PCBs
in Massachusetts
Effluent Sampling Results
January, 1976

Sprague Electric Company, North Adams, Massachusetts

Station	Date	Sample Type	Time (Hours)	Flow Rate M^3/day	Flow Rate GPD	Total PCBs ug/L (ppb)	Daily Quantity[2] Grams	Daily Quantity[2] Ounces
SPRA01	01/21/76	C		760	200,000	120	91	3.2
	01/22/76	C	0705-1405	760	200,000	78	59	2.1
SPRA02	01/21/76	G	1315	-	-	14	-	-
SPRA03	01/22/76	G	1420	-	-	*	-	-

Aerovox Industries Incorporated, New Bedford, Massachusetts

AVOX01	01/14/76	F.C.	0830-1500	2000	0.53	51	102	3.6
	01/15/76	F.C.	0830-1415	2000	0.53	29	58	2.0
AVOX02	01/14/76	T.C.	0750-1450	450	0.12	400	180	6.3
	01/15/76	T.C.	1030-1430	450	0.12	72	32	1.1
AVOX03	01/14/76	G	-	-	-	2.4	-	-

Cornell-Dubilier Electric Corporation, New Bedford, Massachusetts

CDED01	01/14/76	G	0945	-	-	*	-	-
	01/16/76	G	0945	-	-	*	-	-
CDED02	01/14/76	C	0800-1500	91	24,000	710	65	2.3
	01/16/76	C	0730-1430	76	20,000	460	35	1.2
CDED03	01/14/76	C	1040-1340	230[3]	60,000[3]	110	25	0.9
	01/16/76	C	1100-1400	230[3]	60,000[3]	41	9.4	0.3
CDED04	01/14/76	C	0800-1500	34	9,000	2,900	99	3.5
	01/16/76	C	0730-1430	30	7.800	580	17	0.6

TABLE 2 (continued)

Station	Date	Sample Type	Time (Hours)	Flow Rate M^3/day	Flow Rate GPD	Total PCBs ug/L (ppb)	Daily Quantity[2] Grams	Daily Quantity[2] Ounces
General Electric Company, Pittsfield, Massachusetts								
GE005	01/21/76	C	0820-1530	4,200	1.1	14	59	2.1
	01/22/76	C	0830-1530	3,800	1.0	30	110	4.0
GE006	01/21/76	C	0835-1535	2,000	0.53	10	20	0.71
	01/22/76	C	0840-1540	2,000	0.53	4.3	8.6	0.30
SCRU01	01/22/76	G	1535	-	-	9.1	-	-
SCRU02	01/22/76	G	1520	-	-	9.7	-	-

Note:

* Below detection limit of 0.5 ug/L (ppb)

1 " G " - grab sample
" C " - Composite sample, incremental samples collected at one hour intervals. Times shown indicate collection time of first and last sample.

" T.C. " - Time composite - equal aliguots of sample composites at hourly intervals.

" F.C. " - Flow Composite - hourly aliquots composited proportional to flow.

2 Assuming the company production line operate 24 hours per day and flow rate is constant.

3 Company's estimate of total daily flow, not a flow rate

TABLE 3

Analysis of PCB Discharges
from
Industrial Sources in New England
January, 1976

Company Name	Date Sampled	Total PCB from Company (ounces)	Amount of PCB to Municipal STP* (ounces)	Amount PCB directly to Environment (ounces)
Aerovox Industries Inc.	1/14	9.9	6.3	3.6
New Bedford, Ma.	1/15	3.1	1.1	2.0
Cornell-Dubilier	1/14	6.7	5.8	0.9
Electric Corp.	1/16	2.1	1.8	0.3
New Bedford, Ma.				
Jard Co. Inc.	1/21	0.31	0.31	-
Bennington, Vt.	1/22	0.09	0.09	-
Sprague Electric Co.	1/21	3.2	-	3.2
North Adams, Ma.	1/22	2.1	-	2.1
Universal Mfg. Co.	1/28	0.01	0.01	-
Bridgeport, CT.	1/29	0.06	0.06	-
General Electric Co.	1/21	2.81	-	2.81
Pittsfield, Ma.	1/22	4.3	-	4.3

Note:

The above results are based on 8 hour Composite samples at each company, assume that the situation represented in the 8 hour sample persists for 24 hours, and do not attempt to make any judgement based on grab samples at any site.

*The PCB level in the wastewater effluent from the Bennington, VT. Sewage Treatment Plant and the North Adams Sewage Treatment Plant were less than the minimum detectable level of the analysis (i.e. 0.5 and 0.1 parts per billion (ppb) depending on the standard used).

TABLE 4

Station Locations & Analytical Results
PCB Study
Hoosic River
Massachusetts
September 30, 1975

Station No.	Latitude	Longitude	Description	PCB Content (Aroclor 1016) micrograms/liter (ug/L)
SPRA 01	42 42 05	73 07 25	Effluent from Sprague Electric Company's Brown Street Plant at open drainage ditch, North Adams, Massachusetts	57 83
NADM 01	42 42 01	73 08 43	Effluent from North Adams, Massachusetts WWTP at primary settling tank weir	<0.1
HOOS 01	42 41 57	73 07 53	Hoosic River approximately 1.2 Kilometers (0.78 miles) downstream from the confluence with the North Branch and upstream from the North Adams wastewater Treatment Plant	<0.1

FIGURE 1

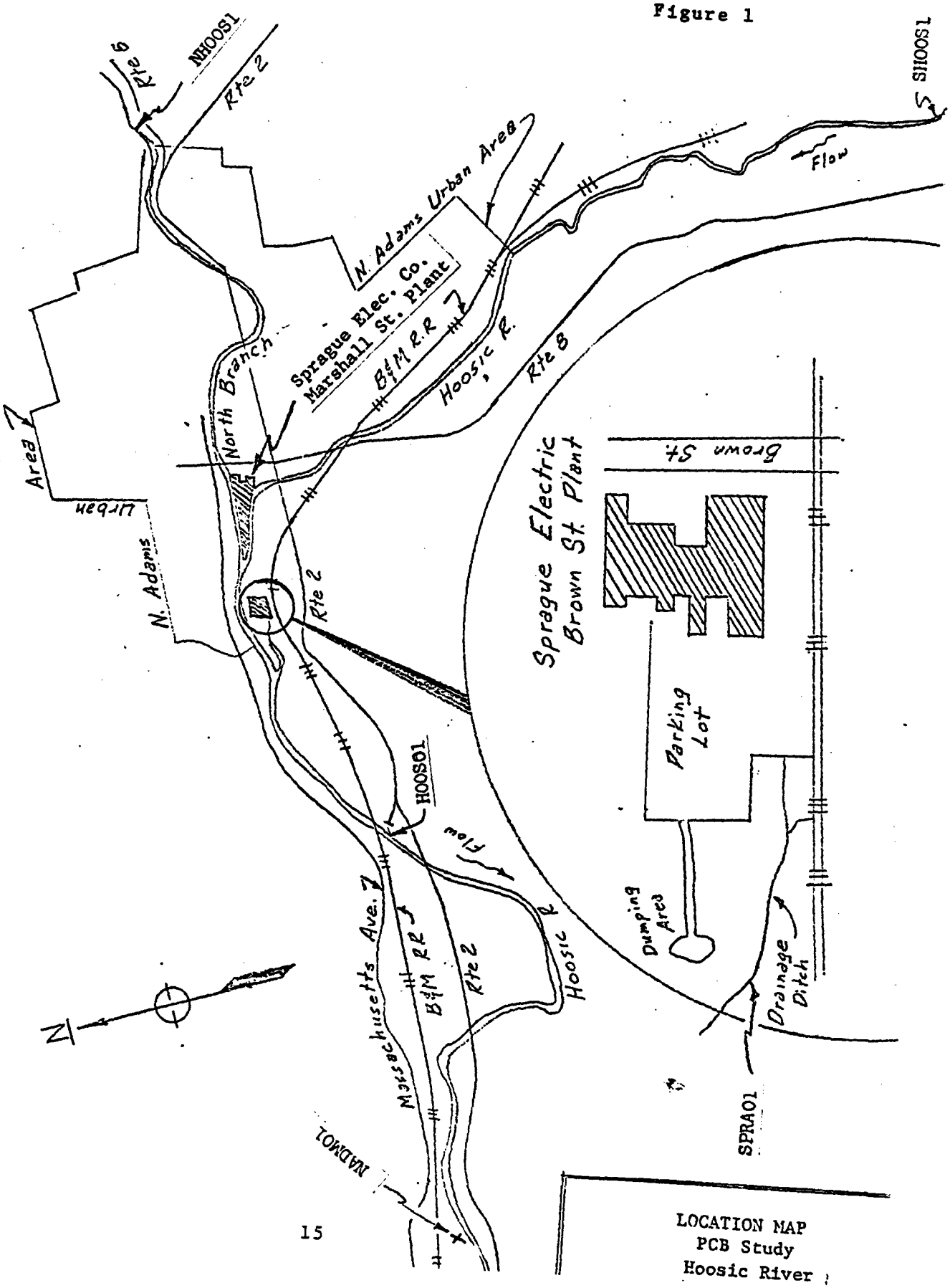


Figure 1
NHOOS1
Rte 6
Rte 2
N. Adams Urban Area
Flow
SHOOS1
Sprague Elec. Co.
Marshall St. Plant
B&M R.R.
Hoosic R.
Rte 8
North Branch
Area
Urban
N. Adams
Rte 2
Brown St.
Sprague Electric
Brown St. Plant
Parking Lot
HOOS01
Flow
Dumping Area
Drainage Ditch
Massachusetts Ave.
B&M RR
Rte 2
Hoosic R.
MADM01
SPRA01
N
LOCATION MAP
PCB Study
Hoosic River

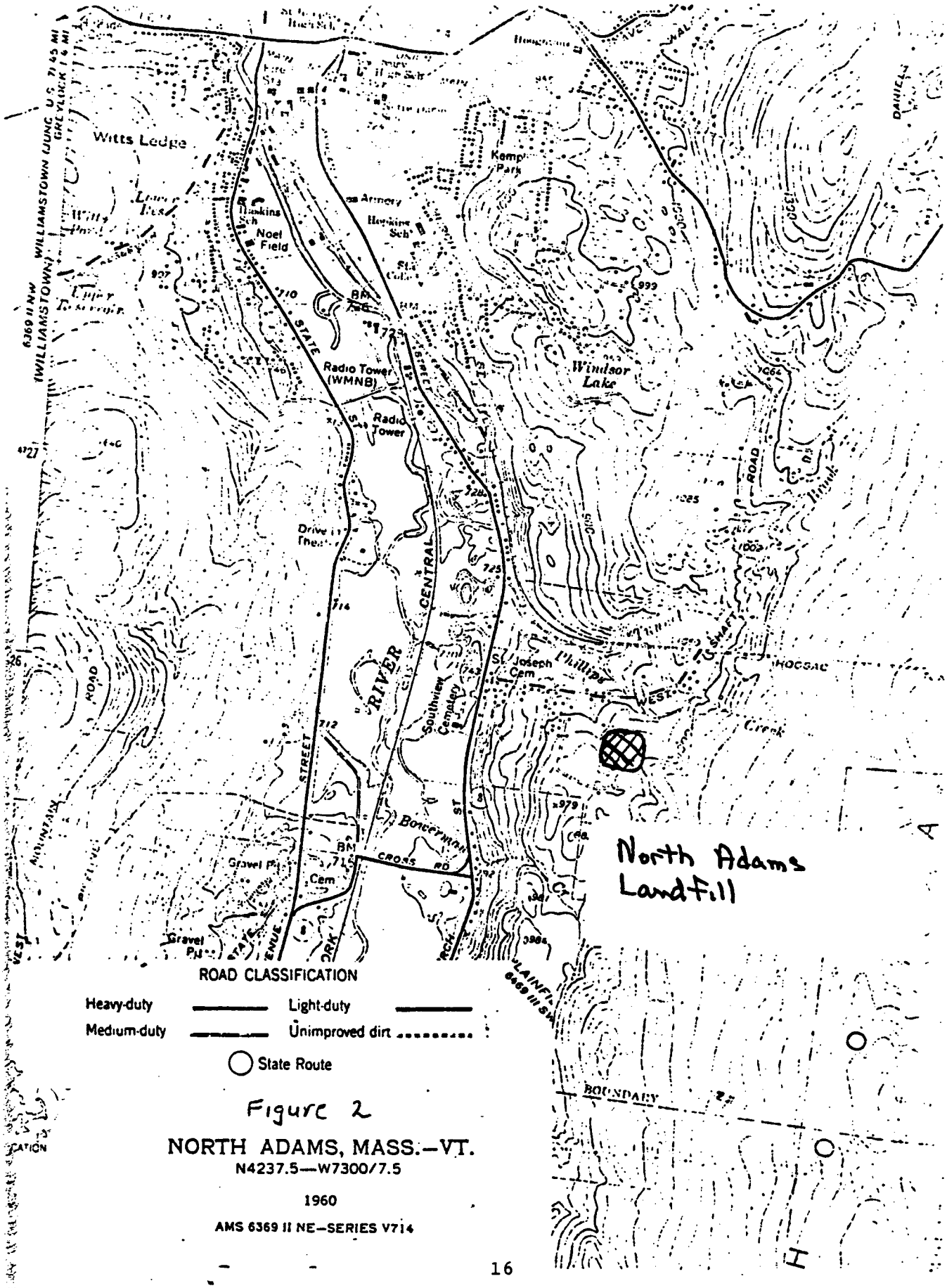


Figure 2

NORTH ADAMS, MASS.—VT.
N4237.5—W7300/7.5

1960

AMS 6369 II NE—SERIES V714

New Bedford:

The city of New Bedford has long evidenced the presence of considerable PCB contamination. Extensive amounts of PCB reported in this area may be related to the fact that New Bedford houses two major PCB users: Aerovox Industries, Incorporated and Cornell-Dubilier Electric Corporation. Environmental measurements taken in this area have been supportive of the notion that PCB levels are highest in areas where industrial users of PCB are present.

I. Cornell-Dubilier Electric Corporation - (CDE)

Cornell-Dubilier located at 1605 East Rodney French Blvd., New Bedford, Ma. is engaged in the manufacture and sale of capacitors which are consumer products, in that their customers with rare exception do not purchase capacitors for resale.

Cornell-Dubilier manufactures primarily Aroclor containing capacitors and relatively small amounts of capacitors containing mineral oil. Capacitors which are impregnated with Aroclor are defined as passive electric devices, metal-encased, hermetically sealed, containing kraft paper and/or plastic film and aluminum foil electrodes.

PCBs are utilized by Cornell-Dubilier for impregnation of capacitors. Aroclor 1016 has been in use since 1971 and Aroclor 1242 was used prior to 1971. In addition, relatively small amounts of Aroclor 1254 had been used as an impregnation fluid until early 1975 when its use was discontinued. It is estimated that between January 1971 - January 1976, Cornell-Dubilier has used more than 3.1 million pounds of Aroclor 1016 and 24,000 pounds of Aroclor 1254.

PCB contamination can result at any time during the use or manufacture of PCBs. One possible route of PCB escape to the environment is through contamination by PCB generated wastes. As such, it is important that the amounts of PCB waste generated and their disposal be accounted for.

In December 1976, EPA Region I performed an on-site inspection of Cornell-Dubilier's facilities. At that time, information was also ascertained as to the liquid and solid PCB wastes being generated by Cornell-Dubilier.

Solid Wastes

Sources of PCB contaminated solid waste include reject capacitors, contaminated solder from sealing operation, diatomaceous earth from filters, absorbent material used to clean small spills and drippings, wiping rags and gloves.

The exact quantity of PCB solid waste generated by Cornell-Dubilier is not known, but it has been estimated that from January 1971 - January 1976, more than 270,000 pounds of Aroclor have been sent to the New Bedford landfill primarily contained in reject capacitors. In response to the letter sent under Section 308 of FWPCA to Cornell, it was reported that only an estimate of the quantities of solid waste generated could be given. Records were not maintained on the total poundage disposed of in the New Bedford landfill, nor were records kept on the breakdown by the type of PCB compound disposed of. Cornell-Dubilier has estimated that 99% of the PCBs disposed of by landfill method were hermetically-sealed capacitors with the balance being absorbent materials.

No attempts were made by Cornell to segregate PCB contaminated wastes from general wastes. The ABC Disposal Company, 246 Clifford Street, New Bedford, Massachusetts was contacted to haul the wastes to the New Bedford landfill. No specific area of the landfill had been designated to receive these wastes.

The plant inspection report points out that under Massachusetts law, PCB wastes are classified as hazardous materials, and haulers must be licensed by the Massachusetts Department of Environmental Quality Engineering. The ABC Disposal Company is unlicensed; but Cornell-Dubilier was unaware of the hazardous material classification or the need for a hauler to be licensed.

Liquid Wastes

Sources of PCB contaminated liquid wastes include discarded test samples from the quality control laboratory, residue from trichloroethylene distillation operation, drippings from valves and connections, unreclaimable PCB drippings from capacitors and racks after impregnation and contaminated vacuum oil. These contaminated PCB liquid wastes are stored in 55 gallon color coded drums placed on pallets, and stored in an open area at the rear of the building. Inspection of this area showed it to be neither covered nor paved. The storage area is exposed to the "elements", and no spill containment facilities exist. Direct observation also showed the ground in this area to be somewhat "oil-laden". The inspection team observed pools of oily waste at the base of some drums and on some covers. Typically, wastes are allowed to accumulate in this area until quantity warrants contracting a disposal company for incineration. In 1971, an estimated 180,000 lbs. of PCBs were shipped via railroad tank car and sent to Monsanto Company, St. Louis, Mo. for incineration. During 1973 and 1974, approximately 489,060 lbs. of PCBs were shipped to Chem-trol Pollution Service, Incorporated, Model City, New York, which both trucked and incinerated Cornell's liquid wastes.

No accurate records were said to exist by Cornell on the total poundage of PCBs incinerated before 1973 or on the type of PCB compound being incinerated during any period.

Wastewater

Cornell-Dubilier Electric Corporation processes their wastewater discharges to the municipal wastewater treatment plant via the City of New Bedford's sewers and to the Acushnet River via a city storm sewer.

The following information on Cornell's wastewater discharges was obtained from the 1976 EPA plant inspection report:

"The New Bedford sanitary sewers received non-cont act vacuum pump cooling waters from a north moat and a south moat. These moats are open drains along the external rear of the building. They receive multiple intermittent pumped discharges from cooling water sumps located within the basement of the building. The combined flow from the moats averages 110,000 gallons per day of surface water infiltration which are pumped from basement sumps, and 10,000 gallons per day of sanitary wastes are discharged.

"The storm drain discharge is permitted (MA0003930) as containing uncontaminated cooling water and a maximum of 1,000 gallons per day of boiler blow down. This discharge also receives flow from a network of underdrains in the boiler room and other buildings removed from the main plant. Mr. Curtis Lopes, Plant Engineer, stated that there may be other unknown discharges to the line from unmapped areas of the plant. The flow enters a wet well which has a vertical tee submerged discharge port similar to that in a septic tank. The wet well, thus, serves as an oil spill containment chamber should a spill occur. Flow from the chamber passes under the main plant and discharges to a storm manhole near the sidewalk at the front of the plant. This flow averages approximately 48,000 gallons per day."*

Sludge samples were taken from the New Bedford Wastewater Treatment Plant in March and April 1976 and analyzed for PCB content by EPA's Regional Laboratory. The results indicated levels of PCB within the sludge.

Sample Date	Aroclor	PCB Concentration(ug/kg)
3/76	1016	64,000 (64. ppm)
	1254	9,600 (9.6 ppm)
4/76	1016	28,000 (28. ppm)
	1254	2,800 (2.8 ppm)
	1016	39,000 (39. ppm)

Wastewater from the treatment plant was also analyzed but contained no detectable levels of PCB.

It should be noted that the New Bedford Wastewater Treatment Plant is a receipient of PCBs from Aerovox Industries Incorporated as well as Cornell-Dubilier Electric Company.

In general, the December 30, 1976 on site inspection of Cornell-Dubilier revealed that from the delivery area through impregnation, "plant housing"

*Report on EPA plant inspection of Cornell-Dubilier - Dec. 30, 1976.

was generally good. Although some staining due to PCB contamination was visible; no obvious oil films were observed nor was any absorbent material seen lying around.

The liquid waste storage area was felt to be the least "maintained" area in the plant. Minimum control and containment were felt to best describe handling practices in this area. Since the liquid waste storage area is a yard storage area, PCB spills or coatings on the drums tend to leach to the ground. It was noted that the flatness of the storage area would probably prevent surface runoff and thus help contain the spread of PCB contamination.

As mentioned earlier, Cornell-Dubilier's liquid wastewater discharges fall under the jurisdiction of NPDES permit No. MA003930. Cornell discharges to a storm drain to the Fort Phoenix Reach. Cornell's current permit, effective as of December 30, 1976 modified the permit issued to them on August 14, 1975, and restricts the amount of PCB to be released by Cornell to 0.010 mg/L (10 parts per billion.) This permit modification represents an attempt to reduce and control the amount of PCB discharged by Cornell and, thus, allowed to enter the environment.

Tables 1 and 5 indicate sample results and stations for the survey of industrial sources of PCBs in Massachusetts and show that Cornell-Dubilier had previously been discharging up to 110 ppb PCB through a storm drain connected to the storm drain to the Fort Phoenix Reach, and 2900 ppb to the municipal sewer. Tables 2 and 3 indicate the daily quantity of PCB released by Cornell-Dubilier and also where these discharged quantities of PCB are released. Sampling performed on January 14, 1976 indicated 6.7 ounces of PCB discharged from Cornell; 5.8 ounces of which were released to the New Bedford Municipal STP with the remaining 0.9 ounces released to the environment. On January 16, 1976, 2.1 ounces of PCB were measured in Cornell's discharge - 1.8 ounces to the STP and 0.3 ounces to the environment.

II. Aerovox Industries, Inc.:

Aerovox Industries Incorporated is located at 740 Belleville Avenue, New Bedford, Massachusetts. Aerovox's sole product is capacitors that are used in a wide variety of electrical applicators ranging from ballasts used in fluorescent light circuits to atomic energy research.

The physical size of the product ranges from units of approximately 1 cubic inch to units of 5,000 cubic inches. Wide variations also exist in capacitance and voltage ratings of the unit.

Aerovox manufactures several categories of capacitors including: paper, paper foil, electrolytic and mica capacitors. All capacitors produced are used as components in other electrical products and classified as industrial consumer products.

The Aerovox facility has employed PCBs as impregnation fluids since 1947. Aroclor 1242 was used until 1971 when Aroclor 1016 was introduced. In 1972, Aroclor 1016 had replaced 1242 as an impregnation fluid. Aroclors 1254

TABLE 5

SUMMARY OF PCB DATA
NEW BEDFORD, MASSACHUSETTS
(Analysis by U.S. EPA, Region I, Surveillance & Analysis Division)

Date Sampled	Type Sample	Station Description	PCB Value ppb
		AEROVOX CORP.	
01/14/76	Water 8-hr. Comp.	North Trough Effluent to Acushnet River	51
01/15/76	Water 8-hr. Comp.	North Trough Effluent to Acushnet River	29
01/14/76	Water 8-hr. Comp.	Sanitary wastes at pump station discharging to WWTP*	400
01/15/76	Water 8-hr. Comp.	Sanitary wastes at pump station discharging to WWTP*	72
01/14/76	Water-grab	Municipal water supply inlet at plant	2.4
		ACUSHNET RIVER-AEROVOX CORP.	
05/10/76	Sediment-grab	Acushnet River, approximately 60 meters downstream of Aerovox effluent discharge	620,000
08/24/76	soft shell Clam	Acushnet River East Bank .3 km downstream of Aerovox effluent discharge.	53,000
	soft shell Clam	Acushnet River East Bank 1.1 km downstream of Aerovox effluent discharge	21,000
	soft shell Clam	Acushnet River East Bank 1.8 km downstream of Aerovox effluent discharge	23,000

Date Sampled	Type Sample	Station Description	PCB Value ppb
		CORNELL-DUBLIER	
01/14/76	Water-grab	Influent-public water supply in boiler room	**N.D.
01/16/76	Water-grab	Influent-public water supply in boiler room	**N.D.
01/14/76	Water 8-hr. Comp.	Cooling water discharge to WWTP-South Moat	710
01/16/76	Water 8-hr. Comp.	Cooling water discharge to WWTP-South Moat	460
01/14/76	Water 4-hr. Comp.	Boiler room effluent discharge to Acushnet River	110
01/16/76	Water 4-hr. Comp.	Boiler room effluent discharge to Acushnet River	41
01/14/76	Water 8-hr. Comp.	Cooling water discharge to WWTP-North Moat	2,900
01/16/76	Water 8-hr. Comp.	Cooling water discharge to WWTP-North Moat	580
05/10/76	Sediment-grab	Acushnet River-approximately 500 meters downstream of plant	143,000

Date Sampled	Type Sample	Station Description	PCB Value ppb
		NEW BEDFORD *WWTP	
03/26/76	Sludge-grab	Before incineration	73,600
04/76	Sludge-grab	Before incineration	30,800
05/10/76	Sediment-grab	Near WWTP outfall	500
05/10/76	Sediment-grab	Near abandoned WWTP outfall	1,900
07/19/76	Water-grab	WWTP influent	106
07/19/76	Water-grab	WWTP effluent	119
		NEW BEDFORD SANITARY LANDFILL	
03/26/76	Water-grab	Groundwater from monitoring well GW-1	**N.D.
03/26/76	Water-grab	Groundwater from monitoring well GW-2	1.0
03/26/76	Water-grab	Groundwater from monitoring well GW-3	**N.D.
03/26/76	Water-grab	Groundwater from monitoring well GW-4	**N.D.
04/76	Sediment-split spoon	Sample from drilling of monitoring well GW-3 (0-7.5')	7,500
	Sediment-split spoon	Sample from drilling of monitoring well GW-3 (15'-17')	**N.D.
	Sediment-split spoon	Sample from drilling of monitoring well GW-3 (15'-17')	**N.D.
04/76	Leachate Seep-grab	Seep from near well GW-3	10

Date Sampled	Type Sample	Station Description	PCB Value ppb
		NEW BEDFORD MUNICIPAL WATER SUPPLY	
01/76	Water-grab	Little Quittacas Pond-raw [1,2]	0.1
01/76	Water-grab	Little Quittacas Pond-raw	**N.D.
		DARTMOUTH, MASSACHUSETTS MUNICIPAL WATER SUPPLY	
02/02/76	Water-grab	Gravel packed well-raw water	**N.D.
02/02/76	Water-grab	Gravel packed well-raw water	**N.D.

NOTE:

*WWTP Wastewater Treatment Plant
**N.D. Not Detectable

1 - Little Quittacas Pond located in Rochester, Massachusetts, approximately 12 miles North of Aerovox.

2 - Raw water samples taken by Aerovox and Analyzed by Weedson - Tenent Laboratories (6/11/75) showed 1.07 ppb PCB

and 1252 had also been used in the past but the quantities are unknown. Between January 1973 and December 1975, Aerovox had used more than 4.0 million pounds of PCB impregnation fluid in its manufacturing process. As a result of the manufacturing process, Aerovox has been generating both liquid and solid PCB contaminated wastes.

Solid Waste

Sources of PCB contaminated solid waste include reject capacitors, diatomaceous earth from Aroclor filtration, absorbent material (speedie-dri), used to clean small PCB spills and drippings, chemical resistant gloves and air duct filters.

The exact quantities of PCB contaminated solid waste which Aerovox has generated is not known. Aerovox has estimated that between January 1973 and December 1975, more than 164,000 pounds of Aroclor contained in reject capacitors were sent to the New Bedford landfill. Approximately 6000 pounds (dry weight) of filter aid was also sent by Aerovox to the landfill. No estimates on quantities of other PCB contaminated solid wastes were available. Aerovox reported to the EPA inspection team that no attempt was made to segregate PCB contaminated wastes from general wastes.

The ABC Disposal Company, 246 Clifford St., New Bedford, Massachusetts is contracted by Aerovox to haul the wastes to the New Bedford landfill. At the landfill, wastes are dropped wherever the landfilling is occurring on that particular day. No specific area of the fill is designated to receive these industrial wastes.

Prior to the EPA plant inspection visit of December 1975, Aerovox had been storing their solid waste within the plant by containment in 55 gallon steel drums. Subsequently, Aerovox began storing its reject capacitors while awaiting instructions from EPA on proper disposal practices.

Aerovox continued work on a method of capacitor evacuation in the hopes that they would then be allowed to landfill their reject capacitors. In May 1976, Aerovox contracted an independent laboratory to test their evacuated capacitors for residual PCB content. The following results of evacuated capacitor bodies were submitted by Woodson-Tenent Laboratories to Aerovox:

Composite of Aroclor 1016 = 885.5 ppm or 0.045 gms per capacitor content weight.

Composite of Aroclor 1254 = 1199.0 ppm or 0.06 gms per capacitor content weights.

In February 1977, Aerovox requested assistance from the Lawrence Experimental Station in evaluating a process they developed to remove the PCB impregnating fluid from faulty capacitors. A report submitted by the Director of the Lawrence Laboratory, Dr. John E. Delaney, on PCB levels in these evacuated

capacitors has been included in the appendix of this report. Basically, it was determined that although complete removal of PCB was not achieved by Aerovox's process, a very high degree of removal was produced. Analyses indicated that on the average, a residual level of 6.215 mg of PCB remained in each capacitor.

Aerovox Industries stated that 23 grams of PCB are used to fully impregnate a capacitor. Based upon this figure, it was calculated that a removal efficiency of 99.973% was attained by Aerovox's evacuation process. Based upon the total weight of whole capacitors, calculations indicated that one ton (2,000 lbs) of evacuated reject capacitors would contain 13 pounds of PCB (Aroclor 1016).

On the basis of the significance of these amounts, the State decided that it would not allow Aerovox to dispose of these "evacuated" capacitors by landfilling them. Available information indicates that Aerovox now stores their solid waste until quantities make it practical for them to ship these wastes out of state for proper disposal.

Liquid Wastes

Sources of PCB contaminated liquid wastes include residue from the trichloroethylene distillation process, discarded samples, contents of the drip pans in storage areas, hot room and on truck floors. At the time of the EPA plant inspection in December 1975, the storage area for contaminated Aroclor was located in the basement of Aerovox's facility, away from the fresh Aroclor storage area. The storage floor area was concrete and contained no drains. Contaminated fluids are stored in capped 55 gallon steel drums which sit on wooden pallets. When approximately 3,500 gallons (40,000 pounds) have been accumulated, the liquid is transferred to a Rollins-owned tank truck and shipped to Rollins Environmental Services, Bridgeport, New Jersey for incineration.

During inspection of the plant facilities, it was noted that the stored drums were clean and dry, i.e., no oil streaks were visible. Plant officials indicated that drums were wiped to remove any external oil then the wiping rags, as well as cotton gloves, are cleaned in a closed loop trichloroethylene bath and re-used. The bath is then distilled and the remaining residue is drummed for incineration.

Wastewater

Aerovox has two wastewater discharges. On the north side of the plant is an external trough which runs the length of the building and discharges directly to the Acushnet River. The trough receives multiple discharges of non-contact cooling water from vacuum pumps. As of December 1975, trough flow was approximated to be 650,000 gallons per day (gpd). Since that time, the plant has been engaged in a water conservation program geared towards reducing Aerovox's flow to less than 300,000 gpd. Aerovox's other discharge contains sanitary wastes which are pumped to the New Bedford sewer system.

Aerovox's wastewater discharges fall under the jurisdication of NPDES permit system (Permit No. MA0003379). Aerovox's permit was updated on December 30, 1976 modifying the permit issued to them on November 19, 1975. This permit modification restricts the amount of PCB to be released by Aerovox to a daily maximum concentration of 0.1 mg/l (100 ppb) until June 30, 1977. During the period beginning July 1, 1977 and lasting throughout the expiration of the permit, Aerovox is authorized to discharge PCBs from outfall serial number 001 at a daily maximum of 19 grams/day (0.67 oz/day) and a daily maximum concentration of 0.01 mg/l (10 ppb).

Tables 1 and 5 indicate that in January 1976 Aerovox discharged from 72 to 400 ppb of PCB in their sanitary wastes released to the New Bedford WWTP (via municipal sewer system). Aerovox's other discharge - the North trough effluent to the Acushnet River was also monitored for PCB content and found to contain from 29 - 51 ppb PCB.

Results of EPA's effluent sampling program for industrial sources of PCBs given in tables 2 and 3 indicate that Aerovox Industries released 9.9 and 3.1 ounces of PCB on January 14 and 15, 1977 respectively. Of these amounts, 6.3 and 1.1 ounces, respectively, where released to the New Bedford Municipal STP, leaving 3.6 and 2.0 ounces of PCB to be released to the environment for each respective sample date. These figures tend to substantiate the need that existed for Aerovox's NPDES permit to be modified in order to reduce the amount of PCBs discharged by the company.

Aside from the PCB determinations performed at Aerovox Industries by EPA-Region I, Aerovox contracted Woodson-Tenant Laboratories to perform PCB analyses on various samples taken from Aerovox and the vicinity thereof. Results of these analyses are contained in Table 6. Two of the analytical results contained in Table 6 warrant some concern and possible follow-up. A tap-water sample taken from a factory in Waltham, Ma on Rte. 128 was found to contain 6.76 ppb of PCB while a tap-water sample from a private home in Marlboro, Ma was found to contain 8.86 ppb of PCB. Recommended standards of PCB in drinking water are being considered at a level of 0.000 ug/l (1 part per trillion). Concern is indicated for two reasons: (1) PCB levels evidenced by results are greatly in excess of the proposed standards for acceptable amounts of PCB in drinking water, and (2) it is unclear where the PCB in these water samples originated from, how it entered the systems, and what the extent of PCB contamination is in the surrounding areas. The first step in answering the above questions should be to verify Woodson-Tenants analytical results and see if PCB levels really exist in the quantities stated.

In general, environment measurements for the existence of PCBs in and around Aerovox's plant facility evidenced some PCB contamination and escape to the environment. The impression given by the EPA inspection team at the time of their Aerovox inspection indicated that housekeeping practices in the fresh storage area needed improvement. Drip pans which were scattered about contained an oil residue, and the oil absorbent was partially saturated. The purpose of drip pans is to contain an occasional drip or leak, should one develop. The inspection team's impression was that this storage area had persistent leaks. Steps to eliminate these leaks by re-piping or resealing pipe joints was suggested to Aerovox's management staff. The use of absorbent material to gather up small spills as opposed to leaving them in place was also suggested. Floor areas around the impregnation tanks and "hot room" were also noted to be in need of improvement. Wood in these areas was overlain by steel plates for floor truck movement and appeared to be oil impregnated from past drips and spills.

TABLE 6

Results of PCB Analysis performed for Aerovox Industries Incorporated
New Bedford, Massachusetts by Woodson - Tenant Industries

Sample No.	Sample Location & Discription	Sample Date	Analysis Date	PCB Content
1	Well water from the bottom of a dug well approximately 20 ft. deep in Lakeview, Massachusetts, well acted as potable water source	5/24/75	6/11/75	0.84 ppb
2	Water from home Northeast portion of New Bedford, approximately 2½ miles from Aerovox	5/24/75	6/11/75	0.24 ppb
3	Drinking fountain water from Acushnet Company, a factory adjacent to Aerovox	5/24/75	6/11/75	1.35 ppb
4	Water sample from little Quittacas Pond in Rochester, Massachusetts which is near the intake of the New Bedford water supply approximately 12 miles North of Aerovox	5/24/75	6/11/75	1.07 ppb
5	Tap water from Factory in Waltham on Route 128		11/25/75	6.76 ppb
6	Water from Acushnet River at Acushnet Saw Mills, approximately 3/4 miles upstream from Aerovox and above the high water mark. Fresh water only at this point		9/4/75	0.657 ppb
7	Tap water sample from private home in Marlboro, Massachusetts		11/25/75	8.86 ppb
8	Liquid discharge from Paskamansett		1/23/76	0.78 ppb
9	River near Route 6 at Midas Muffler. This River drains New Bedford landfill area and upstream from Dartmouth		1/23/76	0.16 ppb

Sample No.	Sample Location & Discription	Analysis Date	PCB Content	Coliform Content
10	Clams; Palmers Island, New Bedford, Massachusetts	10/19/76	2100 ppb (.21 ppm)	0.91/gm
11	Clams; Flats West of Popes Beach Fairhaven, Massachusetts	10/19/76	3990 ppb (3.99 ppm)	0.36/gm
12	Clams; Mattapoisett harbor, Massachusetts	10/19/76	3980 ppb (3.98 ppm)	0.0/gm

The National Institute for Occupational Safety and Health (NIOSH) performed an extensive industrial hygience survey of the Aerovox facility in March 1977. As part of this survey, both personal and area air samples were collected throughout the facility and analyzed for PCB content. Results of this survey were presented in a report of November 29, 1977.

Results indicated that of the 29 personal and 25 area air samples which had been collected and analyzed for PCBs, time weighted averages ranged from 0.17 mg/m^3 for the floorman in the pre-assembly area to 1.26 mg/m^3 (one sample) for the person operating the degreaser after the smoldering operations. The time weighted average for the solderers was 1.06 mg/m^3. The peak concentration of PCB found for the personal area air samples was 1.26 mg/m^3 for the degreaser and for a tanker.

An attempt was made to correlate health effects to the worker exposure of PCBs being experienced at Aerovox. It was pointed out that the current OSHA standard and ACGIH TLV for chlorodiphenyl (42% chlorine) is 1000 ug/m^3 (1 mg/m^3). In a recent criteria document, NIOSH has recommended a limit of 1.0 microgram total PCBs per cubic meter of air (1.0 ug/m^3), determined as a time weighted average (TWA) concentration for up to a 10-hour workday (40 hour workweek).

Based upon the observations made during the NIOSH survey and the results of the air samples, the following conclusions were drawn and recommendations for improvements made with respect to the use of PCBs in Aerovox's manufacturing process. It was noted that althrough Aerovox's use of PCBs is to be discontinued in the near future, steps need to be taken to help reduce and limit occupational exposure in the interim.

1. Because of the greater potential for occupational exposure, the impregnations, heat soak, sealing and degreasing operations should be located in one enclosed area or separate enclosed areas. This area or areas should be equipped with a negative ventilation system and PCB recovery system to prevent air contamination of other areas.

2. The local exhaust system used in the sealing operation (soldering) would be more efficient if it was extended down closer to the soldering operation. This will prevent air contaminated with PCBs from flowing past the worker's breathing zone when the worker bends over.

3. A more efficient method to vent the impregnation chamber would be to pull a vacuum on each chamber before opening the chamber up to remove the impregnated capacitors.

Results of this NIOSH survey have aroused concern from both EPA and OSHA (Occupational Safety and Health Administration). OSHA has made arrangements to perform further sampling and conduct a plant inspection of the Aerovox facility sometime in January 1978. EPA is currently looking into the possibility of conducting their own inspection of Aerovox with respect to the company's use and disposal of PCBs.

EPA inspection of the facility would help to clarify the extent of PCB contamination in existence at Aerovox. It would also aid in implementing regulations (which will be final in the near future) on the labeling and disposal of PCBs as required under Section 6e of the Toxic Substances Control Act.

III. New Bedford Harbor and Coastal Waters

At some point in the history of both Aerovox and Cornell-Dubilier's PCB use, various amounts of PCBs were released and discharged to the Acushnet River and New Bedford Harbor. Monitoring of these water-bodies for PCB contamination was jointly undertaken by the Massachusetts Department of Environmental Quality Engineering and EPA Region I, beginning in May 1976. Results of this sampling program are contained in Table 7. A key to sample code locations and map indicating these locations is also included.

Several of the results contained in Table 7 describe "gross existing and potential insults to the New Bedford environment". Results warranting concern include:

1. The 620,000 parts per billion (620 ppm) value for the May 5, 1976 sediment sample taken in the Acushnet River directly below the Aerovox outfall.

2. Sediment samples taken along the Acushnet River between Aerovox and Cornell-Dubilier containing PCB levels of 47.4, 61.3 and 77.9 parts per million.

3. The 21,23, and 53 parts per million concentrations of PCB found in clam samples in the Acushnet River below Aerovox on August 24, 1976.

4. A composite of 3 eels containing 92.0 ppm PCB taken from the Acushnet River, upstream of Popes Island.

5. The 736 ppm of PCB found in the New Bedford Municipal Wastewater Treatment Plant sludge, prior to incineration during April 1976.

Results of this sampling program necessitated the State Department of Public Health to advise the public against eating bottom feeding fish, shellfish and eels. On March 8, 1977 Dr. Jonathan Fielding, Commissioner of Public Health in Massachusetts, requested that bottom feeding fish, shellfish and eels not be taken for eating from the Acushnet River for health reasons. This area (area 1) extending north of a line between Ricketson's point to Wilbur Point is basically a recreational fishing area.

Table 7

Summary of PCB Analysis Results in ppm (mg/kg)
New Bedford, Massachusetts Survey
May - November 1976

Sample Location	Sample Code	Discription	Laboratory							
			EPA		FDA		Cat Cove		L.E.S.	
			Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.
Apponogansett Bay	D-1	Shellfish		3.1	0.20		0.20	1.32		
" "	D-2	Shellfish		3.6	0.20		0.17	1.33		
" "	D-3	Shellfish		5.0			0.47	3.38		
Buzzard's Bay	NB-1	Shellfish					1.30	9.49		
" "	NB-2	Shellfish					0.35	2.78		
" "	NB-3	Shellfish					0.72	5.37		
" "	NB-4	Shellfish					1.81	11.1		
" "	NB-5	Shellfish			0.40		0.41	3.29		
" "	NB-6	Shellfish					0.44	3.08		
Buzzard's Bay	F-1	Shellfish					0.7	7.0		
" "	F-2	Shellfish					3.5	18.0		
" "	F-3	Shellfish					-	-		
" "	F-4	Shellfish					0.06	0.44		
" "	F-5	Shellfish					0.06	0.4		
" "	F-6	Shellfish					0.32	2.35		

Laboratory

Sample Location	Sample Code	Discription	EPA		FDA		Cat Cove		L.E.S	
			Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.
Acushnet River	NBS-1	Sediment		47.4			34.8	84.5		
" "	NBS-2	Sediment		61.3			15.0	17.7		
" "	NBS-3	Sediment		77.9				0.48		
" "	NBS-4	Sediment		143						
" "	NBS-5	Sediment		0.5						
" "	NBS-6	Sediment		1.9						
" "	ARS-10	Sediment		620						
Acushnet River	FS-1	Sediment		74.8			28.7	88.0		
" "	FS-2	Sediment		21.5			10.5	23.0		
" "	FS-3	Sediment		4.1			-	-		
" "	FS-4	Sediment		0.3			0.16	0.20		
Acushnet River Popes Island		Blackback Flounder (Filet)					6.0	2.47		
Acushnet River Popes Island		Blackback Flounder (Whole)			10.1					
Buzzard's Bay	NB-4	Scup (Whole)					6.1	26.6		
" "	SS-1	Scup (Whole)					11.4	43.2		
" "	SS-1	Tautog					1.18	5.57		

Laboratory

Sample Location	Sample Code	Discription	EPA		FDA		Cat Cove		L.E.S.	
			Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.
Acushnet River Popes Island		Blue Crab					5.57	29.5		
Fairhaven Nastetucket Bay		Blackback Flounder Filet							7.6	
Fairhaven S.E. of Rocky Pt.		Baby Lobster (67 gms)							0.9	
Fairhaven S.E. of Rocky Pt.		Butterfish Filet							0.7	
Dartmouth		Blackback Flounder Filet							3.9	
New Bedford E. of Negro Ledge		Blackback Flounder Filet							19.0	
Dartmouth-S.E. of Ricketsons Pt.		Blackback Flounder Filet							20.0	
New Bedford Negro Ledge		Butterfish							0.9	
New Bedford Henrietta Rock		Blackback Flounder Filet							8.3	
New Bedford E. of Fort Rodman		Lobster Tail Meat							7.4	
New Bedford E. of Fort Rodman		Lobster Claw							16.	

Laboratory

Sample Location	Sample Code	Discription	EPA		FDA		Cat Cove		L.E.S.	
			Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.
New Bedford E. of Fort Rodman		Lobster Tomalley							27.0	
New Bedford E. of Fort Rodman		Silver Fluke							6.4	
New Bedford E. of Fort Rodman		Cunner							57.0	
New Bedford E. of Fort Rodman		Fluke							18.0	
New Bedford S. of Hurricane Barrier		Fluke							21.0	
New Bedford N. of Hurricane Barrier		Blackback Flounder							22.0	
New Bedford N. of Hurricane Barrier		Fluke							22.0	
Barnstable Harbor		Flounder Filet					0.05	0.25		
Bass River		Flounder Filet					0.03	0.15		
Wellfleet Harbor		Flounder Filet					0.01	0.05		
Waguoit Bay		Flounder Filet					0.02	0.10		
Essex Bay		Flounder Filet					0.04	0.20		

Laboratory

Sample Location	Sample Code	Discription	EPA		FDA		Cat Cove		L.E.S.	
			Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.
Pleasant Bay		Flounder Filet					0.02	0.10		
Acushnet River .3 km S. of Aerovox		Clam	53							
Acushnet River 1.1km S. of Aerovox		Clam	21							
Acushnet River 1.8 km of Aerovox		Clam	23							
Acushnet River Upstream of Popes Island		Composite Fish (Composite Homogenate)	0.75	3.4						
" "		Blue Crab (edible portion)	0.99	4.5						
" "		American Eel (Composite of 3 Eels portion)	92.0	288.0						
Market Sample		Unknown							0.38	
" "		Quahog							0.30	
" "		" "							0.63	
" "		Eel							0.95	

Sample Location	Sample Code	Discription	Laboratory							
			EPA		FDA		Cat Cove		L.E.S	
			Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.
Market Sample		Quahog							1.41	
" "		" "							1.08	
" "		Fish							< 0.1	
" "		Quahog							0.39	
" "		Lobster							0.21	
" "		Lobster							1.12	
" "		Lobster							0.32	
" "		Lobster							< 0.1	
" "		Fish							< 0.1	
" "		Fish							0.76	
" "		Fish							0.21	
" "		Fish							0.1	
Market Sample		#1120 "A" & "B" (water)							Both < 0.1	
Boston Harbor		Smelt							3.9	

PCB Analysis Results of Lobsters
in
New Bedford, Massachusetts

Sample Location	Sample Code	Sample Date	Laboratory Results ppm* (mg/kg)
Butter Flats	B-1	5/6/77	8.2
Butter Flats	B-2	5/6/77	11.7
Fort Rodman	C-1	5/6/77	7.9
Fort Rodman	C-2	5/6/77	9.3
Egg Island	D-1	5/6/77	6.3
North Ledge	F-1	5/6/77	4.9
North Ledge	F-2	5/6/77	5.8

NOTE:
*PCB reported as mg/kg of 1254 in edible tissue, wet weight

Key

Code

NB= New Bedford
F = Fairhaven
D = Dartmouth
SS= Silver Shell Beach
S = Sediment Sample
ARS= Accushnet River Sediment

Station Code	Area
NB - 1	Near New Bedford wastewater treatment plant outfall (outfall off Clark Point)
NB - 2	Inner Portion Clark Cove
NB - 3	Mouth Clark Cove
NB - 4	Butter Flats Near Cornell Dublier
NB - 5 & 6	Buzzard's Bay
F - 1	Near Pope Beach
F - 2 & 3	West Side of Sconticut Neck
F - 4	Little Bay
F - 5	East of Sconticut Neck
F - 6	Buzzard's Bay (West Island)
D - 1	Mid - Portion Apponagansett Bay
D - 2	Mouth Apponagansett Bay
D - 3	Buzzard's Bay
NBS - 1	South of Fish Island (Upper Harbor- between Coggshall Street and Pope's Island)
NBS - 2	North of Palmer Island (Upper Harbor)
NBS - 3/NBH B	South of Palmer Island (Upper Harbor)
FS - 1	Off Crow Island (Upper Harbor)
FS - 2	Phoenix Beach (Upper Harbor)
FS - 3	East of Phoenix Beach (Upper Harbor)
FS - 4	West of Sconticut-Neck off little Egg Island

Key

Laboratories participating in Analysis:

EPA New England Regional Laboratory

EPA Contractor - Environment Science & Engineering Incorporated Laboratory (E.S.E.I.), Gainsville, Florida

FDA Laboratory

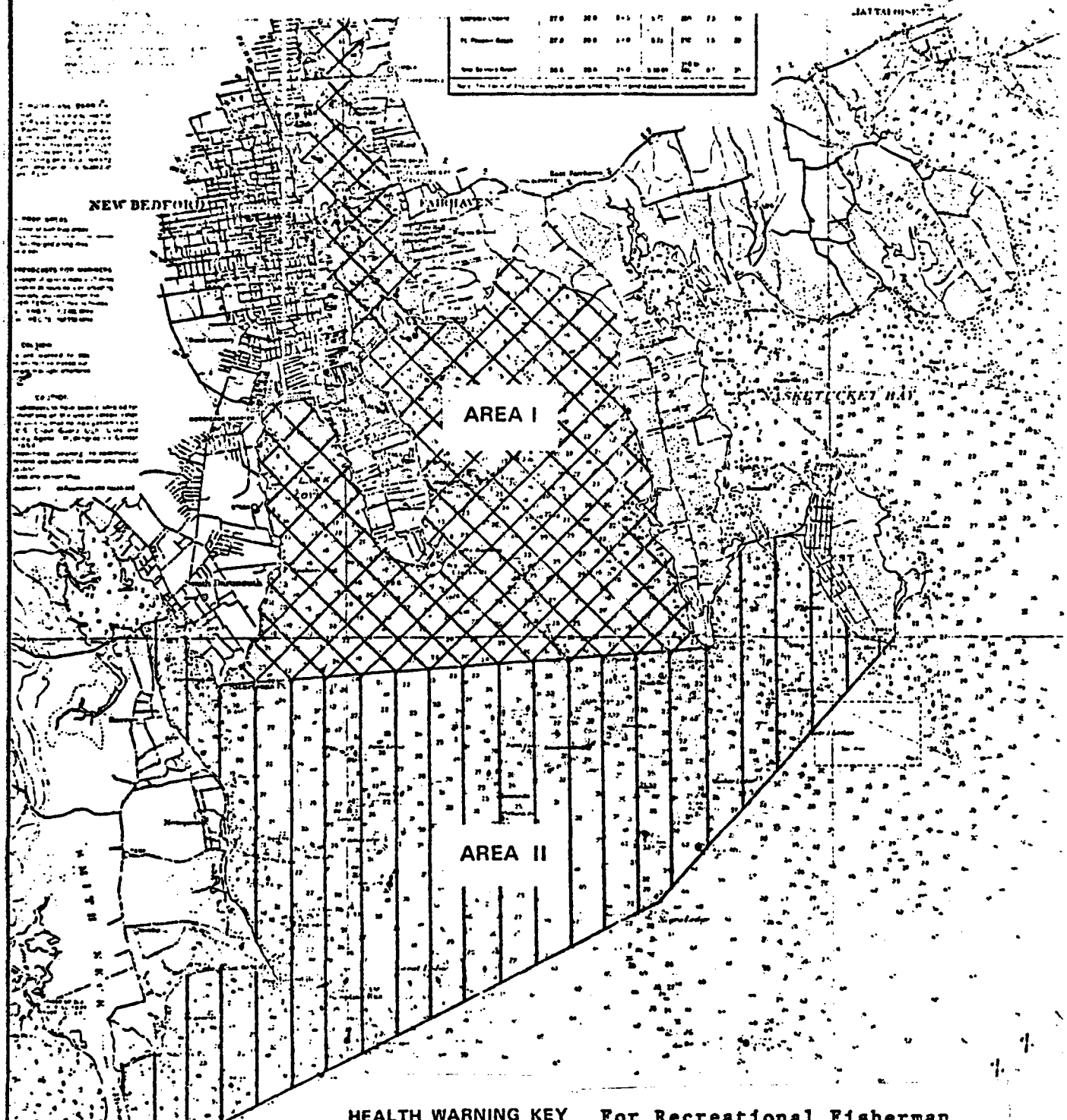
Massachusetts Department of Environmental Quality Engineering

Contract Labs: Lawerence Experimental Station (L.E.S.)

Massachusetts Division of Marine Fisheries - Cat Cove Laboratory

FIGURE 3

MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH



HEALTH WARNING KEY **For Recreational Fisherman**

AREA I — Bottom feeding fish, shellfish and eels not to be eaten from these waters because of PCB contamination.

AREA II — Bottom feeding fish not to be eaten from these waters because of PCB contamination.

As of March 7, 1977

This warning to recreational fishermen was also extended to not eating bottom feeding fish from the area just beyond the Acushnet River area - north of the line running from Mishaum Point, to "Gong 3" on Hursett Rock, to Rocky Point on West Island. Samples taken from this area showed bottom feeding fish to have elevated PCB levels. Figure 3 indicates the areas under advisement.

Due to concern expressed over PCB levels detected during the initial New Bedford monitoring program, Massachusetts Department of Environmental Quality Engineering and Division of Marine Fisheries continued monitoring efforts throughout 1976 until May of 1977.

Lobsters sampled for PCB contamination in New Bedford in May 1977, had PCB concentrations from 4.9 to 11.7 ppm PCB. Out of the seven lobsters sampled, six were found to contain PCB in quantities above the 5.0 ppm standard established by the FDA. On June 3, 1977, Public Health Commissioner Fielding issued an advisory that lobsters from the Acushnet River not be taken for eating due to health reasons. The affected area is outlined as extending north of a line between Ricketson's Point in South Dartmouth to Wilbur Point in Fairhaven, Massachusetts.

The area of concern which lies between Ricketson's Point and Wilbur Point, is used for both recreational and commercial lobstering. Recreation fishermen were warned not to take lobsters from the area. After a meeting on June 2, 1977 of health, environmental marine fisheries officials and lobstermen, the commercial lobstermen voluntarily agreed to withdraw all their traps from the affected area.

Massachusetts' Department of Public Health also began monitoring lobsters and fish at commercial landings and in the markets as a further precaution. The Massachusetts Department of Environmental Quality Engineering (DEQE) and Division of Marine Fisheries indicated at this time that they would continue monitoring efforts within the Acushnet River and New Bedford Harbor to determine the extent of PCB contamination in existence.

Monitoring for PCBs was supposed to extend throughout the outer harbor area and into Buzzards Bay in order that the extent of PCB migration would be identified. To help clarify what the background level of PCB contamination is, further sampling along the coast was also planned.

At a meeting between EPA, Massachusetts DEQE and the Division of Marine Fisheries held in December 1977, the status of the Massachusetts PCB monitoring in New Bedford's inner and outer harbor was discussed. DEQE reported that top feeding fish had been sampled in the outer harbor area. This data is shown in Table 8. Quahogs were also sampled from Sconticut Neck but analysis results have not yet been ascertained from the State. The only "recent" results received from the State are of lobsters sampled during June and July, 1977 off the Massachusetts coast in outlying areas. These results are contained in Table 9. Results indicate PCB concentrations in lobsters ranging from 0.01 ppm (Plymouth) to 0.32 ppm (Cape Cod Canal) to 0.70 ppm (Westport Goose Berry Neck).

TABLE 6
PCB Analysis Results
Fish Samples

Sample Name	Sample Location	Sample No.	Sample Date	Laboratory Results (ppm) mg/kg Wet Wt. basis	Dry wt. basis
Blue Fish	Cape Cod Canal	--	10/7/77	1.2	4.7
Blue Fish	"	--	10/7/77	0.5	1.3
Blue Fish	"	--	10/7/77	0.6	2.0
Blue Fish	"	--	10/7/77	0.5	1.8
Blue Fish	Martha's Vineyard Wasque, S. Side	--	10/18/77	0.5	1.6
Blue Fish	Barnstable Sandy Neck	--	10/16/77	0.4	1.3
Blue Fish	Cape Cod Bay	--	8/77	0.9	2.2
Blue Fish	Martha's Vineyard Wasque, S. Side	--	10/18/77	1.2	4.8
Striped Bass	--	P-61	10/26/77	0.5	1.9
Striped Bass	--	P-62	10/26/77	0.5	1.8
Striped Bass	--	P-63	10/26/77	0.1	0.3
Striped Bass	--	P-64	10/26/77	0.4	1.6
Striped Bass	--	P-65	10/26/77	0.3	1.0
Striped Bass	--	P-66	10/26/77	0.1	0.4
Striped Bass	--	P-67	10/26/77	0.1	0.3

Table 8 (Continued)

Sample Name	Sample Location	Sample No.	Sample Date	Laboratory Results (ppm) mg/kg Wet Wt. Basis	Dry Wt. Basis
Striped Bass	Cape Cod Bay	--	8/77	0.5	1.8
Striped Bass	Martha's Vineyard Wasque, S. Side	--	10/18/77	0.3	1.0
Striped Bass Fillet	Provincetown Area	1	10/7/77	1.3	5.3
Striped Bass internal Organs	Provincetown Area	1	10/7/77	1.1	5.0
Striped Bass Fillet	Provincetown Area	2	10/7/77	0.5	1.8
Striped Bass internal Organs	Provincetown Area	2	10/7/77	1.2	3.5
Striped Bass- Fillet	Provincetown Area	3	10/7/77	0.5	1.8
Striped Bass internal Organs	Provincetown Area	3	10/7/77	1.4	3.1

TABLE 9

PCB Analysis Results
Lobsters

Sample Location	Sample Number	Sample Date	*Laboratory Results mg/kg (ppm)
Martha's Vineyard	543332	6/30/77	0.10
Cape Cod Canal	543337	7/11/77	0.32
	338		0.13
	339		0.06
	340		0.02
	341		0.05
Westport Goose Berry Neck	543342	7/28/77	0.04
	343		0.03
	344		0.03
	345		0.06
	346		0.02
	347		0.04
	348		0.70
Plymouth	543349	7/27/77	0.05
	350		0.01
	351		0.01

*PCB reported on wet weight basis, as Aroclor 1254

Results of lobsters sampled in the outlying coastal areas suggest that a "problem" with PCB contamination does not exist. However, there is no data presently available to demonstrate how far out of the Acushnet River/ New Bedford Harbor area PCB pollution extends. Tentative plans exist within the State to sample sediment within New Bedford's outer harbor. This sampling will probably not occur until the spring of 1978. Results of several fish samples (Tables) indicate the need for further monitoring. Since the outer harbor area represents a sizable commercial fishing and lobstering industry, it is important to identify whether appreciable amounts of PCB exist and if fish and lobsters are being contaminated above current FDA safe consumption standards.

The only other available data on PCBs in New Bedford Harbor and vicinity comes from the National Marine Monitoring Program "Mussel Watch". As part of this program, Mytilus edulis and a related mussel species, Mytilus californianus were collected on the U.S. east and west coasts and oysters were collected on the U.S. southeast coast and analyzed for PCBs. The west coast data is from Dr. Robert Risebrough of Bodega Marine Laboratory, Bodega, California and the east coast data is from Dr. John W. Farrington of the Woods Hole Oceanographic Institution, Woods Hole, Ma.

The data indicates (see appendix) that high PCB levels exist in harbor areas such as San Pedro Harbor (Los Angeles), San Diego Harbor, Boston Harbor, Rockaway (Long Island -New York Bight), etc. The second highest of these occurs at one station in San Pedro Harbor where 8.7 ppm (dry weight) of PCB was recorded. The highest of these occurs in the New Bedford Harbor mussel which contains 110 ppm (dry weight) of PCB. It should be noted that this value is a factor of 10 higher than any other concentration of PCB in mussels from U.S. waters.

As previously stated, market sampling is periodically performed to monitor the possibility of PCBs reaching the consumer. In December 1976, clams and fish sampled and analyzed were found to contain 0.2, 0.2, 0.3, and 0.4 parts per million of Aroclor 1254. Other market samples included: flounder - 10.1 ppm, 0.0 ppm; Yellowtail flounder - 0.0 ppm; and Cod fillets - trace and 0.0 ppm. Market sampling conducted from June-November 1977 indicated that lobsters and fish reaching the consumer were not comtainated with PCBs. Of the six lobsters analyzed, one contained 3 ppm PCB (Aroclor 1254 wet weight basis) and all others contained only trace amounts.

Monitoring market samples is not just confined to the New Bedford area. Lobster sampling was also performed in Fox Cove, SW Harbor, Plymouth, Ipswich and Nantucket.

Sample Location	PCB Content
Fox Cove	trace
SW Harbor	trace
Plymouth	lobster meat - trace lobster tomalley-1.1 ppm
Ipswich	lobster meat - trace lobster tomalley-1.5 ppm
Nantucket	0.0 ppm

The overall situation in New Bedford Harbor is not encouraging. Available data and information indicate that a serious "PCB problem" does exist within the Harbor. To date, the approach in dealing with the Harbor has been mandated by concern with "public health". Under this auspice, the closures within contaminated portions of the Harbor to fishing, shellfishing and lobstering were made. Until recently, there have been no specific plans made for "cleaning up" the PCB contamination within the Harbor. Activity has instead focused on attempting to protect individuals from exposure to PCBs.

In the fall of 1977, several things happened which resulted in EPA seriously looking into the problem of PCB "clean up" within the Harbor.

An article appeared in the November 8, 1977 issue of Environmental Science and Technology entitled, "Copper and Other Heavy Metal Contamination in Sediments from New Bedford Harbor, Massachusetts: A Preliminary Note", by Peter Stoffers, Colin Summerhayes, Ulrich Fostner and Sambasira R. Patchineelam. This article was based on research done by the authors at the Woods Hole Oceanographic Institution completed in the spring of 1977 on "Fine-grained Sediment and Industrial Waste Distribution and Dispersal in New Bedford Harbor and Western Buzzards Bay, Massachusetts." The following has been abstracted from this report:

"New Bedford Harbor and its approaches form the estuary of the Acushnet River in southeastern Massachusetts. The estuary is weakly stratified and only partially mixed because river discharge is very small. It appears to be typical of the inlets of the coast of New England and is a branch of a larger estuary - Buzzards Bay.

"Silt and clay are being transported into the estuary in suspension by landward-moving bottom currents that are driven by wave and tidal energy. These fine sediments come from Buzzards Bay, but may originate out on the continental shelf. Before the entrance to the harbor was almost completely blocked by a hurricane barrier, these sediments were accumulating in the harbor at rates of about 1-2 cm/yr in the deeps, and less than 0.5 cm/yr in the shallows. Construction of the barrier reduced the efficiency of tidal flushing, causing the rate of siltation to increase by a factor of 4-5. Outside the harbor, silt and clay accumulate in the drowned valley of the Acushnet and in related depressions at rates of 2-3 mm/yr.

"In the water column, silt and clay sized minerals are suspended together in organically bonded agglomerates. During sediment transport, the silt and clay become partially fractionated, probably by differential settling of the aglormerates. Because fractionation is more effective where wave and tidal energy are strongest, there is a smaller proportion of clay relative to silt in the harbor than there is seaward. Nevertheless, the net transport of clay is still landward.

"Fractionation due to differential settling also appears to have formed a very thin, soupy layer of clay-rich material at the sediment-water interface that appears to carpet the study area. This layer seems to form a transition zone between the much more silty and less mobil subsurface sediments and the highly mobile suspensates of turbid near-bottom waters. Further study is needed to ascertain precisely the nature and persistence of this layer.

"Wastes rich in metal are discharged into the waters at the head of the harbor, and rapidly become fixed in the bottom sediment throughout the harbor. Together, Cu+Cr+Zn, the three main contaminant metals, locally form more than one percent of the dry weight of harbor sediments. The metals are located in the very fine silt and clay fractions of the sediment. They migrate slowly out of the harbor, most probably by eddy diffusion in near-bottom waters and appear to have spread out over portions of Buzzards Bay in a carpet 10-20 cm thick. Calculations suggest that about 25 percent of the excess metal in the bay is derived by fallout from urban air that blankets the entire country. The remaining excess metal may represent 24 percent of what was discharged into the harbor and shows to what extent the harbor acts as a leaky sink for contaminants.

"Organic wastes derived by discharges of sewage are deposited in the harbor, and close to the Clarks Point sewer outfall. Wastes appear to move away from these depocenters in small amounts, under the influence of waves and tides. Organic waste material forms a significant part of the soupy, clay-rich layer that carpets the area. Assuming that organic waste is moved about in the same way that metal wastes are, then perhaps 24 percent of the organic particulates associated with sewage discharge and up in Buzzards Bay.

"Clearly, New Bedford Harbor operates as a sediment trap. But it forms a somewhat inefficient trap for clay-sized particles and, as a result, acts as a "leaky sink" for organic and industrial contaminants (here we refer only to contaminants that move as part of the bottom sediment, not to those that remain in solution in the water column). Other estuaries along the coast of New England can be expected to operate in similar ways with respect to siltation and waste dispersal."

The major findings of this study were:

1. The construction of a hurricane barrier has caused a significant increase in the sedimentation rate in New Bedford Harbor;

2. The Harbor acts as an imperfect trap for materials that are introduced into it, thereby allowing the transfer of industrial the transfer of industrial contamination to Buzzards Bay;

3. The surface and near surface sediments of New Bedford Harbor are highly enriched in metals these metals having been derived locally.

In October 1977, EPA Region I was informed that the Army Corps of Engineers (COE) had let a contract for the environmental assessment of maintenance dredging of New Bedford Harbor.

Preliminary data from the aforecited Woods Hole study and results of State and Federal PCB monitoring in the harbor indicated extremely high metals and PCB content. Metals and PCB concentrations of the sediment are reported at levels of 10,000 ppm (sum of Cd+Cu+Cr+Zn) and 50 to 100+ ppm respectively. Because of the high siltation rate (3 to 4 cm/year), EPA felt that the channels would have to be maint enanced dredged every 2-4 years producing a rehash of all the toxic sediment and disposal problems currently being faced by EPA and the State.

The Corps of Engineers Laboratory in Vickburg and EPA's Gulf Breeze Lab received this data on the PCB and metal concentrations in the inner harbor. They concurred that the harbor's sediment contamination comprised a serious problem. Routine dredging has been postponed for several years and pressure was mounting to have the channel cleared. Further, it was brought to EPA attention that a Scandanavian firm had vague intentions to construct a major port with underground oil storage in the Harbor. The Corps informed EPA of a contract with Cortell and Associates, Waltham, Ma to prepare an environmental report on the dredging proposal.

On this basis, a recommendation from EPA's Permits Branch and the Toxic Substances Coordination committee requested that the COE consider using Section 115 (In-Place Toxic Pollutants) of the Federal Water Pollution Control Act (FWPCA) for removal of all highly polluted sediment in New Bedford Harbor inside the protective hurricane barrier and the sludge mount surrounding the Clark's Point Sewer Outfall. Core samples would be required to estimate the volume of contaminated sediment and to identify high concentration areas. It was felt that as the NPDES Program was currently controlling the discharge of these pollutants, it would be logical to undertake a radical removal of the entire reservoir. Although this proposal would require a larger disposal site, the intent would be to remove the reservoir in order to eliminate recontamination of the surface layer with each minor dredge. The new lesser polluted silt would then be more amenable to disposal in the future.

In November, it was reported to EPA that the Corps of Engineers' mandate would restrict their dredging of the New Bedford Harbor to channel maintenance <u>without</u> extending to the general pool of pollutants. The Environmental Assessment being prepared by Cortell Associates for the Corps will be completed in the spring of 1978. The assessment should contain some data on contaminants in the sediments. As EPA's involvement with kepone in the James River has thus far been directed to study and not removal, it indicates that Section 115 funds will probably not be available for mitigation in New Bedford Harbor.

Spoils from the harbors maintenance dredging will be placed behind a metal-sheet walled land site according to the Corps latest draft plan. EPA is currently aware of two prior disposal sites within New Bedford Harbor.

IV. New Bedford Landfill, Incinerators, etc.

Aside from the PCB problem in existence within the harbor, New Bedford has several other areas of concern with respect to PCB contamination. From the 1920's until 1970, the primary means of solid waste disposal (including residential, commercial and industrial wastes) utilized in New Bedford was incineration. New Bedford's first incinerator, located off Shawmut Avenue, operated from the 1920's until October 1959 when a new incinerator was constructed on the same site. From 1959 to February 1971 the majority of the city's refuse was processed at this incinerator (including waste from Aerovox and Cornell-Dubilier). The ash residue from both of these incinerators was disposed of on site.

In February 1971, the city began landfilling all refuse except paper and commercial waste, collected during the city's night collection which continued to go to the incinerator. The incinerator was completely closed down in January 1974. Since 1971, when the city began phasing out incineration, refuse has been landfilled at the old ash residue disposal site located adjacent to the incinerator.

As with most municipal incinerators, the New Bedford incinerator did not operate at the extreme temperature and dwell time necessary to decompose PCB compounds. The relatively low temperatures used in operation of the incinerator would instead tend to volatilize the PCBs and add to contamination of the atmosphere.

Over the years, most of the PCB contaminated solid waste (gloves, absorbent material, filter materials, etc.) sent to the incinerator was most likely volatilized. It is suspected, however, that large quantities of PCBs contained in sealed reject capacitors were not volatilized but instead remained within the capacitors and were landfilled with the ash residue.

In addition to receiving PCB contaminated solid waste, it is suspected that the large quantities of PCB liquid wastes generated by Aerovox and Cornell-Dubilier were also disposed of at the municipal disposal site.

As mentioned previously, wastewater discharges from Aerovox and Cornell-Dubilier known to contain concentrations of PCBs are treated by the New Bedford Wastewater Treatment Plant. Sludge from this plant (after dewatering to 22% solids) is disposed of in a multihearth furnace (max. temps. 1600^{o}f with the flue gases passing through a low energy scrubber. Information from a 1976 report on the plant indicated that approximately 1100 lb/hr of sludge were destroyed in the incinerator which operates on the average of 15 hours per day for a 5 day week. Ash from this process is disposed of in the New Bedford Municipal landfill.

In 1976, samples of sludge taken from the New Bedford Wastewater Treatment Plant were found to contain from 39,000 ppb to 75,000 ppb (35-75 ppm) of polychlorinated biphenyls. On the basis of these results, EPA decided to request contractor assistance to sample and analyze polychlorinated biphenyl (PCB) emissions from the New Bedford sewage sludge incinerator. Samples were collected on February 9, March 1 and March 3, 1977 from the incinerator flue gas, the incinerator sewage sludge feed, the ash stream from the incinerator, the precooler and scrubber water feeds and the scrubber water effluent. PCB stream concentrations were determined by perchlorination of samples. Gas chromatography was then used to quantify the resulting decachlorobiphenyl (DCB). GC/mass spectrometry was used to confirm the presence of PCBs.

The objective of the study was to determine the concentrations and mass emission rates of polychlorinated biphenyl compounds emanating from the New Bedford Municipal sewage sludge incinerator. Results of this study performed by GCA Corporation were released in a final report in September 1977 and are as follows:

"The results of this study indicate that PCB compounds are broken down by incineration. The amount of PCB compounds in the flue gas accounts for between 2 and 3 percent of total PCB input. The actual quantity of emissions ranged from 3.08 to 10.56 ug/m^3 which resulted in a discharge rate of between 8.28 and 25.48 mg/hr, respectively.

"The PCB compounds which were emitted were primarily dichloro and trichloro derivatives, presumably the incomplete breakdown products of incineration of Aroclor 1242 or 1248 which were found in the incoming sludge.

"The dichloro and trichloro derivatives were also found in the water streams and the ash stream. The total PCB concentrations in the ash streams ranged from 0.95 ug/g to 2.35 ug/g. The water feeds ranged from 3.00 ug/l to 8.25 ug/l and the scrubber effluent ranged from 2.50 to 3.50 ug/l.

"The input and discharge rate of PCB in the water streams represented a major component in the PCB mass balance. The scrubber water effluent discharge rates represented between 16 and 37 percent of the total PCB input. This stream discharged between 219 mg/hr and 309 mg/hr of PCB compounds. These compounds were identified as a mixture of predominantly dichloro and trichloro biphenyl compounds.

"While polychlorinated biphenyls were found in all streams, it is evident that incineration either breaks down the compounds to less chlorinated compounds or completely consumes the compounds. The flue gas emissions represent only a small fraction of the total PCB streams; the water effluent contains the bulk of PCB output.

"The calculated efficiency of the incinerator was determined by the percent difference in the overall mass balance of PCB compounds in all streams. This value was calculated to be between 46 and 77 percent. This value is not considered as representative of the incinerator due to the high scrubber water PCB levels."*

The GCA study recommended that the water feeds and effluent from the incinerator scrubber be examined further to assess their impact and source of PCBs. The study was unable to determine whether the PCBs found in the water samples resulted from breakdown of Aroclors by incineration or passed through the system unmodified from the influent water. Uncertainty exists as a result of the use of primary effluent water from the chlorine detention tanks as the scrubber water.

In March 1977, further ambient PCB testing was performed at the New Bedford Sewage Treatment Plant. Ambient PCB measurements were taken by EPA Region I, S&A Division, in conjunction with the aforementioned source testing performed by GCA. The method of collection utilized a FlorisiL medium connected to an air pump. The FlorisiL collection medium was returned to the laboratory after exposure to be analyzed by GC/Mass Spec. techniques.

On March 1, 1977, wind speed and direction measurement were taken hourly and averaged 15-20 mph from the west-southwest direction for the test period. Hourly flow rate measurements on the sampling trains were made to insure that a representative average flow rate could be obtained and for use in subsequent calculations. The downwind site was located 380 feet from the stack and the upwind site was located 165 feet from the stack. Each sampling train ran about 5 hours. On March 3, 1977, the wind averaged 12-15 mph from the westerly direction for the duration of the test. The downwind site was located 250 feet from the stack and the upwind site 95 feet from the stack. Sampling trains again ran approximately 5 hours. Figure 4 indicates the sampling locations.

Results of this sampling program are as follows:

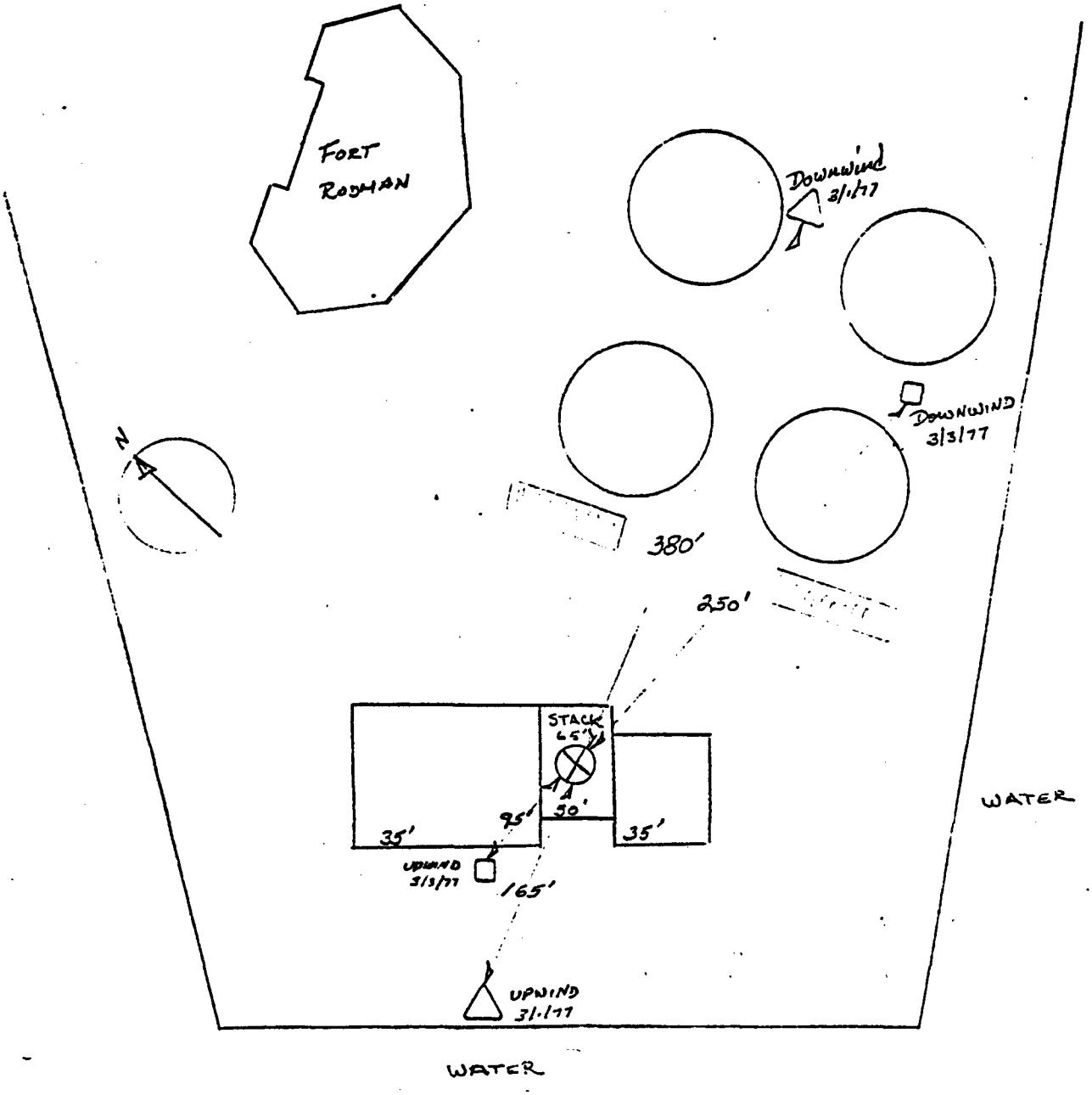
Sample Date		PCB Concentration[1]
March 1, 1977	upwind	38 ng/m^3
	downwind	58 ng/m^3
March 3, 1977	upwind	150 ng/m^3
		240 ng/m^3
	downwind	95 ng/m^3
		110 ng/m^3

[1]Results are reported in (ng/m^3)= Nanograms per cubic meter
1 ng = .001 ug

* "PCB Compounds Emanating from the New Bedford Municipal Wastewater Incinerator", final report by GCA Corporation prepared under subcontract to JACA Corporation, under EPA Control No. 68-01-3154, September 1977.

FIGURE 4

SAMPLER LOCATIONS FOR AMBIENT PCB MEASUREMENTS AT NEW BEDFORD SEWAGE TREATMENT PLANT ON 3/1/77 & 3/3/77



New Bedford's municipal disposal site is located on Shawmut Avenue. This sanitary landfill started accepting the major portion of the wastes generated in New Bedford in 1971 when the city began phasing out the use of the incinerator. Subsequent to final closure of the incinerator in January 1974, all the city's (1,500 tons/week) refuse has been disposed of at the municipal land disposal site. After the first few years of operation during which the site was operated as an open dump, the municipality began a waste spreading, compaction, and daily cover operation. While this site does not have an approved operating plan, the daily operation is in accordance with state regulations.

In early 1976 as part of a regional effort on PCBs, the Solid Waste Program began to examine landfill sites within Region I for PCB contamination. The New Bedford site was selected for study because of the large quantities (minimum of 500,000 lbs) of PCBs received for over 25 years, and its proximity to the Dartmouth, MA drinking water supply. The purpose of the investigation was to establish if PCBs had migrated from the landfill and if so, to determine the extent of groundwater contamination.

Four monitoring wells were installed in the swamp at the toe of the west face of the landfill. Groundwater samples were taken from the four wells and analyzed for PCBs. PCBs were only detected in well No. 2 at a concentration of 1 ppb PCB as Aroclor 1016. A surface leachate seep sample taken near well No. 3 was found to contain 10 ppb PCB. Soil samples were taken from three levels during the drilling of well No. 3. PCBs were detected in the first level (0.-7.5ft) at a concentration of 7,500 ppb.

During the summer of 1977, Environmental Science and Engineering, Inc. (ESEI) was contracted by EPA Office of Toxic Substances to conduct a study on the transport of PCBs from the New Bedford landfill. The objective of the study was to establish if migration from the landfill was occurring (Phase I). This involved a one-time field survey wherein samples were collected from all media in the vicinity of the landfill that may serve as PCB transport media. Analysis for PCB was performed on selected samples suspected to be the most likely contaminated by PCB originating at the landfill.

In October 1977, a draft report, "Environmental Assessment of Polychlorinated Biphenyls(PCBs) near the New Bedford, MA., Municipal Landfill", presented the results of the Phase 1, preliminary investigation of PCB migration from the landfill site.

PCB was detected in the groundwater at low concentrations which decreased with depth in the soil and only on the north side of the landfill. No PCB was detected, even at very low levels, in the Dartmouth water supply. Low concentrations of PCBs were found in soils and biota from Apponogansett Swamp as well as in fish and bottom sediments from the Paskamanset River north of I-95. In EPA's opinion, the report indicates that although some movement of PCBs has occurred, PCBs are not escaping through these routes in large quantities, especially considering that an estimated 500,000 pounds of PCBs were discarded at the landfill from 1971-76 and that unknown but potentially large quantities were discarded prior to 1971. PCB levels in the biota samples were also low compared to some taken in the Harbor.

In the sampling data of June 28, 1977, the average ambient airborne PCB level at the landfill was 1.19 ug/m^3 (microgram per cubic meter), slightly in excess of the 1.0 ug/m^3 maximum concentration recommended by the National Institute for Occupational Safety and Health (NIOSH) for an 8-hour industrial exposure. EPA has some concern that the preliminary results indicate possible escape of PCB from the landfill into the air. It cannot be determined without further study if the landfill is the source of this airborne PCB or if there are other airborne sources in the area. The wind, at the time of sampling, was blowing neither across a major portion of the landfill before reaching the sampler nor from the direction of the industrial users in New England.

The report an another contract, "PCB Compounds Emanating from the New Bedford Municipal Wastewater Incinerator" showed some PCB emission from the incinerator stack. EPA sampling of ambient air near the New Bedford sludge incinerator on March 1 and 3, 1977 (see Page 17) showed considerably lower ambient levels than the stack emissions and those observed at the landfill. Hence, it is unlikely that the incinerator is the source of PCBs measured in the ambient air at the landfill.

On the basis of the results contained in this preliminary report, EPA decided to undertake a limited ambient air sampling program for PCBs in New England. Members of the Air Section, in cooperation with Environmental Science & Engineering (ESE) of Gainesville, FLA, conducted a field sampling program at four potential sources of PCB emissions in New Bedford: New Bedford Municipal Landfill, Aerovox Industries, Cornell-Dubilier Electronic Corporation, and the New Bedford Municipal Sludge Incinerator.

The purpose of the study was two-fold: first, to determine if the landfill is a measurable source of airborne PCB emissions, and secondly, to determine if residential areas near potential sources of PCB emissions are being subjected to airborne PCBs.

Two different sampling methods were utilized in this field sampling program. One method developed by ESE consisted of a modified "Hi-vol" and employed porous polyurethane foam as the collection media. After sample collection, these samples were returned to ESE in Gainesville for subsequent analysis. The ESE methodology was utilized at all sample sites.

Replicate samples were run with the FlorisiL method at selected sites, where higher concentrations were expected, to determine the precision of the FlorisiL method and to assess the comparability of the two methods employed. The analysis of the FlorisiL samples were run at Region I, Surveillance & Analysis Division.

Table 10 contains a summary of the analyses performed by the ESE and EPA Region I laboratories. In general, the co-located samples agreed reasonably well between methods; however, the FlorisiL method consistently produced higher results. Agreement between replicate FlorisiL samples was found to be quite good. The site sampled downwind of Aerovox Industries produced the only ambient air samples which showed substantial PCB emission.

The study results show that the New Bedford Landfill is not an appreciable wintertime source of airborne PCB emissions and does not appear to have an impact on residential areas.

TABLE 10

Analysis of PCB Air Samples From New Bedford

Date	Site	Location	PCB (ng/m^3)* ESE	PCB (ng/m^3)* EPA
01/17/78	New Bedford Landfill	Upwind	8.5	--
		On site	21	28 24
		Downwind	13	12 18
01/19/78	Cornell Dublier	Upwind	19	--
		Downwind	5.1	32 30
01/24/78	New Bedford Sludge Incinerator	Upwind	4.3	--
		Downwind	13	--
01/27/78	Aerovox	Upwind	5.6	--
		Downwind	490**	703 774

*Aroclor 1242/1016
**Aroclor 1016 only

SAMPLING PROGRAM

1. New Bedford Municipal Landfill - three sampling sites were selected; an upwind site, a site on the landfill itself, and a downwind site representative of population exposure in a residential area. The upwind site was located in the New Bedford Airport parking lot, 1,300 meters north of the landfill site. The landfill site was located in the identical area sampled previously by ESE in June of 1977. The downwind site was located at the end of Elmwood Street off of Hathway Street, 1,300 meters southwest of the landfill site. This area is on the edge of a single family residential area and was the closest population exposure downwind of the landfill.

   The actual sampling took place on January 17, 1978. The day was characterized by cloudy skies with light snow falling throughout the day. The winds were light (0-5 mph) and variable (northeast to southeast). The ground was frozen with a surface temperature of -1/2°C. There was an inch or two of snow covering the ground in most areas. The air temperature averaged -2°C for the sampling period.

   A total of three samples were taken - one at each site, utilizing ESE's sampling technique and equipment. In addition, two Florisil samples were collected at the landfill site and also at the downwind site. All samples were collected over a four hour period.

2. Cornell Dublier Company - two sites were sampled for this part of the study. The upwind site was located 400 meters north northwest of Cornell Dublier on East Rodney French Boulevard. The downwind site was located 400 meters southwest of Cornell Dublier on Cleveland Street off of Rodney Street. This site was situated in a single family residential area and was within 100 meters of Roosevelt Junior High School.

   These samples were taken on January 19, 1978. The day was partly cloudy with light north to northeast winds averaging less than 5 mph. The air temperature was 0°C.

   One "Hi-vol" method sample was taken at each site and two Florisil samples were taken at the downwind site only. The samples collected were of three hours duration.

3. New Bedford Sludge Incinerator - three hour "Hi-vol" samples were collected on January 24, 1978, at an upwind site 35 meters southwest of the incinerator's stack and at a downwind site 110 meters northeast of the plant. Due to physical constraints, it was impossible to locate the downwind site proximate to a residential area.

This sampling day was clear and had a strong southwest wind of 15-20 mph. The air temperature averaged 3°C for the sampling period.

4. Aerovox Industries, Inc. - two ambient sampling sites were selected; an upwind site 800 meters southwest of the facility on Desantels Street, and a downwind site in a single family residential area 400 meters northeast of the plant on Bitteau Street.

   The sampling took place on January 27, 1978, and consisted of two 3 hour "Hi-vol" samples, one at each site, and two 3 hour Florisil samples taken at the downwind site. The day was characterized by cloudy skies, an air temperature of -1°C and gusty southwest to westerly winds varying from 10 to 25 mph.

Pittsfield

Recently, Pittsfield and vicinity have been considered areas experiencing a serious problem with PCB contamination. Pittsfield has housed a major PCB user, General Electric Company, since the early 1930's. The long-term effects of the use of PCBs at General Electric's facility coupled with other contributing sources of PCBs, has presented the Pittsfield area with several environmental concerns.

General Electric Company

General Electric is located at 100 Woodlawn Avenue, Pittsfield, Massachusetts. General Electric Company has been using PCBs at their Pittsfield facility since 1932, in the manufacture of capacitors and transformers. In the early 1950's the capacitor operation was moved to New York while the transformer manufacturing divisions continued to operate in Pittsfield.

General Electric utilizes PCBs for the production of power and distribution transformers (including railroad, furnace, rectifier, saturable and grounding transformers). The amount of PCB liquid in these transformers varies considerably. Distribution transformers contain from 30 to 4,400 pounds of PCB liquid. Power units may be divided into three classes: (1) railroad transformers containing 700 to 2,400 lbs of PCB liquid, (2) furnace transformers containing 2,000 to 4,000 lbs, and (3) rectifier transformers which contain up to 19,000 lbs of PCB liquid.

The "PCB liquid" used by General Electric, is a mixture of the Aroclors they receive from Monsanto, with Trichlorobenzene and other additives to produce their own dielectric fluid, trade name "Pyranol". Pyranol is approximately 40 percent Trichlorobenzene and 60 percent Aroclor.

Prior to 1971, Aroclor 1260 was blended to manufacture the transformer dielectric fluid. During 1971 and 1972, both Aroclor 1260 and 1254 was employed. Aroclor 1254 was used from 1972 until March 1977, when General Electric voluntarily gave up the use of PCBs as a component in their insulting fluid.

Solid Waste

Sources of PCB contaminated solid waste include diatomaceous earth from filtration system, filter paper from filtration systems, absorbent material, wiping rags, solids collected in fill station sumps, unreclaimable transformer parts and empty steel drums.

Prior to 1971, all of General Elctric's solid waste was sent to landfill. Since 1971, General Electric has segregated its waste streams such that only non-contaminated materials are sent to the Pittsfield landfill. Materials suspected of contamination have been stored on site, mainly in 55 gallon drums at an open disposal area for eventual shipment to Texas Ecologist Inc., Robstown, Texas for landfilling. The storage area is located in an open scrap-yard. Stored drums are mounted on wooden pallets and stacked 2 high. As of EPA's on-site inspections of January 21 and February 10, 1976, approximately 1,000 drums had been accumulated.

Ninety-five percent of the municipal, commercial and industrial wastes generated in Pittsfield are disposed of in the Pittsfield Municipal disposal site located on E Street in Pittsfield. No attempt is made to segregate the industrial waste received by the site, most of which comes from General Electric.

The following information was ascertained on the disposal site during the EPA inspection in 1976:

A. General Information:

1. Site location - E St., Pittsfield (See Figure 4)
2. Owner/Operator - Municipality
3. Estimated year site placed in operation - 1952
4. Area of site - 42 acres
5. Area filled in as of 1976 - 36 acres
6. Approximate quantities of refuse accepted - 60,000 tons per year

B. Operational Data

1. Method of fill - area fill
2. Nature of cover material - evacuated sand and gravel from site to elevation five feet above historic flood level of river.
3. Current operational status - considered a sanitary landfill
4. Leachate control and monitoring - none
5. Leachate discharges - no known surface discharge

C. Hydrological Data:

1. Distance to groundwater - 15 feet
2. Groundwater - apparently moving towards the Housatonic River
3. Proximity to surface water - older fill within 50 to 60 feet of the Housatonic, new portion of fill within 100 feet

It should be recognized that this site serves as a possible source of PCB contamination to the environment as it does receive wastes from G.E. which may contain PCBs.

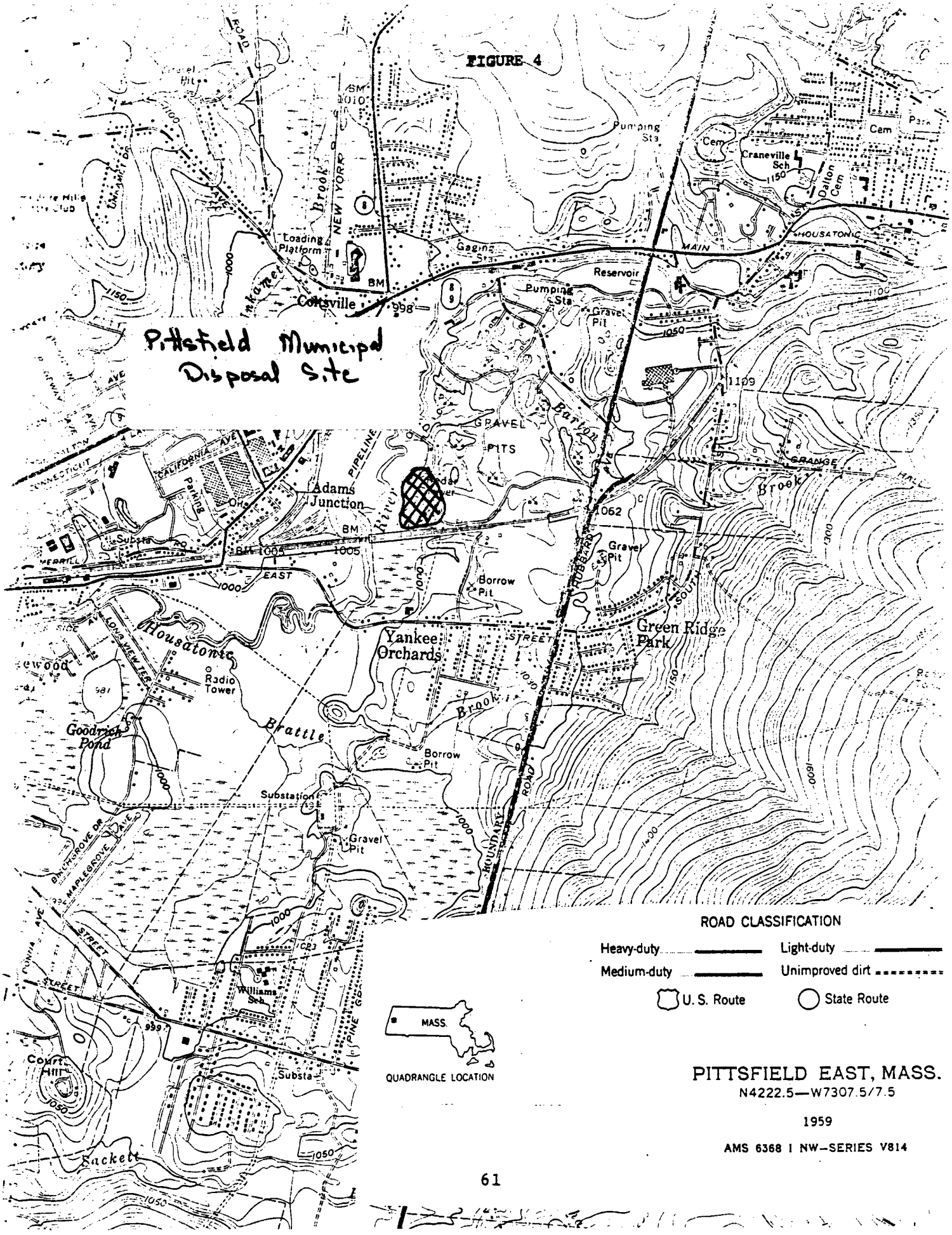
Another source of solid waste is generated by the handling of contaminated liquid. One the drums used to store contaminated liquid have been emptied, they must be disposed of. General Electric estimated that each drum contains approximately a one pound PCB residual. From December 1973 - 1975, approximately 1,500 of these contaminated drums had been sold to an unknown scrap steel contractor for return to steel mill furnaces.

Liquid Wastes

Liquid wastes contaminated by PCBs have also presented several problems.

Sources of PCB contaminated liquid waste include drip pans, Pyranol from transformers to be rebuilt or scrapped, returned transformers, recyle storage tanks, rinse storage tanks, drippings and spills accumulated in sumps below handling stations, Pyranol from General Electric service shops throughout the country, contract disposal of wastes from other manufacturers using PCBs, oil water separators, and kerosene contaminated with Pyranol from transformer cleaning operations.

FIGURE 4



PITTSFIELD EAST, MASS.

N4222.5—W7307.5/7.5

1959

AMS 6368 I NW—SERIES V814

All contaminated Pyranol which is considered recoverable is returned to building number 68 for upgrading.* Irrecoverable Pyranol is sent to General Electric's waste disposal area for incineration.

The Pyranol in the tank farm's recycle storage tank is transferrred to a tank truck via the unloading shelter and hauled back to building number 68. There it is pumped, first through a diatomaceous earth filter and then through a pressed paper filter. The fluid may be cycled through these filters several times until it meets industrial specifications or is termed irrecoverable. If upgrading is successful, the Pyranol is returned for reuse; if not, it is held for incineration.

Other pathways of possible PCB release include drummed wastes contained at stations throughout the plant. These drums receive the Pyranols collected in drip pans. General Electric's policy is that waste pyranol is not permitted to stand in small pails or containers; but shall be immediately transferred to approved containers, i.e. heavy duty 55 gallon steel drums. When filled, these drums are sealed, color and letter coded, and then transported to the disposal area. The department generating the waste is made responsible for delivery to the disposal site. Motorized floor trucks, fork lifts, or pick-up trucks may be used to transport the drummed wastes.

As of 1976, General Electric became licensed by the Massachusetts Department of Environmental Quality Engineering to receive and incinerate waste Aroclors from other plants. Since constructing its incinerator in 1972, the Pittsfield plant has apparently served to destroy the PCB liquid wastes from General Electric service shops in Western Massachusetts. These wastes may be delivered in drums or within whole transfomers.

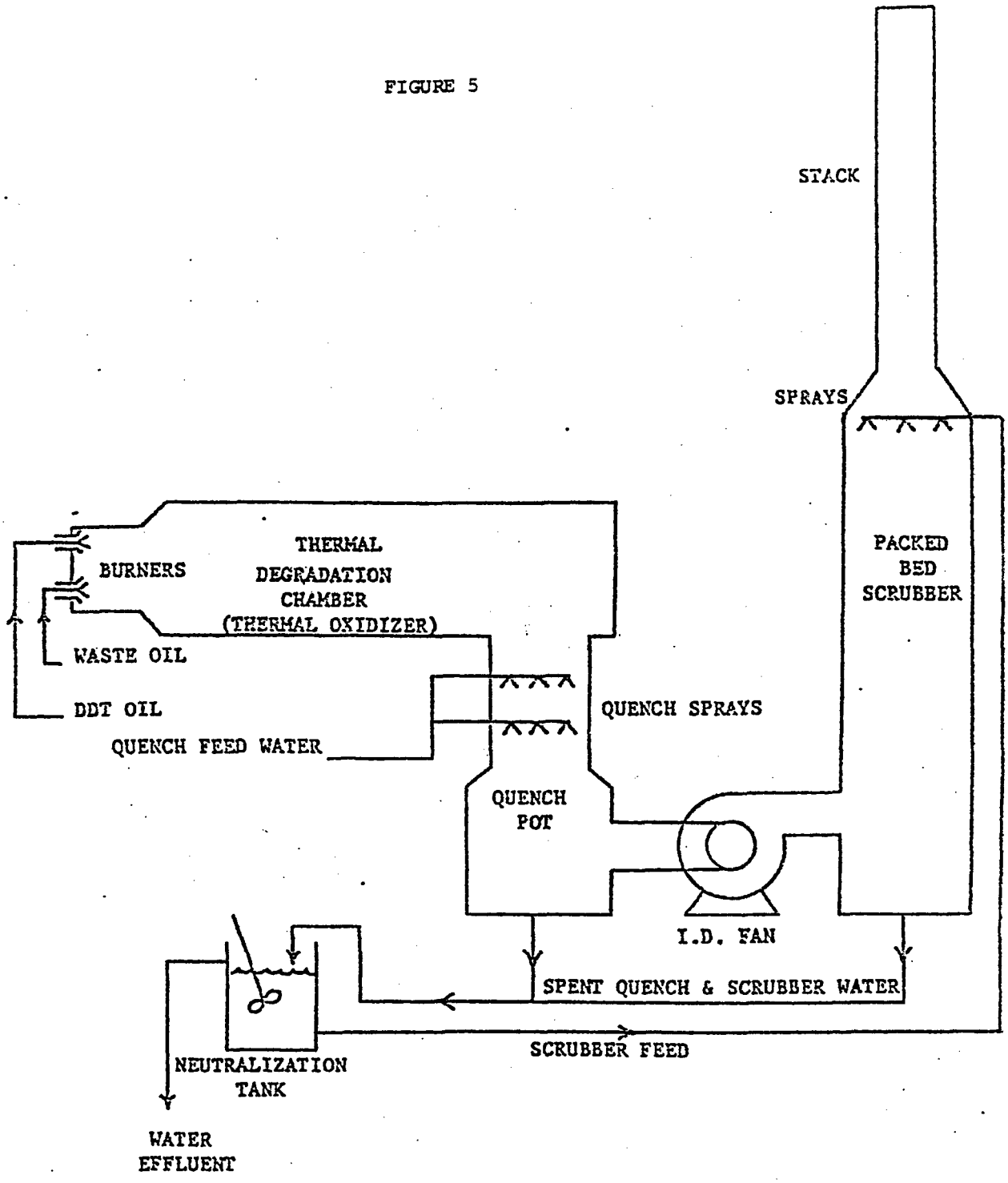
Contaminated kerosene is another major source of PCB contaminated liquid waste. Source include, degreasing transformers to be repaired, Pyranol transformers from which the Pyranol has been removed and is then cleaned with kerosene before any other work begins. This kerosene is treated like contaminated Pyranol. It is drummed, color and letter coded, and sent to the disposal area for incineration.

Liquid wastes which are to be incinerated, are transferred from building Number 68 or delivered to the storage area in drums. Drums are eventually emptied into a vat and the contents transferred according to color and letter code to an appropriate 3,000 gallon storage tank at the incinerator. The entire incinerator tank farm is surrounded by a concrete dike and all PCB contaminated liquid wastes are stored here and blended for incineration.

In late 1972 General Electric installed a high-temperature incinerator, called a thermo-oxidizing system. The General Electric incinerator consists of a horizontally mounted cylindrical combustion and oxidation chamber followed

*Building Number 68 contains nine tanks for the storage and blending of Aroclors; 3-15,000 gallon tanks; 4-10,000 gallong tanks; and 2-1,000 gallon tanks.

FIGURE 5



PROCESS SCHEMATIC

THERMAL OXIDIZER INCINERATOR - PESTICIDES INCINERATION PROGRAM
GENERAL ELECTRIC COMPANY, PITTSFIELD, MASSACHUSETTS

by a quench pot packed bed scrubber and stack. Figure 5 shows the process schematic. Two steam atomizing burners inject the combustible liquid wastes into the combustion section with air, in such a manner to create a vortex type turbulence. This produces high heat release and effective combustion promoting the thermal degradation process. After combustion, the waste gases proceed through the oxidation chamber which provides sufficient residence time at elevated temperatures 871.1 to 982.2^{0}C (1600 to 1900^{o}F) for the degradation reactions to go to completion. The chamber utilized in this study was approximately 3.3 meters long (27feet) by 2.13 meeters (7feet) in diameter, providing a residence time of about three seconds at the test conditions. The flue gases from the oxidation chamber pass through a quench pot which contains a series of water sprays to cool the gases. An induced draft fan then forces the cooled gases through a packed bed scrubber column mounted on the base of the stack. Here any acids produced in the combustion process are absorbed in the scrubbing water. The water is then neutralized prior to disposal.

Air Discharges

Sources of PCBs discharged to the air at the G.E. facility include release from the ventilation system, vacuum pumps on storage tanks, tank trucks, storage tanks, kerosene cleaning vats and the incinerator stack.

The 1975 EPA plant inspection report stated that the incinerator stack was the only PCB related air discharge having an emission control device. The stack is equipped with a packed bed-scrubber. The scrubber water is cycled from and to the influent end of the oil/water separator at outfall 005.

G.E. plant official, James Thayer, felt that the other potential sources of major PCB losses were the ventilating exhaust ducts serving the kerosene wash vats. Mr. Thayer said that G.E. had sampled these exhausts for PCBs and PCBs were not detected in measurable quantities.

The EPA inspection team felt that other areas which probably contribute high concentrations of PCBs for short periods were the PCB storage locations. When the Aroclor was transferred to the storage and blending tanks and Pyrano was transferred to tank trucks and then to storage tanks, air saturated with PCBs was emitted. Likewise, when Pyranol was recycled, high concentrations of PCBs to the air were emitted.

Since PCBs are no longer being actively used by G.E., sources of PCB release to the air has most likely been reduced. PCB release to the air can still occur, however, around areas of the plant which remain contaminated with PCBs.

Wastewater and Storm Water

The main sources of General Electric's wastewater include scrubbed water, groundwater treatment (groundwater/oil separation) water, and runoff from the General Electric facility and surrounding city areas. The wastewater situation at the General Electric facility was characterized in the following manner as of the on-site EPA inspections performed in January and February, 1976.

"Drains in the transformer fill areas had been removed and plugged as have those in the other Pyranol handling areas. Wastewater flow from the transformer departments discharge through outfalls (serial nos. 001, 005 and 006). Outfalls 005 and 006 are known to contain PCB concentrations exceeding one microgram per liter. Outfall 005 serves the power transformer department, the distribution transformer department, contiguous city areas, and the incinerator. Outfall 006 serves the power transformer department plus storm runoff from city urban areas. Both discharges also serve the groundwater collected as part of General Electric's groundwater/oil containment program. Flows discharging through these outfalls are treated by oil/water separators."

Beginning in 1964, G.E. embarked upon a formal oil pollution control program. As part of that program they reduced their number of wastewater outfalls from 35 to 10 and constructed 4 oil/water separators. As oily water enters the separator, its current is slowed down in order to give the oil an opportunity to rise to the top. At the end of the separator the oil is skimmed off for reuse. Three of the four wastewater outfalls serve the transformer manufacturing area. They are designated as Serial Nos. 001, 005 and 006 and fall under the jurisdiction of NPDES Permit No. MA0003891. Figures 6 and 7 indicated G.E.'s existing outfalls and discharges.

Prior to 1971, General Electric (Pittsfield) sold its waste oils (Pyranol included) to salvage contractors. It was suspected that much of this oil was employed for dust control by being spread over unpaved areas. Just north from outfall 006 an area exists which, at one time contained a tank farm which may have had spills or leakage. This area along the East Branch of the Housatonic River was also utilized as a landfill site. No accurate records exist but capacitors, transformers, and waste fluids may have been thus disposed. In any event, groundwater from this area is oil contaminated.

Oil carried in the groundwater table had been leaching to the East Branch of the Housatonic River. In 1966, G.E. embarked on a groundwater recovery program to eliminate these discharges. A series of wells and interceptor basins were developed with the water flowing into them pumped through oil/ water separators and then discharged at outfall 005 or 006.

Waste oil collected at these separators had relatively high concentrations of Aroclor 1260. Collected oil was drummed and held in 55gallon drums until a satisfactory disposal method could be obtained. In 1972, G.E. completed construction of its liquid injection incinerator suitable for PCB destruction.

Oil slicks which were previously visible drifting along the river's edge have nearly disappeared. However, the company then became faced with two point source discharges of PCB.

The construction of the incinerator and scrubber control of its stack emissions added to the PCB concentrations in outfall 005. In 1975, EPA participated in a demonstration test burn of DDT in General Electric's incinerator. Contaminated waste oil containing 1.7 percent PCB was used to provide additional heat. Test results indicated that PCB destruction efficiency exceeded 99.99 percent. Since December of 1972, General Electric has incinerated more than 270,000 pounds of PCBs.

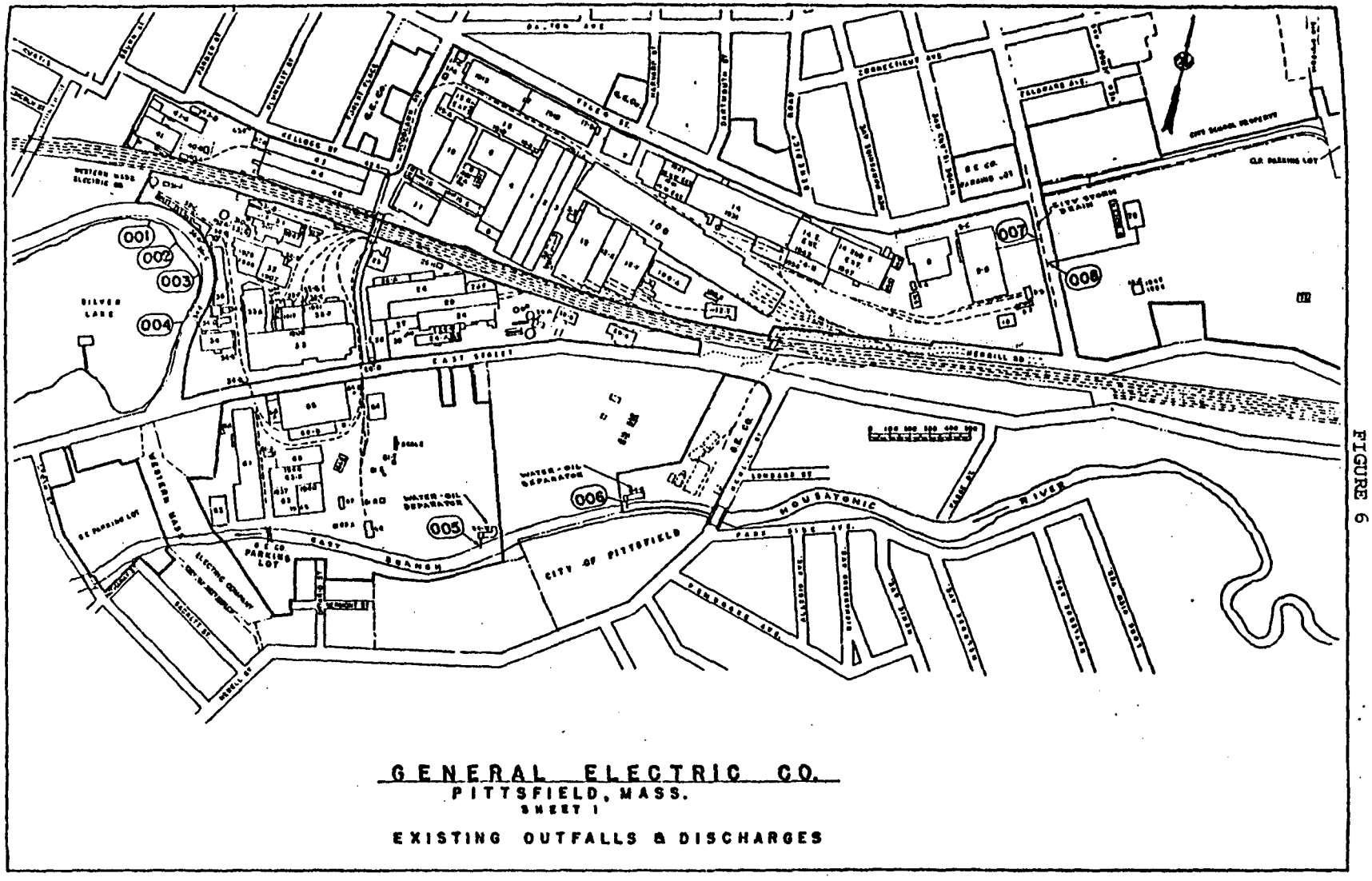

001
002
003
004
005
006
007
008
EAST STREET
HOUSATONIC
RIVER
CITY OF PITTSFIELD
WATER-OIL SEPARATOR
WATER-OIL SEPARATOR
EAST BRANCH
SILVER LAKE
G E NERAL ELECTRIC CO.
PITTSFIELD, MASS.
SHEET 1
EXISTING OUTFALLS & DISCHARGES

FIGURE 6

EXHIBIT II

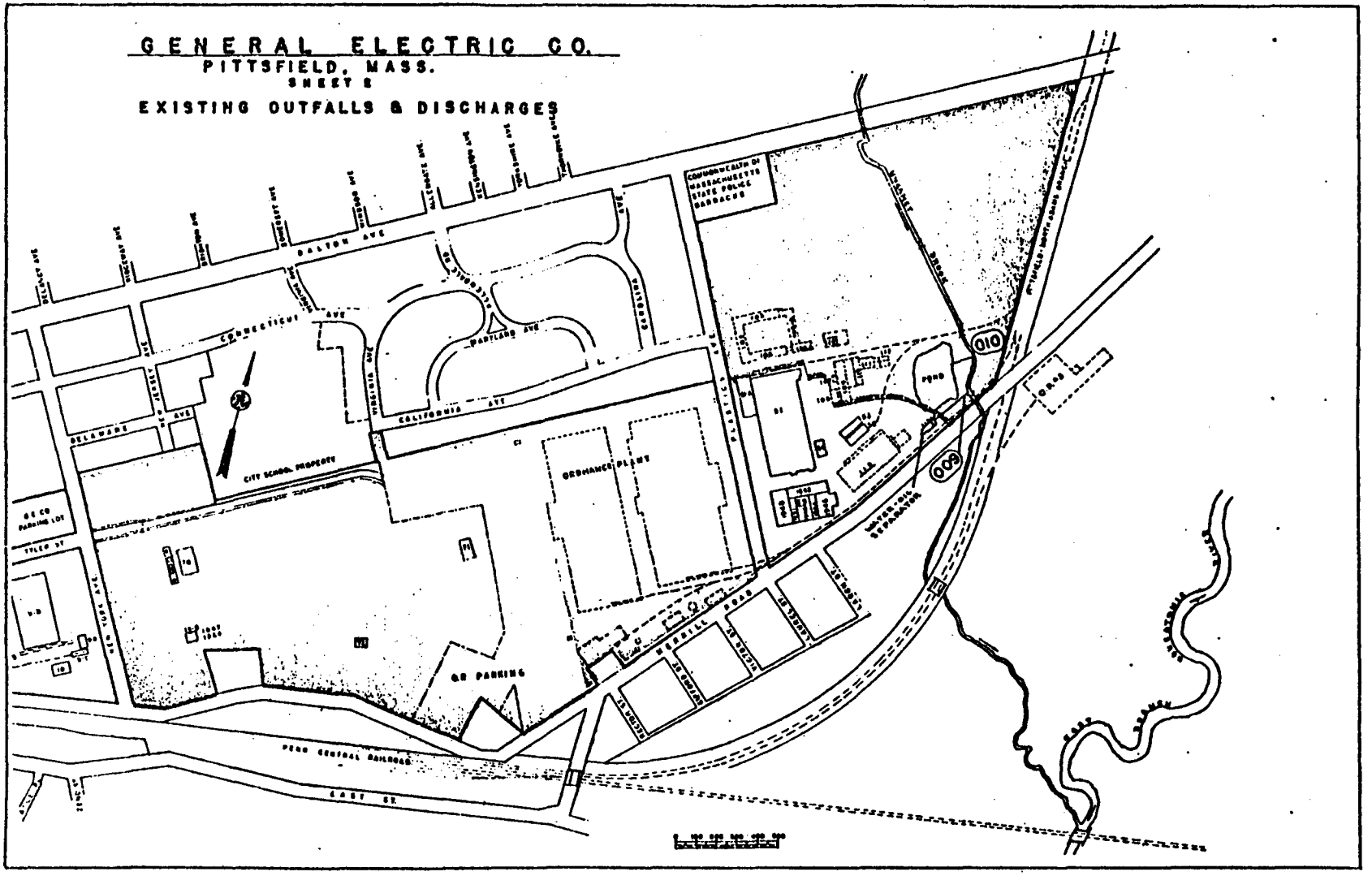


FIGURE 7

Figure 7

Sanitary waste from G.E.'s Pittsfield facility is treated by the Pittsfield Municipal Wastewater Treatment Plant (Figure 8). This primary and secondary plant (trickling filter) generates approximately 30,000 gallons (10% solids) of sludge per week. Sludge is dried in sand-drying beds where the solids content is increased to 40%. The dried sludge is then disposed of on the 125-acre site of the sewage treatment plant.

As of the 1976 plant inspection, the plant superintendent indicated that a swampy area adjacent to the Housatonic River was being filled in. Areas previously filled in were now covered with grass.

A sample of the sludge collected on 2/10/76 was analyzed by the EPA regional laboratory and found to contain the following:

Aroclor 1016	- liquid	- 1 ug/l (3ppb)
	- sediment	- 1400 ug/kg (1.4ppm)
Aroclor 1254	- liquid	- 3 ug/l (3ppb)
	- sediment	- 8000 ug/kg (8.0ppm)
Aroclor 1260	- liquid	- 3 ug/l (3ppb)
	- sediment	- 8000 ug/kg (8.0ppm)

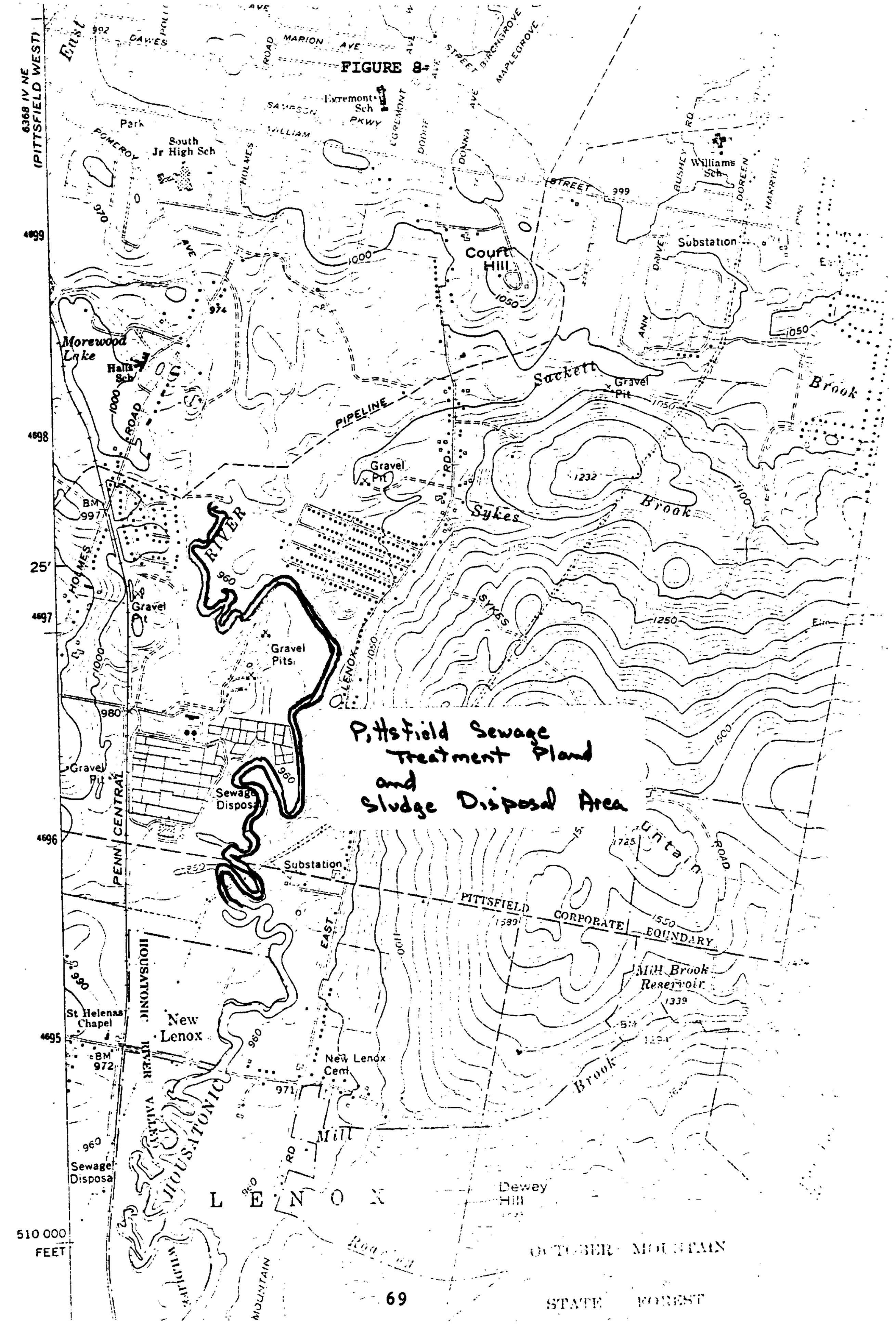
Sludge from the Pittsfield Sewage Treatment Plant has always been disposed of on the 125-acre site where the sewage plant is located. This site acts as a potential source of PCB contamination to the Housatonic as this site is located adjacent to the Housatonic River in Pittsfield.

As mentioned earlier, General Electric has ten existing discharges (average flow is 6 million gallons per day) consisting of process waste, non-contact cooling water and stormwater to the East Branch to the Housatonic River, Silver Lake and Unnamed Brook, (Class C watercourses) at Pittsfield, Ma.

General Electric has four wastewater discharges falling under the jurisdiction of NPDES Permit No. MA0003891. Outfalls 005 and 006 currently have discharge limitations set for PCBs. G.E. was first issued their discharge permit in December 1974. This permit was then modified in December 1975. PCB discharge limitations were set for outfall serial number 005 at a daily average of 0.1 kg/day (0.02 mg/l) and a daily maximum of 0.33 kg/day (0.07 mg/l), based upon weekly average and maximums, respectively.

Serial outfall number 006 had a discharge limiation of 0.012 kg/day (0.0058 mg/l) on a daily average basis, and a daily maximum of 0.045 kg/day (0.022 mg/l).

General Electric was monitored for PCB content during the PCB survey conducted by EPA in January 1976. Tables 1, 2 and 3 show that approximately 4 ounces of PCBs/day were measured going to the Housatonic River. G.E.'s effluent water was found to contain up to 30 parts per billion (ppb) of PCB. On the basis of these results, EPA determined that G.E.'s NPDES permit should be modified in order to reduce the amount of PCBs being discharged by the Company to the environment. A public notice was issued on 4/2/76 for a proposed permit modification to reduce the PCB concentration in G.E.'s process water to 0.001 mg/l (1ppb) on a daily average basis by July 1, 1977. The proposed permit also sought


Pittsfield Sewage Treatment Pland and Sludge Disposal Area
6368 IV NE (PITTSFIELD WEST)
East
DAWES
MARION AVE
Exremont Sch
SAMPSON PKWY
WILLIAM
EGREMONT
DODGE
DONNA
BUSHEY RD
DOREEN
Williams Sch
Park
POMEROY
South Jr High Sch
HOLMES
STREET 999
Substation
Court Hill
1000
1050
974
Morewood Lake
Halls Sch
ROAD
PIPELINE
Sackett
Gravel Pit
Brook
1232
1100
Sykes
Brook
SYKES
RIVER
960
BM 997
25′
HOLMES
Gravel Pit
Gravel Pits
LENOX
1250
980
Gravel Pit
Sewage Disposal
1500
PENN CENTRAL
Substation
1725
ROAD
PITTSFIELD CORPORATE BOUNDARY
1550
EAST
HOUSATONIC RIVER
Mill Brook Reservoir
1339
St Helenas Chapel
New Lenox
BM 972
New Lenox Cem
971
Brook
HOUSATONIC
Mill
RD
960
Sewage Disposal
L E N O X
Dewey Hill
510 000 FEET
MOUNTAIN
OCTOBER MOUNTAIN
STATE FOREST
4699
4698
4697
4696
4695
FIGURE 8

to limit the concentration of polychlorinated biphenyls released from contaminated groundwater and discharged to surface waters (i.e. Housatonic River) to less than 0.010 mg/l (10 ppb) on a daily average basis by July 1, 1977. The proposed permit also would require the applicant to install and operate waste treatment facilities on or before June 30, 1977.

General Electric stopped using polychlorinated biphenyls in all their processes in March 1977. Prior to cessation of manufacturing Pyranolfilled transformers in March 1977, G.E. was involved in a total PCB containment program to reduce losses at the point of manufacture.

As of August 1977, G.E. (Pittsfield) was meeting its permit requirements allowing an average PCB discharge of four ounces (10 ppb) per day within the plant's average daily total of 40 million pounds (6 1/2 million gallons of wastewater). G.E. claims that none of this PCB discharge resulted from recent manufacturing use due to their containment practices but is the result of residual amounts of PCB accumulated in the plant facilities pipes, drains and ground.

General Electric was notified on August 22, 1977 of EPA's intention to establish more stringent permit discharge limitations for PCBs. At a meeting on September 14, 1977, Company officials outlined their proposed program to reduce existing discharge levels. Major facets of the program include:

1. Cleaning, removal and disposal of all PCB storage and hand ling tanks, pipes, pumps, etc. As of October 1977, this effort was 95% complete. Equipment is solventcleaned, cutup and sent to smelter to be melted down.

2. Some 12002000 barrels of PCB wastes are being removed from the plant site and sent to a chemical landfill in the midwest.

3. G.E. contracted O'BRIEN and GERE, Consulting Engineers, who performed a survey of all pipe systems within G.E.'s plant facility which may have been exposed to PCB contamination. Based on the results of this survey, piping systems are presently either being abandoned (after cleaning, pipes are sealed and grouted), replaced, or relined with polyethlene liners (the liner is jointless and thus prevents infiltration of PCB contaminated groundwater as well as "seal" in any PCBs accumulated on old pipe). The estimated completion date for drainage area to discharge 005 was 12/31/77. Area 006 is estimated to be completed in early 1978. This system was found to be relatively "clean" and most pipes only require cleaning.

4. The Company has plans to install a second oil/water separator in series with the existing separator servicing discharge 005 (the largest and most contaminated discharge). This is expected to be completed in 1978.

5. G.E.plans to investigate the possibility of rerouting uncontaminated stormwater into the city drain system.

6. The Company has installed separate oil/water separators on the discharge from its groundwater wells. Collected waste oil is incinerated by hightemp incineration. Water is recycled to ground.

7. The Company has ceased the use of PCBs in their manu facturing process.

As a result of the September 14th meeting, it was agreed that EPA would ree evaluate the proposed modification of G.E.'s permit. By October, G.E. submitted (as agreed upon) a revised engineering report with projected dates for program completion and proposed permit discharge limits for PCBs consistent with anticipated results upon completion of the program. EPA's Regional Administrator and the Director made a preliminary determination to modify G.E.'s permit and to require the permittee to implement the PCB control program outlined in the engineering report submitted to EPA, and to reduce the average quantity of PCBs from discharges 005 and 006 from the presently permitted four ounces per day to a total of one ounce per day (equal to a concentration of five parts per billion) by April 1, 1979. The permit also requires G.E. to submit annual reports assessing further reductions versus available removal and control technology. G.E.'s permit modification should become effective by the end of January 1978.

Impetus for modifying G.E.'s NPDES permit came as a result of the amounts found to be released by the Company during EPA's industrial PCB survey in January 1976 and as a result of concern expressed over the "high" levels of PCBs found within the Housatonic River in both Massachusetts and Connecticut. As stated earlier, the G.E. plant has released varying amounts of PCBs to the Housatonic in their industrial discharge from 1932 until the present. In fact, prior to the Company's installation of the two oil/water separators and a groundwater well system, over a pound per day of PCBs were reportedly discharged.

Aside from General Electric's Pittsfield facility acting as a source of PCB contamination to the Housatonic, several other potential sources exist. Other possible sources of PCBs to the Housatonic include landfills which exist within the river drainage area as well as the municipal sewage treatment plant sludge disposal sites located in the vicinity of the river.

In line with the above, the Massachusetts Department of Environmental Quality Engineering began a sampling program in August 1977 to define the extent of PCB contamination within the waters of the Housatonic River Basin, along with determining where and what the contributory sources of PCB contamination are. Results of this program and a discussion thereof will be presented later on in this report.

Housatonic River

The Housatonic River has its source in North Adams, Massachusetts and flows southward through western Mass. and Conn. and eventually empties into the Long Island Sound. Daming of the river for electrical power production and by paper mills in Lee, Mass. created a pond/marsh area known as Wood's Pond. This pond is approximately ten miles south of Pittsfield (where G.E. is located). Surface area of the pond is about 25 acres. In this pond system, the flow rate of

the river to this spot settles out. Although the pond itself is fairly large, it is quite shallow with a maximum depth of about ten feet. In 1976, a group performing a study of the Housatonic made the following comments. "The bottom of the pond is nondistrinctdue to a thick layer of suspended sediments. Depth of this layer was deserved to be threetofour feet. The marsh, pond, and surrounding land are part of a conservation area which begins three miles below Pittsfield."*

Numerous data has been collected on PCBs in the Housatonic by both State and Federal agencies. Under the Pesticides Monitoring Program, the Massachusetts Division of Fisheries and Game began analyzing for PCBs in 1970 in fish and caged mussels collected from the Housatonic River. In the Summer of 1970, PCBs were identified in samples collected from the Housatonic. In order to further evaluate biological monitoring, it was recommended that the use of fish and caged mussel samples be continued to establish general locus of polychlorinated biphenyl compound (PCB) introduction to the Housatonic River.

The following pages dealing with this monitoring program have been excerpted from the Massachusetts Division of Fisheries and Game's Progress Reports on Pesticides Monitoring in Massachusetts, "The Presence of Polychlorinated Biphenyls in the Housatonic River".

FIELD WORK

"In July 1971, three sampling areas were chosen on the Housatonic River and fish were collected from each. Sample locations are shown in Figure 1. Below is a general description of these initial sampling areas:

H1 This is the upstream station. It is located in Hinsdale on Route 8, one mile north of the intersection of Routes 8 and 143. Here the water is cold, clear and fast flowing. Both white suckers and brook trout were collected with dip nets.

H2 This station is located in Pittsfield on Route 8 and 9 be hind the KMart store, 5.2 miles downstream from H1. Here the water is cloudy and fast flowing with a gravel bottom. Rotenone collection in this section of the river yielded only white suckers which were used for analysis.

H3 This station is located in Pittsfield at the intersection of Holmes Road and the river, 6.1 miles downstream from H2. In this location, the river is wider, flows more slowly and the bottom is sandy. The only fish collected here by the use of rotenone were white suckers and one pumpkinseed.

"The fish from these sampling areas were all collected on 7 July 1971. Cages of mussels were also introduced for subsequent collection and analysis. In September, two additional sampling locations were chosen in Pittsfield near the General Electric plant. These stations which are described below are situated between H2 and H3.

*"PCB Concentration in Fish and Sediment of the Housatonic River", Drew, Gray, Sapp and Whiting.

Newell Street - This is an upstream station and is located below the Newell Street bridge, 3.3 miles downstream from H2.

Along with the information acquired from the State's Pesticides Monitoring Program on PCBs in the Housatonic, the EPA laboratory in Gulf Breeze, Florida has generated data on PCBs in the Housatonic as part of a fish sampling program conducted in Connecticut on a yearly basis since 1972. All fish were sampled from the mouth of the respective river basins. The results are as follows:

		PCB CONTENT (1254)* Year Sampled				
River Sampled	Species	1972	1973	1974	1975	1976
Houstonic	Cunner	138	389	491,408	497	270,289
	Atlantic bluefish	-	-	324,360	-	-
	Bluefish	-	-	328	-	-
Thames	Cunner	434	293,181	461,618	134	-
	Atlantic Silverside	-	-	199	139	-
Connecticut	Cunner	592	153,678	1,065	-	-
	Atlantic Silverside	-	-	395,300	278	-
Quinssipiac	Cunner	272	588,294	409,413	396	-
	Atlantic Silverside	-	-	351	-	-

*All data expressed as ug/kg (ppb) based on whole body, wet weight juvenile fish.

The Environmental Protection Agency in Region I has conducted several studies to determine what the extent of PCB contamination is in and around the Housatonic River. Throughout 1972-1976, analyses were performed on various water, sediment, and fish samples which EPA had collected. The results of these studies are indicated in Tables 10, 11 and 12; sample locations are shown in Figures 9 and 10.

Ambient water values in the Housatonic ranged from approximately 0.03 parts per billion (detection limit for the analysis upstream of the General Electric outfall to 0.42 parts per billion below the outfall and down again to the detection level further downstream.

Sediment readings taken from the river bottom ranged from 0.05 parts per million (ppm) upstream, to 139 ppm, 26 ppm, 54 ppm and 1.4 ppm successively downstream with an anomaly of 134 ppm occurring at the inner dam face in Woods Pond.

On the basis of these results from Connecticut's monitoring program, the following health advisories were released by the State's Dept. of Health.

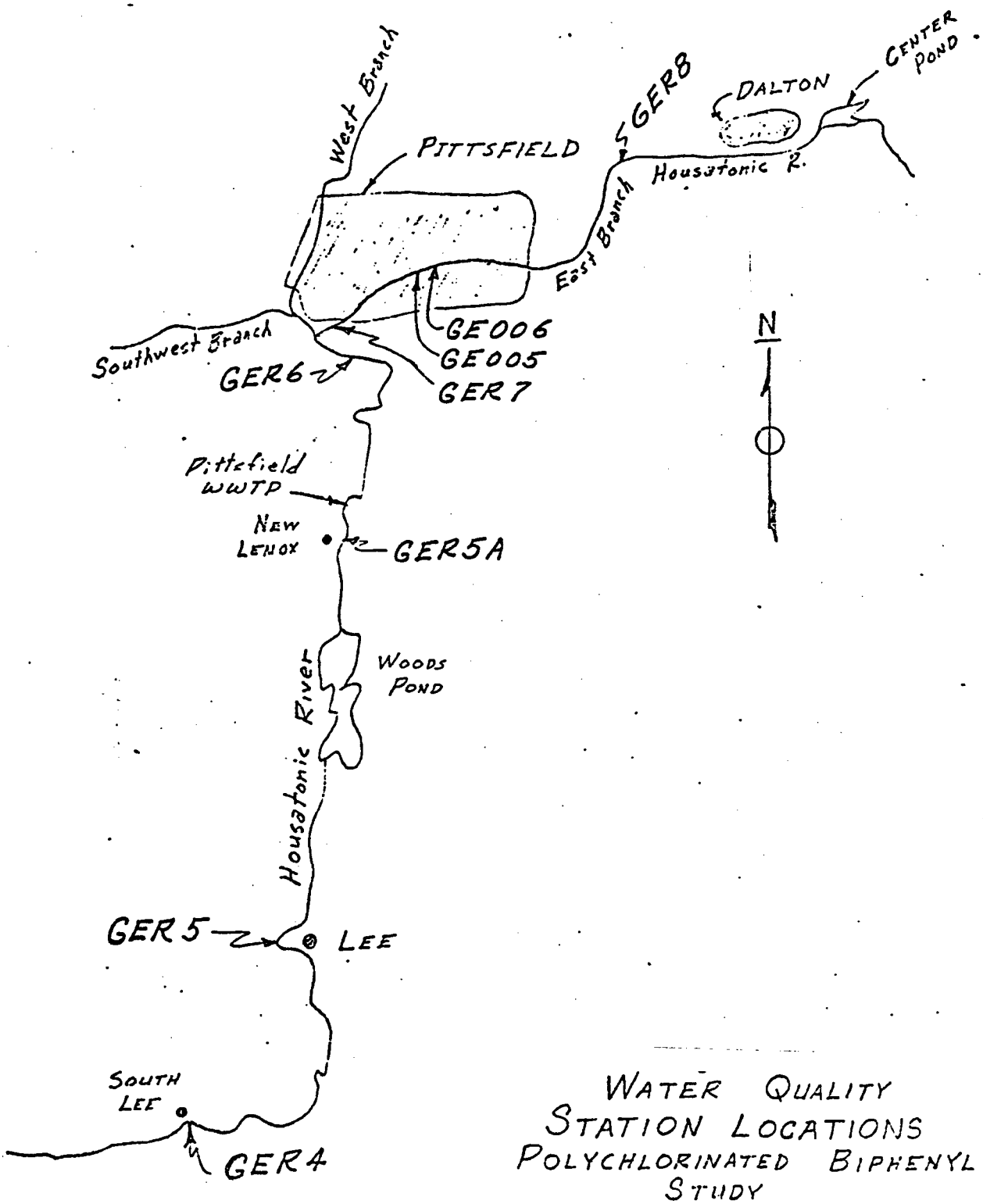
TABLE 10

WATER SAMPLES

Sample Station	Location Description	Sample Date	PCB Level-micrograms per liter (ug/l) or ppb
GER04	Housatonic River at Meadow St. Bridge, South Lee, Ma.	8/26/75	-L.03
GER05	Housatonic River at Rte 20 Bridge, Lee, Ma.	8/26/75	L.03
GER05A	Housatonic River at New Lenox Road Bridge, New Lenox, Ma.	8/26/75	0.06*
GER06	Housatonic River at Pomeroy Ave. Bridge, Pittsfield, Ma.	8/26/75	0.06*
GER07	East Branch of the Housatonic River at Pomeroy Ave. Bridge, Pittsfield, Ma.	8/26/75	0.42
GER08	East Branch of the Housatonic River at Hubbard Ave. Bridge near USGS Dalton Gage, Pittsfield, Ma.	8/26/75	L.03
GE005	General Electric Company, outfall #005. Oil-water separator effluent containing groundwater, runoff, incinerator scrubber water, and wastewater from power transformer department.	8/26/75	120
GE006	General Electric Company, outfall #006. Oil-water separator effluent containing groundwater and wastewater from the power and distribution transformer departments.	8/26/75	4.6

* interferences present
L = less than

FIGURE 9



WATER QUALITY
STATION LOCATIONS
POLYCHLORINATED BIPHENYL
STUDY
Housatonic River, Mass.
August 1975

Not to Scale

TABLE 11

Sediment Samples

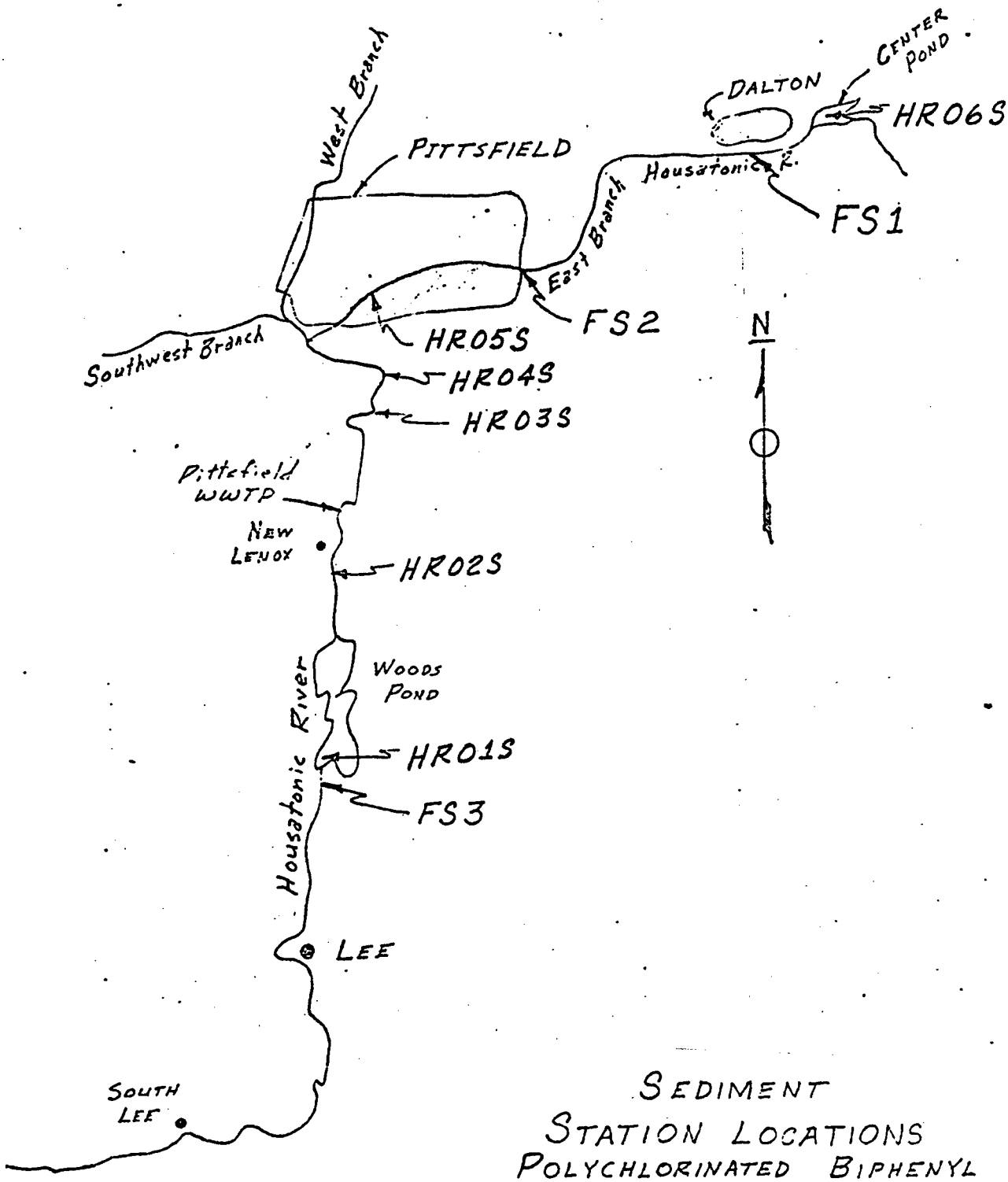
Sample Station	Location Description	Sample Date	PCB Level-ppm dr weight mg/kg (pp
HR01S	Housatonic R. approximately 300 meters (1000') upstream of Woods Pond Dam, Lee, Ma.	8/26/75	134
HR02S	Housatonic R. approximately 150 meters (500') downstream of New Lenox Rd. Bridge, New Lenox, Ma.	8/26/75	1.4
HR03S	Housatonic R. approximately 5 kilometers (3 mi) upstream from the Pittsfield WWTP outfall, Pittsfield, Ma.	8/26/75	53.9
HR04S	Housatonic R. 200 meters downstream of the Pomeroy Ave. Bridge, Pittsfield, Ma.	8/26/75	26.3
HR05S	East Branch of the Housatonic near Lyman St. bridge (immediately downstream of the G.E. Co's outfall #'s 005 and 006), Pittsfield, Ma.	8/26/75	139
HR06S	East Branch of the Housatonic near the center of Center Pond, Dalton, Ma.	8/26/75	0.05

Fish Samples

Sample Station	Specimen	Stream Location	Sample Date	PCB Level* wet weight, mg/l (ppm)
FS-1	3 trout	E. Housatonic St. Bridge	8/29/75	0.28
FS-2	1 catfish 1 perch 2 bluegills	East Street, 200 yards upstream of Fasce Place. Below landfill	8/29/75	17.4
FS-3	4 bass	Outer base of Woods Pond Dam	8/29/75	34.0

*Value for fillet and skin only

FIGURE 10



SEDIMENT
STATION LOCATIONS
POLYCHLORINATED BIPHENYL
STUDY
Housatonic River, Mass.
August 1975

Not to Scale

TABLE 12

SEDIMENT SAMPLES

SOURCE	PCB level - ppb or (ug/kg) 1972	1973	1974	1975	1976
Housatonic R. at Stratford	--	--	29	43	14
" " " Stevenson (Monroe)	10	--	2	14	4
" " " Falls Village	70	40	--	--	--
" " " New Milford	--	--	130	68	94
" " near Canaan	--	--	130	60	76
Lake Lillinonah at Brookfield	--	--	240	430	1100
Lake Zoar at Riverside	--	--	32	52	78
Thames River at Mohegan	--	--	180	40	160
Peguabuck River at Farmington	--	--	0	50	740
Park River at Hartford	--	--	350	110	1000
Quinnipiac River at Meriden	--	--	200	0	270
" " " Wallingford	800	25	-	50	26
Naugatuck River at Ansonia	--	--	90	370	1600
Still River at Danbury	--	--	--	--	1300
" " " Brookfield	--	--	87	67	2400
Impoundment at Falls Village	--	--	--	--	5400

On June 24, 1977, State Health Commissioner, Dr. Douglas S. Lloyd made a general recommendation that fish taken from the Housatonic River not be eaten.

On July 5, 1977, State officials revised the June 24th blanket warning. Further analyses, according to Dr. Lloyd, revealed that, "PCB levels of trout caught in the Housatonic River north of the Rhote 341 bridge in Kent are high. We recommend that fish taken from that section of the river and north not be eaten.

"Based on sediment samplings for PCB content, the Housatonic River south of the bridge down through Lake Lillinonah are suspect and fish samples are being collected by the Fish and Water Life Unit of DEP for analysis by our Health Department Laboratory. Fish samples from Candlewood Lake at this time are at PCB levels indicating the fish are safe to eat. Right now, we have no reason to suspect high levels taken below Lake Lillinonah."

Continued monitoring during July and August, 1977 showed PCB contamination existing further downstream in the Housatonic than had previously been suspected. Results indicated that PCBs in the Lake Lillinonah stretch were at levels approximately equal to or exceeding the current federal safety standard of 5 ppm.

Commissioner Lloyd subsequently advised against consuming fish from the Lake Lillinonah area, stating that eight of the nine fish samples taken in the last month (July) were of "high" or questionable levels. These results sharply contrasted sampling results taken in the same area in 1976.

Connecticut's Dept. of Environmental Protection and the Dept. of Public Health were mutually concerned over the possibility of PCB contamination of fish within the Housatonic since the portion of the Housatonic flowing through Connecticut had been annually stocked with game fish.

The Connecticut State Health Laboratory performed a few PCB analyses on fish in 1975; began expanded surveillance in 1976; and became involved in an extensive monitoring program to determine the extent of PCB contamination within the Housatonic and surrounding waterbodies in February 1977. This monitoring program has lasted from February to November 1977 and will remain in progress for as long as necessitated.

The results of Connecticut's sampling efforts are shown in Table 13.

Connecticut's monitoring efforts were then extended downstream to the Lake Zoar region of the Housatonic. Results found fish with PCB levels as high as 26.0 ppm. Subsequently, a health advisory was issued on all fish taken in the Lower Housatonic to the Stevenson Dam at Lake Zoar. Figure 11 indicates the affected portions of the Housatonic.

Up to this point, Massachusetts had not acknowledged that a problem with PCBs in the Upper Housatonic also existed. This claim was based on the supposed fact that since Massachusetts did not stock the Upper Housatonic with game fish (as Connecticut did in the lower portion), no fishing occurred. Under increased pressure from environmental groups, EPA and the State of Connecticut, Massachusetts initiated a monitoring program in August to determine the level of PCBs in existence in the Upper Housatonic, and to locate sources of PCB contamination (besides G.E.) to the Housatonic.

FIGURE 11

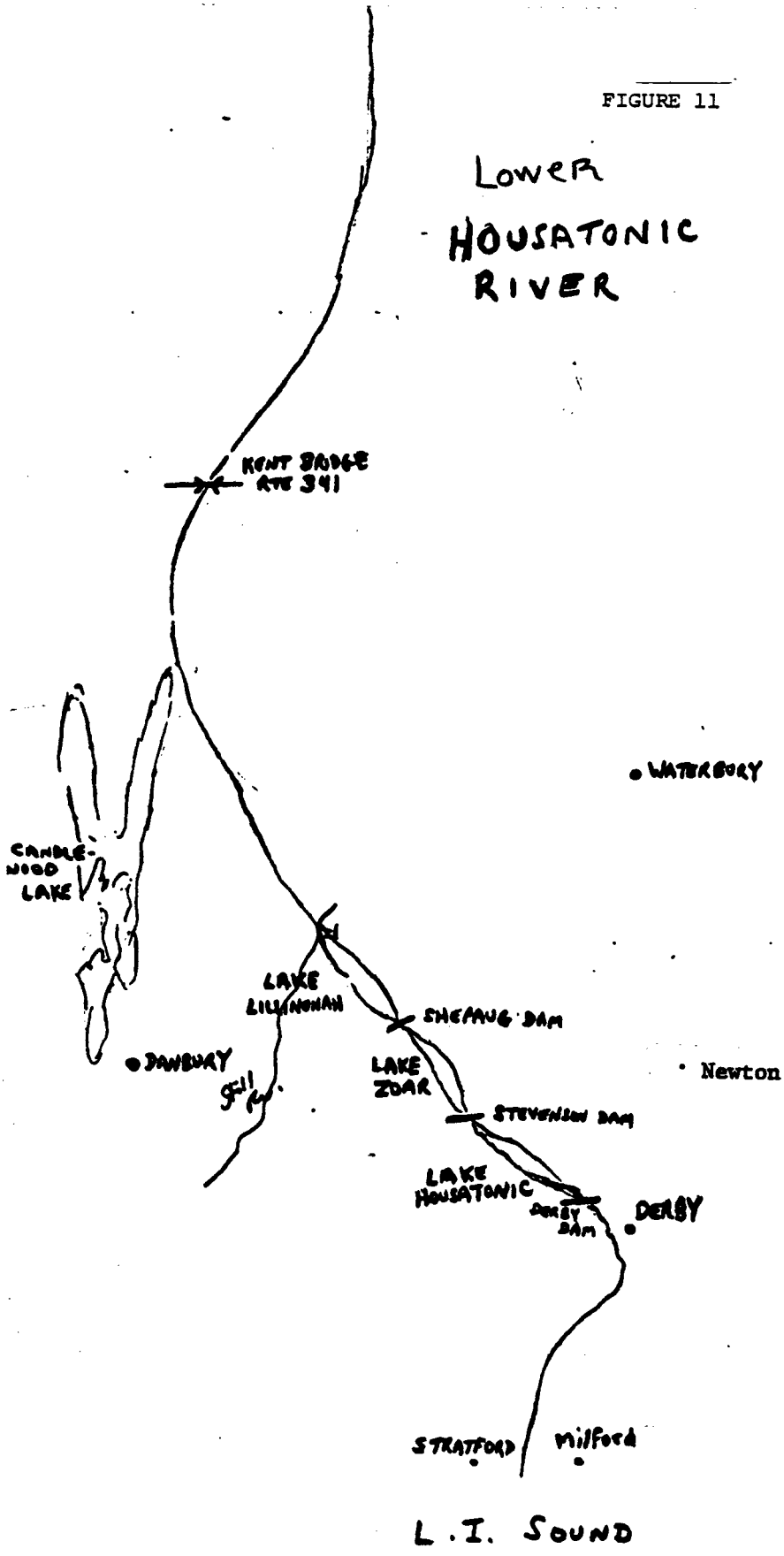

Lower
HOUSATONIC
RIVER
KENT BRIDGE
RTE 341
WATERBURY
CANDLE-
WOOD
LAKE
LAKE
LILLINONAH
DANBURY
LAKE
ZOAR
Newton
LAKE
HOUSATONIC
DERBY
DAM
DERBY
STRATFORD
Milford
L. I. SOUND

TABLE 13

Results of
PCB Monitoring Program
in
Connecticut
(Analysis Performed by Conn. Dept. of Health Laboratory)

Date Reported	Sample	Location	PCB content mg/kg (ppm)
9/75	striped bass	Saugatuck River	4.2
9/75	" "	Black Rock Harbor	5.7
12/75	" "	Niantic River	2.0
1/76	" "	Housatonic River	1.5
"	" "	" "	3.6
"	" "	" "	2.0
"	" "	" "	0.19
"	" "	" "	0.15
10/76	" "	" "	0.54
2/76	" "	Stamford Harbor	0.33
"	" "	" "	0.07
"	" "	" "	0.2
4/76	oysters	Darien Bed #1214	0.1
"	"	New Haven Bed $449	0.2
5/76	yellow perch	Lake Lillinonah	2.0
11/76	" "	" "	0.82
1976	" "	" "	0.41
"	" "	Connecticut River, Hartford	0.3
"	" "	Crystal Lake, Ellington	0.3
2/76	striped bass	Connecticut River	5.1
9/76	" "	" " , Saybrook	0.7
"	" "	" "	2.6
11/76	" "	Long Island Sound, Sheffield Is.	4.6
10/76	" "	Black Rock Harbor	0.69
"	" "	Shee Is., Norwalk	0.98
9/76	black bass	Connecticut River	4.8
11/76	weak fish	" "	4.4
"	" "	Long Island Sound, Branford	0.69
"	common sucker	Farmington River	0.12
"	white sucker	Quinnipiac River, Meriden	0.36
"	sucker	Housatonic River	38
"	white sucker	Lake Lillinonah	2.4
5/76	sucker	Composite of Lake Lillinonah and Quinnipiac River	5.6
12/76	clams	Stratford (natural beds)	0.2

Table 13 Continued

Date Reported	Sample	Location	PCB content mg/kg (ppm)
West Cornwall Area			
2/8/77	brook trout - 10"	Falls Village	0.3
"	yellow perch - 11"	" "	4.7
2/16/77	oysters	Westport - Bloom's #207	0.25
2/28/77	water	Watertown	*N.E. - Chlordan
"	"	Canterbury	" - Pest
3/11/77	"	N. Branford	" - Chlordan
3/31/77	"	Bloomfield	" - Pest
4/26/77	oysters	Branford/Stony Creek Bed #D	0.19
4/29/77	water	Waterbury	*N.E. - Pest
"	"	"	" "
"	"	Stamford	0.03 chlorda:
5/11/77	oysters	New Haven, State Shellfish Spawning Bed	0.60
5/11/77	"	New Haven Bed # 453	0.90
"	water	Mystic Valley	*N.E. - Pest
"	"	" "	" "
"	"	New Britain	0.001
"	"	Avon	*N.E. - Chlordan
5/27/77	striped bass	Thames River, Fort Shantock	2.7
"	" "	" " " "	1.5
"	" "	Niantic River	1.3
6/17/77	sm. mouth bass	Housatonic River	4.0
"	brown trout (holdover)	" "	13.8
"	brown trout (holdover)	" "	16.7
"	" " "	" "	13.8
Cornwall/West Cornwall Area			
6/24/77	brown trout (3 yrs)	Housatonic River	19.
"	" " "	" "	40.
"	" " "	" "	43.
"	" " "	" "	16.
"	" " "	" "	18.
"	" " "	" "	25.
"	" "	Burlington Hatchery	0.14
"	" "	" "	0.07 est.

Table 13 Continued

Date Reported	Sample	Location	PCB content mg/kg (ppm)
8/8/77	Brown trout	Cornwall/W. Cornwall	43.0
"	" "	" "	40.0
"	Rainbow trout	" "	26.0*
"	" "	" "	9.1*
"	Golden trout	" "	4.6*
"	Brown trout	" "	13.0*
"	Sediment	New Milford	0.094 ('76)
"	"	Lake Lillinonah	1.1 ('76)
"	yellow perch	" " (Bridgewater)	0.3
"	white catfish	" " "	11.0
"	white perch	Lake Lillinonah (Bridgewater)	6.3
"	" "	" " "	3.7
"	small mouth bass 7yrs	" " "	2.7 **
"	" " " 5yrs	" " "	5.8 **
"	" " " 7yrs	" " "	4.1
"	large mouth bass 6yrs	" " "	5.2
"	" " "	" " "	4.7
"	yellow perch	" " "	2.0 ('76)
"	" "	" " "	0.8 "
"	" "	" " "	0.4 "
"	white sucker	" " "	2.4
"	brown bullhead	Candlewood Lake	4.2
"	large mouth bass	" "	1.2
"	" " "	" "	1.1
"	yellow perch	" "	0.7
"	brown trout -3	" "	1.0 **
"	" " "	" "	0.7 **
"	" " "	" "	0.7 **
"	" " "	" "	0.5
"	sediment	Brookfield (Still River)	2.4 ('76)
"	"	Danbury " "	1.3 "
"	"	Lake Zoar (Oxford-Newtown)	0.08 "
"	catfish	" " -3 years	4.4
"	sediment	Monroe	0.004 "
"	"	Naugatuck River at Ansonia	1.6 "
"	"	Stratford	0.014 "
"	striped bass	Housatonic River at Sound	1.5 "
"	" "	" " " "	3.6 "
"	" "	" " " "	2.0 "
"	" "	" " " "	0.2 "
"	" "	" " " "	0.2 "
"	" "	" " " "	0.5 "
"	" "	Cornwall/West Cornwall	13.0*
"	rainbow trout	" " "	10.0*
"	brook trout	" " "	10.0*
"	" "	" " "	9.6*

*April, May and June stock - 1977

** F.D.A. Laboratory 7/29 - 8/5/77

Table 13 Continued

Date Reported	Sample	Location	PCB content mg/kg (ppm)
6/27/77	rock bass	Housatonic River (Falls Village)	1.0
"	" "	" " " "	1.0
"	large mouth bass	Candlewood Lake	1.8
"	yellow perch	" "	1.5
"	" "	" "	1.0
"	" "	" "	1.0
"	" "	" "	1.0
"	rock bass	Housatonic River (Falls Village)	1.5
"	" " 9 1/2"	" " " "	9.0
"	muds	" "	800 (ug/l)
"	"	" "	1200 "
"	"	" "	500 "
6/29/77	trout (11-13 mos. spent in river)	Cornwall	18.0 ppm
6/30/77	brown trout 11.4" (11-13 mos. spent in river)	Cornwall/West Cornwall	25.0
6/30/77	brown bullhead (fish fillet)	Candlewood Lake (New Milford)	4.2
7/7/77	large mouth bass (fish fillet)	Candlewood Lake (New Milford)	1.2
7/77	yellow perch (fish fillet)	" " " "	1.1
"	yellow perch	Lake Lillinonah (Housatonic Arm)	0.3
"	white catfish	" " " "	11.
"	white perch	" " " "	6.2
"	" "	" " " "	3.7
"	rainbow trout (stocked 1977)	Housatonic River	26.0
"	golden trout "	" "	4.6
"	brown trout "	" "	13.0
"	rainbow trout "	" "	9.1
8/8/77	sediment	Falls Village	5.4 ('76)
"	yellow perch	" "	4.7
"	brown trout	" "	0.3
"	sucker	" "	38.0
"	sediment	Canaan	0.076 ('76)
"	brown trout	Cornwall/West Cornwall	14.0
"	" "	" " "	17.0
"	" "	" " "	16.0
"	" "	" " "	18.0
"	" "	" " "	19.0
"	" "	" " "	25.0

Table 13 - Continued

Date Reported	Sample	Location	PCB Content mg/kg (ppm)
8/17/77	W. Catfish - 5yrs.	Lake Lillinonah	8.0
"	W. Perch - 6yrs.	" "	10.0
"	W. Perch - 5yrs.	Lake Zoar	4.3
"	Small mouth Bass - 4yrs.	" "	1.3
8/25/77	Small mouth Bass - 7yrs	Lake Lillinonah	9.8
"	" " " - 4yrs.	" "	3.0
"	White Catfish - 5yrs.	" "	4.3
"	" " "	" "	8.6
9/01/77	Yellow Perch - (8-10yrs.)	Lake Zoar	2.6
"	White Catfish - (6-9yrs.)	" "	26.0
"	White Perch - 5yrs.	" "	6.4
9/15/77	Black Crappie (3-4yrs.)	" "	0.66
"	Smallmouth Bass (3-4yrs.)	" "	2.7
"	Largemouth Bass - 4yrs.	" "	2.0
9/16/77	Yellow Perch	" "	0.4
9/16/77	White Perch	" "	8.2
9/27/77	" "	" "	3.6

Table 13 - Continued

Date Reported	Sample	Location	PCB Content mg/kg (ppm)
10/11/77	Yellow Perch - 4yr.	" "	0.9
"	White Catfish (3-5yrs.)	" "	4.7
"	White Perch - 5yrs.	" "	7.0
10/24/77	Carp - (4-6yrs.)	" "	10.4
"	White Catfish (3-5yrs.)	" "	4.4
"	" " (5-7yrs.)	" "	5.5

TABLE 14

Table 14

Massachusetts PCB Monitoring Program

Results

(Analyses Performed by Lawerence Experimental Station)

Sample Date	Sample	Station Number	Location	PCB Content mg/kg (ppm)
9/9/77	water	1	Orchard Road, Dalton	.00016 (.16ppb)
6/77	water	2	Center Pond, Dalton	∠.001
8/26/77	sediment	2	Center Pond Dalton	0.05
9/9/77	sediment	2	Center Pond Dalton	0.1
9/9/77	water	2	Center Pond, Dalton	.00019 (.19ppb)
6/77	water	3	Hubbard Ave., Pittsfield -above landfill	.001
6/77	sediment	3	Hubbard Ave., Pittsfield -above landfill	0.15
*8/26/75	water	3	Hubbard Ave., Pittsfield -above landfill	∠.00003 (.03ppb)
*8/29/75	Fish	3	Hubbard Ave., Pittsfield -above landfill	0.28
9/9/77	water	3	Hubbard Ave., Pittsfield -above landfill	.00034 (.34ppb)
9/9/77	sediments	3	Hubbard Ave., Pittsfield -above landfill	0.56
*8/29/75	Fish	4	East Street, Pittsfield -below landfill	17.4ppm
4/77	Fish	4	East Street, Pittsfield -below landfill	9.5
4/77	Fish	4	East Street, Pittsfield -below landfill	1.5

Table 14 Continued

Sample Date	Sample	Station Number	Location	PCB Content mg/kg (ppm)
4/77	Fish	4	East Street, Pittsfield -below landfill	7.7
4/77	Fish	4	East Street, Pittsfield -below landfill	0.9
6/77	water	4	East Street, Pittsfield -below landfill	.001
6/77	sediment	4	"	0.13
6/77	sediment	4	"	0.37
9/9/77	water	4	"	.00016 (.16ppb)
9/9/77	sediment	4	"	0.08
3/15/77	water	6	East Street, Pittsfield -Test Well	.035
4/19/77	water	6	"	.002
9/9/77	water	7	Newall Street, -above G.E. outfalls	.00052 (.52ppb)
9/9/77	sediment	7	"	0.18

Table 14 Continued

Sample Date	Sample	Station	Location	PCB Content mg/kg (ppm)
*8/26/75	sediment	9	Elm Street, Pittsfield-Below G.E.	139
*8/26/75	water	9	"	.00042 (.42ppb)
6/77	water	9	"	.004
6/77	sediment	9	"	.174
9/9/77	water	9	"	.00064 (.64ppb)
9/9/77	sediment	9	"	12.7
9/9/77	water	10	South Street, Pittsfield-West Branch	.00044 (.44ppb)
9/9/77	sediment	10	"	0.14
*8/26/75	water	11	Holmes Road,-Above Pittsfield STP	.00006 (.06ppb)
*8/26/75	sediment	11	"	26.3
*8/26/75	sediment	11	"	53.9
9/9/77	water	11	"	.00097 (.97ppb)
9/9/77	sediment	11	"	.084
*8/26/75	water	13	New Lenox RD., Lenox-Below Pittsfield STP	.00006 (.06ppb)
*8/26/75	sediment	13	"	1.4
9/9/77	water	13	"	.00076 (.76ppb)
9/9/77	sediment	13	"	40.2
*8/29/75	Fish	14	Woods Pond, Lenox	34.0
*8/29/75	sediment	14	"	134.0
6/77	water	14	"	.004
6/77	sediment	14	"	0.30
9/9/77	water	14	"	.0011
9/9/77	sediment	14	"	1.2
9/13/77	Fish (carp)	14	"	13.5
9/13/77	Fish (carp)	14	"	6.1
9/13/77	Frogs	14	"	11.5

Table 14 Continued

Sample Date	Sample	Station No.	Location	PCB Content mg/kg (ppm)
3/9/77	water #3	15	Schweitzer Wells-proposed water supply	0.5
3/9/77	water #4	15	"	0.9
5/16/77	water #2	15	"	0.0
5/16/77	water #3	15	"	0.0
5/16/77	water #4	15	"	0.0
8/26/77	water #2	15	"	.0048
8/26/77	water #3	15	"	.002
8/26/77	water #4	15	"	.0027
9/9/77	water #3	15	"	.00031 (.31ppb)
9/9/77	water	16	Risingdale Dam, Great Barrington	.00016 (.16ppb)
9/9/77	sediment	16	"	0.21
9/13/77	Fish (carp)	16	"	3.5
9/13/77	Fish (Bass)	16	"	6.9
9/13/77	Fish (pumpkin-seed)	16	"	13.3
9/13/77	Fish (catfish)	16	"	33.6
9/13/77	Fish (catfish)	16	"	29.0
9/13/77	Fish (pumpkin-seed)	16	"	2.3
9/13/77	Fish (carp)	16	"	64.4
9/13/77	Fish (carp)	16	"	12.3
9/13/77	Fish (shiner)	16	"	10.4
9/13/77	Fish (Perch)	16	"	32.5
9/13/77	Fish (Perch)	16	"	3.0

Table 14 Continued

Sample Date	Sample	Station No.	Location	PCB Content mg/kg (ppm)
9/13/77	Fish(Perch)	16	"	31.3
9/13/77	Fish(Carp)	16	"	3.9
9/9/77	water	17	Andrus Road, Sheffield	.0002 (.20ppb)
9/9/77	sediment	17	"	0.28
9/13/77	Fish(carp)	17	"	19.9
9/13/77	Fish(Sucker)	17	"	4.7
9/13/77	Fish(Perch)	17	"	3.5

Note:

* Sampling and Analysis performed by EPA - Region I

Results of this survey (see Table 14) were released in October and evidenced the presence of high levels of PCBs in water, fish and frogs which had been taken out of the Housatonic from the DaltonPittsfield line along the East Branch and the mainstem of the river to the Connecticut border. PCB levels were as high as 64.0ppm in carp taken in Great Barrington; 11.5 ppm in frogs from Woods Pond, Lenox; and sediment samples were found to contain as much as 134 ppm of PCB.

Contrary to previous claims, it was discovered that this portion of the Housatonic is utilized for fishing and frogging (frogs are also sold). As a result, on October 28, 1977, Public Health Commissioner, Dr. Jonathan Fielding, issued a health warning regarding the consumption of fish or frogs from the affected area. The warning does not apply to the river's west branch. Commissioner Fielding requested that fish and frogs taken from the Housatonic not be eaten but returned to the river unharmed. Warnings were also posted along the affected length of the river by the State.

Connecticut health officials on the same day issued a similar warning extending from the Massachusetts border south to Newtown, Connecticut.

On the basis of the results found in the State's study, it was felt that the PCBs measured and found to be evident in water and fish from the Housatonic were principally the result of release from sediments which had accumulated PCBs discharged (from G.E.) into the river. Results also indicated that PCBs may have also been leached from landfills in which PCBcontaining materials had been disposed of over a long period of time. Two paper mills sampled also evidenced results warranting concern. PCB levels determined at the Schweltzer Mills (Station #15) and the Rising Mills (Station #16) implicate them as sites of PCB contamination and as being or having been direct sources of PCB to the Housatonic.

Aside from the Federal and State run and supported PCB studies of the Housatonic, a study of PCBs in the Housatonic was conducted by several University of Massachusetts students under a grant from the Institute for Man and Environment. These students sampled and analyzed fish and sediment of the Housatonic in the Spring of 1976. Sediment samples were procured upstream of G.E. (#1), just below the G.E. plant (#5), three miles downstream (#8), and ten miles downstream of G.E. at Wood's Pond (#9, #11). All fish samples were taken from Wood's Pond and consisted of: four goldfish genus Carassius, one sunfish genus Lepomis, and two catfish. These fish were considered to be representative of the area by the researchers for the following reasons:

1. All fish are restricted from further downstream migration by the Wood's Pond Dam;

2. Any migration above G.E. which may have occured would be restricted by a second dam in Pittsfield; and

3. The fish sampled were all quiet water species and it was thus assumed that they had spent their entire lives in the pond.

In May 1977, the results of this study were released in a report entitled, "Quantitative Determination of Polychlorinated Biphenyl Contamination of the Housatonic River, Berkshire County, Mass.".

Sample	Amount PCB	Sample Weight	Concentration (ppm)
Catfish #1	.2579 ng	5 g	12.80 ppm
Goldfish #7	.3416 ng	2 g	17.08 ppm
Goldfish #6	1.4360 ng	5 g	28.72 ppm
Sunfish #3	.2765 ng	2 g	13.83 ppm
Sediment #1	.4144 ng	30 g	1.38 ppm
Sediment #5	2.9474 ng	30 g	9.82 ppm
Sediment #11	1.0934 ng	30 g	3.64 ppm
Sediment #9	1.3969 ng	30 g	4.65 ppm

The authors made the following interpretations of the data they obtained:

"First, the existence of PCBs in the soil and the biota of the Housatonic River in appreciable quantity; second, the bioaccumulation expected by the researchers at the outset of the project seems to be in evidence; third, a significant increase in PCB after the G.E. effluent pipes in Pittsfield indicates that to a large extent, Pittsfield appears to be a major source of PCB contamination. It should be noted that the results of this analysis are quite comparable to EPA studies done on the Housatonic in 1976."

January 1976, EPA Region I analyzed several water supplies in the Pittsfield vicinity for PCB content. These supplies were monitored for PCBs as part of Region I's surveillance of selected water supplies within New

England. Samples of raw water were analyzed for PCB content from the following supplies: Cleveland Reservoir, Fainham Reservoir, Upper Sackell and Ashley Lake. Analysis results detected less than 0.05 ppb (ug/l) of PCB (detection limit for the analysis) within the waters tested.

The most recent data on PCBs is the result of a monitoring program initiated by the Massachusetts Dept. of Environmental Quality Engineering. DEQE performed analysis for PCB content on potential water supplies and groundwater samples in the Pittsfield vicinity near the Housatonic River. A test well located on East Street (Station #6) in Pittsfield, which on 3/15/77 was found to contain .035 mg/l and on 4/19/77 evidenced .002 mg/l, failed to indicate the presence of PCBs when sampled on 10/25/77. Groundwater samples were collected on 11/1/77 and 11/18/77 with the following results:

Sample	Station No.	Sample Date	PCB content ug/l(ppb) as Aroclor 1254
Sheffield, Town Hall	21	11/1/77	0.02
Glendale, Tinker Well	20	11/1/77	None detected
South Lee, Drake Well	19	11/1/77	None detected
Lenox, Blake Well	18	11/1/77	0.06
Great Barrington, Hans Restaurant	21	11/18/77	None detected
Sheffield, Riiska Well	22	11/18/77	None detected

The State's plans for future monitoring of the Houatonic and water supplies in the vicinity thereof is expected to continue on a seasonal basis.

The State is currently attempting to develop a working knowledge of procedures and methods employed to remove PCB contamination from soils and sediments so that an abatement strategy can be developed. EPA Region I is working with the State towards this end.

A P P E N D I X

Massachusetts

CONTENTS

APPENDIX MA-1

ENVIRONMENTAL ASSESSMENT OF POLYCHLORINATED BIPHENYLS (PCBs)

NEAR NEW BEDFORD, MA

MUNICIPAL LANDFILL

Final Task Report
Research Request No. 4
Contract No. 68-01-3248

by

Charles L. Stratton, Karen L. Tuttle, and J. Mark Allan

ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
P. O. Box 13454, University Station
Gainesville, Florida 32604

Project Officer
Thomas Kopp

OFFICE OF TOXIC SUBSTANCES
ENVIRONMENTAL PROTECTION AGENCY
Washington, D.C. 20460

May, 1978

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENT

This environmental assessment was conducted in cooperation with personnel of the Environmental Protection Agency, Region I; in particular, Mr. David K. Moon, Dr. Thomas Spiller, Dr. Edward L. Taylor, and Mr. Allan Oi. The sampling program was planned with the assistance of Dr. Ian C.T. Nisbet of Clement Associates. Dr. Olin C. Braids of Geraghty & Miller, Inc., assisted with the groundwater sampling.

SECTION 1

INTRODUCTION

Environmental Science and Engineering, Inc. (ESE) was requested to conduct an evaluation of the transport of polychlorinated biphenyl (PCB) from a municipal landfill located in New Bedford, Massachusetts. This task was performed under Contract 68-01-3248 with the Environmental Protection Agency (EPA), Office of Toxic Substances.

The objectives of this task were to:

1. Establish if there is migration of PCB from the landfill, and if migration exists;

2. Determine the extent and degree of environmental contamination with PCB originating at the landfill;

3. Determine the mode, rate, and direction of PCB migration from the landfill; and

4. Establish a long-term groundwater monitoring program for PCB.

It was decided to approach this task in two phases. The objective of the first phase was to establish if there is migration of PCB from the landfill. This involved a one-time field survey wherein samples were collected from all media in the vicinity of the landfill that may serve as PCB transport media. An excess number of samples were taken. PCB analysis was conducted on selected samples suspected to be the most likely to be contaminated by PCB

originating at the landfill. The results of this survey are described in this report. A second phase field survey was confined to the assessment of airborne PCB levels in the vicinity of the landfill and near three other potential sources of PCB in the area. The results of the second survey are also described.

SECTION 2

DESCRIPTION OF THE SITE

The New Bedford municipal landfill has been the site for the disposal of reject capacitors and other wastes from two nearby capacitor manufacturing plants, Aerovox Industries, Inc., and Cornell-Dubilier Electronic Corporation. Over one-half million pounds of PCB have been disposed in this landfill over the years. PCB wastes have not been disposed of for the past two years. In the past, Aroclor® 1242 was reported to be the predominant PCB material used at these facilities. Since 1970, Aroclor 1016 has been used.

The landfill is located one-half mile from the Paskamanset River near the southern end of a large glacial lake deposit that extends from the Apponagansett Swamp to the northern limit of the Acushnet Cedar Swamp. Figure 1 shows the location of the landfill near the New Bedford Airport and Interstate 195.

This landfill has been in use for 56 years. It covers an area of 40 acres, 24 of which are filled with refuse covered with fill material. The geology of the area consists of a layer of freshwater peat varying from 7 to 10 feet thick, underlain by a thin layer of silty fine sand, and then layers of stratified silts and clayey silts with thin layers of silty clay. The sand and silt layers vary from 8 to 36 feet deep.

Groundwater, leachate, and soil samples were taken adjacent to the New Bedford municipal landfill as part of a regional PCB waste survey conducted by EPA Region I ("New England PCB Waste Management Study," EPA Region I, November, 1976). The results of the sampling effort indicated a trace (1 ug/l) of PCB in one of four shallow groundwater samples taken at the edge

AND SURROUNDINGS

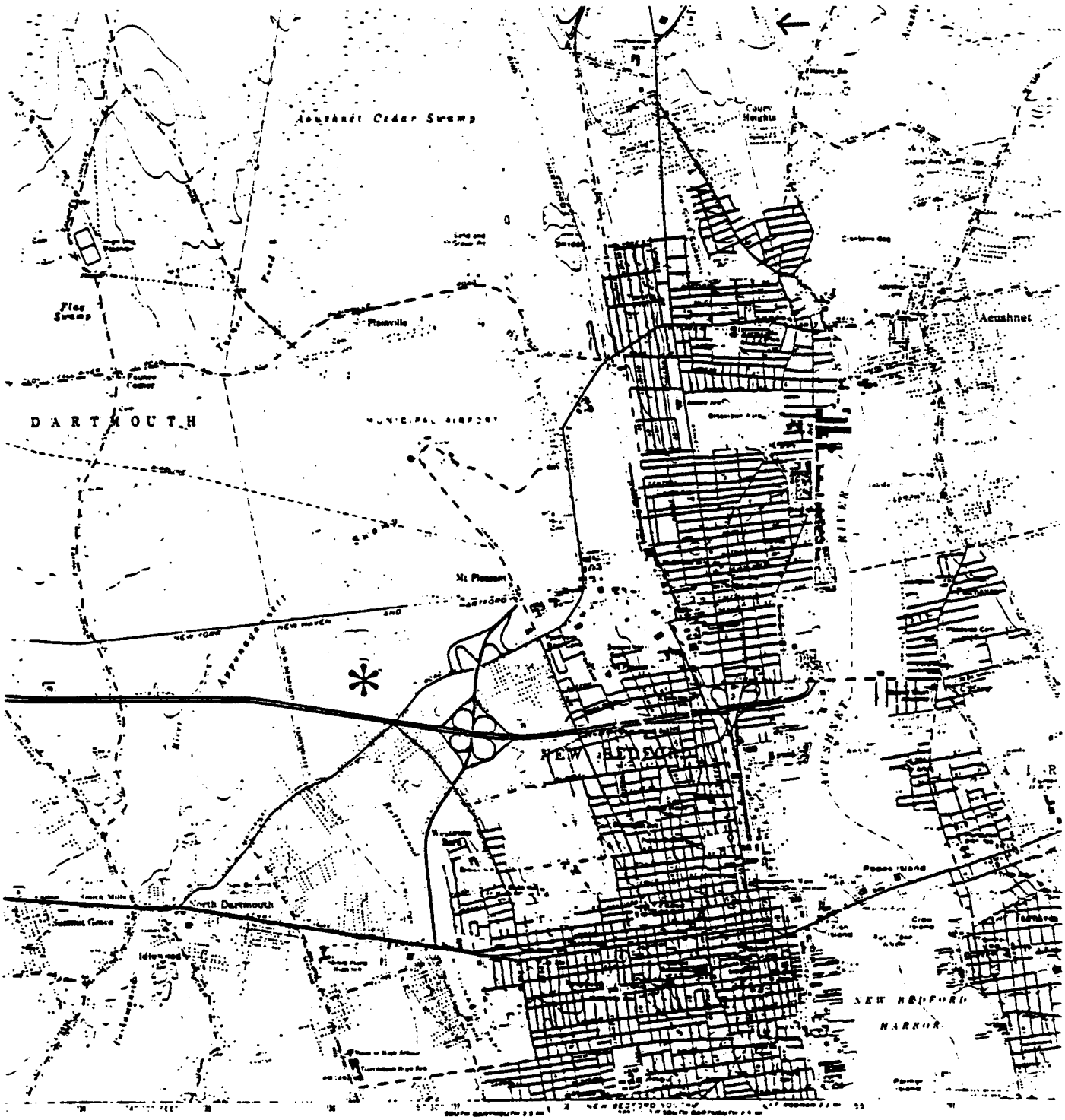


FIGURE 1

of the landfill. A sample of surface leachate contained 10 ug/l of Aroclor 1016, and a surface soil sample contained 5.8 ppm Aroclor 1016 and 1.7 ppm Aroclor 1254. Other soil samples did not contain detectable levels of PCB. These results indicated that transport of PCB from the landfill may be occurring.

SECTION 3

FIELD SURVEY AND SAMPLING

The first field survey was conducted on June 28 through 30, 1977. The objective of this field survey was to collect samples representative of all possible modes of PCB transport from the landfill, as illustrated in Figure 2. Principal emphasis was placed on the potential for contamination of groundwater and drinking water supplies.

Samples were taken of ground water, landfill leachate, surface water, sediments, soil, air, vegetation, and aquatic and terrestrial biota in the vicinity of the landfill, Apponagansett Swamp, and the Paskamanset River. Samples taken and locations are described below.

Ground Waters

Fourteen well points were hand-driven to various depths around the edge of the landfill at the locations shown in Figure 3, which is an aerial photograph of the landfill. Conductivity readings were taken at each of these sites. Well depth and conductivity are listed in Table 1. The conductivity studies show that at locations where two or more points were driven to different depths, the wells with the shallowest depth have the highest conductivities. This indicates that the leachate plume is shallow. Wells 3, 4, and 5 were grouped together and show this trend. Wells 7, 8, and 9 also show this same trend.

POSSIBLE AVENUES FOR PCB TO RE-ENTER THE ENVIRONMENT FROM LANDFILL DISPOSAL SITE

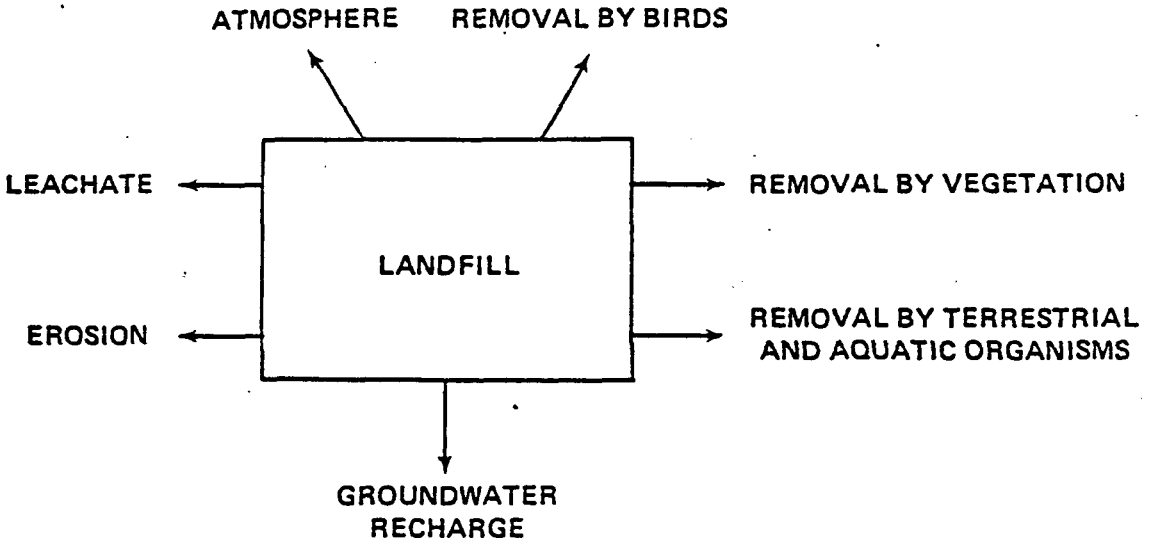


FIGURE 2


N
11
6
10
9
4
8
14
5
3
7
PVC TEST WELL
13
12
2
1
SURFACE WATER SAMPLING POINTS
GROUNDWATER SAMPLING POINTS

FIGURE 3

TABLE 1. WELL TEST DATA

Well No.	Conductivity (umhos/cm)	Depth (m)	Depth (ft)	Sulfate (mg/l)	Chloride (mg/l)	Iron (mg/l)	Total Organic Carbon (mg/l)
1	517	3.7	12.0	31	84	3.56	1.0
2	221	3.0	10.0				
3	159	4.7	15.5	<5	13	5.26	14
4	258	3.4	11.0				
5	498	2.1	6.5			3.37	
6	234	1.8	6.0				
7	246	6.4	21.0	<5	24	3.14	16
8	923	3.5	11.5				
9	1,058	2.1	6.5	9.2	149	7.80	48
10	394	3.4	11.0				
11	357	3.2	10.5				
12	1,525	1.8	6.0	35	296	4.88	2.7
13	301	1.8	6.0				
14	923	4.9	16.0				

Soils

Difficulty was encountered in taking the soil core samples, since the terrain around the well points was too wet to sample deeper than 18 inches. Two core fractions were taken in the vicinity of Wells 7 and 9. Surface soil samples were taken at Wells 1, 3, 4, and 12.

Drinking Water

Eighteen liters of water were collected at both Well A and Well B of the Dartmouth Municipal Water Works. In addition, a sample was taken from a private drinking water supply in the vicinity of Station 8 (see Figure 4). This residence (23 Tolland Path) has a deep artesian well (approximately 200 feet deep), and water was taken from an outside spigot for subsequent PCB analysis. These large volumes of water permitted PCB detection in the ppt (parts per trillion or nanograms per liter) level.

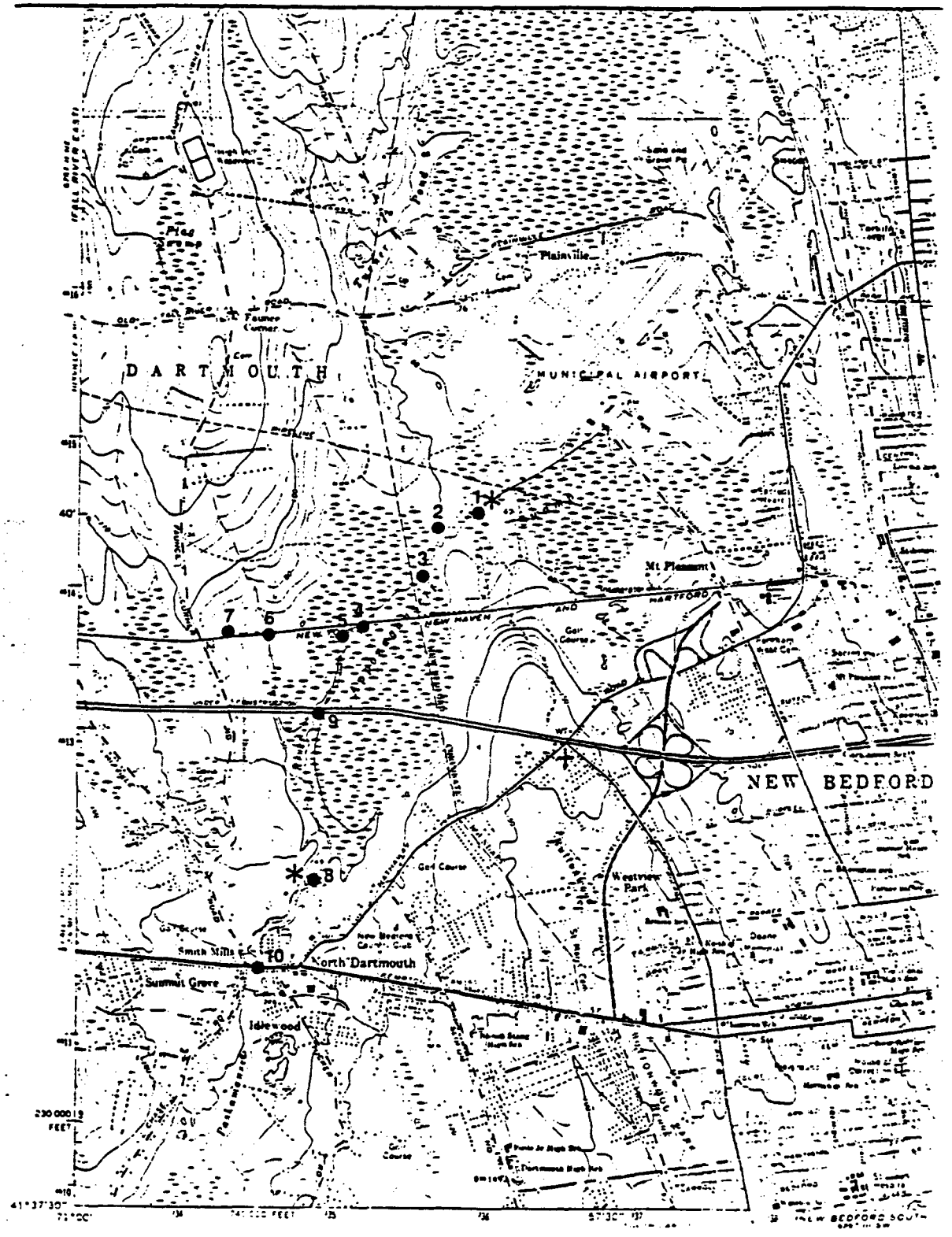
Surface Water and Sediments

The Paskamanset River was sampled at ten different locations (see Figure 4). Conductivity and pH were determined in situ, and the samples listed in Table 2 were collected.

Two additional bottom sediment samples were taken from the stream, one approximately 4 miles downstream from the landfill in the vicinity of the Dartmouth Municipal Water Supply (not shown on map) and one near I-195 next to the Holiday Inn (see Figure 4).

The Apponagansett Swamp was sampled at seven different locations, as illustrated in Figure 5. Conductivity and pH were determined in situ, and samples were taken of water, emergent vegetation, and benthic organisms as described in Table 3. It appears from the conductivity data that if landfill leachate is entering the marsh, it is entering from the north and west sections of the landfill.

STREAM SAMPLING STATIONS



● STREAM SAMPLING STATIONS

✱ FISH SAMPLING POINTS

+ BOTTOM SEDIMENT

FIGURE 4

MARSH SAMPLING STATIONS

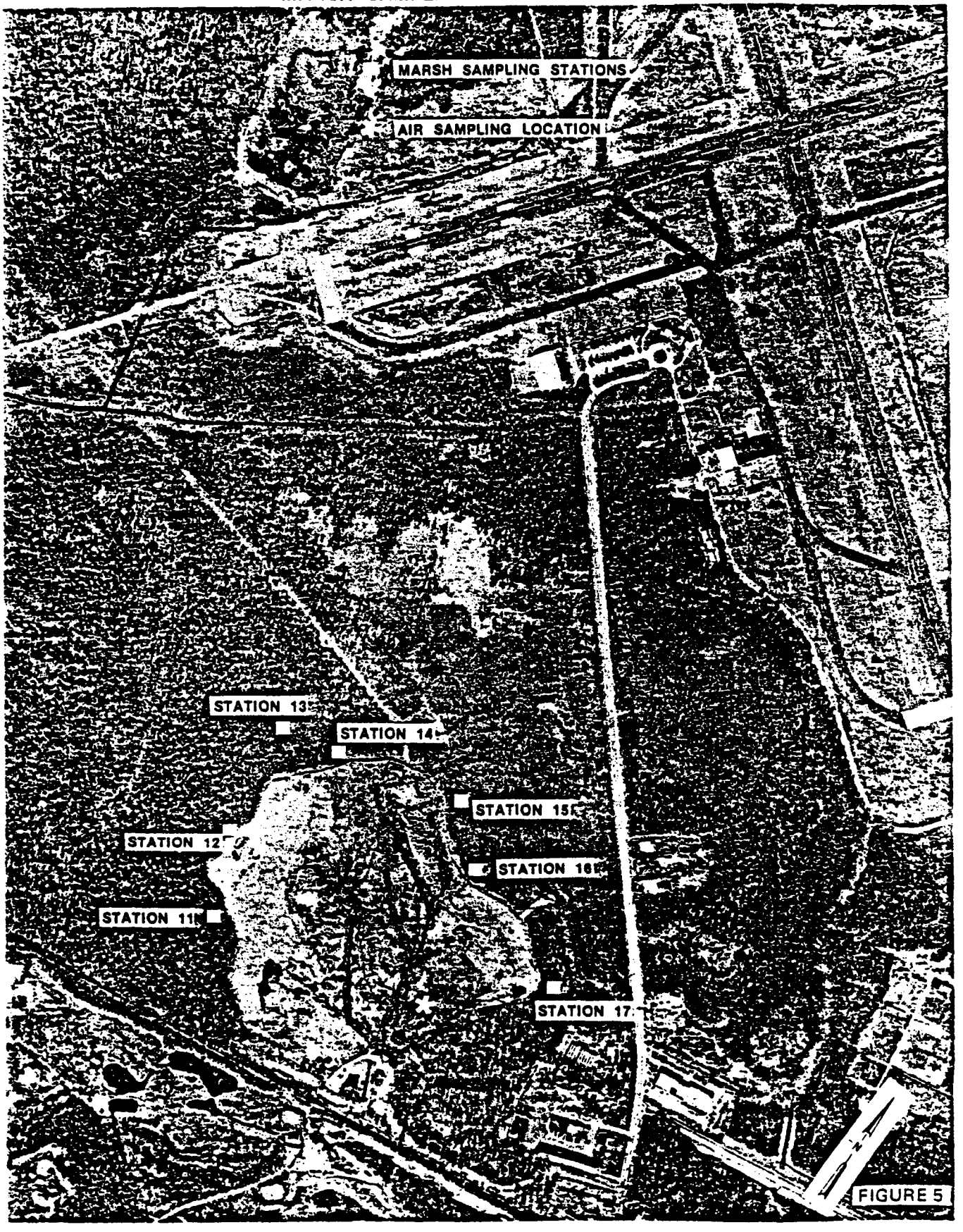


FIGURE 5

TABLE 2. STREAM SAMPLING STATIONS

Station No.	pH	Conductivity (umhos/cm)	Benthos	Bottom Sediment	Water	Fish
1	7.4	170	X	X	X*	X
2	5.9	72	X	X	X	
3	6.9	104	X	X	X	
4	5.5	68	X		X	
5	5.9	80		X	X	
6	5.3	38		X	X	
7	6.1	90		X	X	
8	6.3	89		X	X*	X
9			X			
10			X			

*18-liter sample collected.

TABLE 3. MARSH SAMPLING STATIONS

Station No.	pH	Conductivity (umhos/cm)	Benthos	Vegetation	Water
11	7.2	524	X	X	X
12	7.1	552	X	X	X
13	6.9	2,852	X	X	X
14	7.2	1,748	X	X	X
15	7.1	2,070		X	X
16	6.6	2,208		X	X
17	7.1	1,380	X	X	X

Vegetation

Vegetation was collected at each of the seven marsh stations as indicated in Table 3. The dominant type of vegetation was collected at each location.

Aquatic Biota

Benthic organism samples were collected at the stream and marsh stations where noted in Tables 2 and 3. Approximately 15 fish were collected at Station 8 (Figure 4), most of which were 4 inches or less in length and of mixed varieties. Pumpkinseed (Lepomis gibbosus) was the predominant variety. Only one fish was collected at Station 1.

Terrestrial Biota

A total of 150 snap traps was set along 5 transect lines, as shown in Figure 6. Ten trap stations 10 meters apart were situated along each transect with 3 snap traps at each station. A total of 29 organisms consisting of 2 different species of mice were collected. Six were collected from the transects along the pipeline, and the remaining 23 were collected from the transects along the golf course road. The field mice captured were of the Peromyscus sp. This species is omnivorous, eating grains, fruits, insects, and other small organisms. Life expectancy is less than one year.

Twenty eggs of the herring gull (Larus argentatus) were collected at Ram Island, Mattapoisett, Massachusetts, on June 20, 1977, by Dr. I.C.T. Nisbet. One egg was collected from each of 20 nests. Because of the late date of collection, most of the eggs had been incubated 2 to 3 weeks. Ram Island is the nearest gull colony to the New Bedford landfill (about 7 kilometers), and most, although probably not all, herring gulls from this colony feed at the landfill. They also feed on fish wastes from the port and on natural foods along the shore.

TERRESTRIAL TRAP LOCATIONS

TERRESTRIAL TRAP LINES

N

FIGURE 6

Air

All air samples were taken by the method of high-volume sampling at the landfill site during the period June 28 through 30, 1977. Duplicate 30-, 60-, 180-, and 360-minute samples were taken. One 15-minute sample was taken. The location of the air sampler is shown in Figure 5. Wind velocity during sampling is reported in Table 4.

TABLE 4. AIR SAMPLES TAKEN JUNE 28 THROUGH 30, 1977*

	Wind Direction	Velocity
15-minute sample	WSW	10 to 15 mph
30-minute sample	WSW	10 mph
60-minute sample	WSW	10 mph
180-minute sample	WSW	10 to 15 mph
360-minute sample	NW	12 to 15 mph

*Ambient temperature 26°C.

Additional air samples were taken in conjunction with EPA Region I personnel during January, 1978. Samples were taken upwind, on site, and downwind of the landfill and upwind and downwind of three other potential sources of airborne PCB in the area, including the municipal sewage sludge incinerator, Aerovox Corporation, and Cornell-Dubilier Electronics Corporation facilities. All of these samples were of 3 hours duration, comprising approximately 175 cubic meters of air. During this sampling period, the ground was frozen and a light snow cover was present. Ambient temperature was 0°C.

SECTION 4

ANALYTICAL RESULTS AND DISCUSSION

Ground Waters

All shallow groundwater samples taken along the periphery of the landfill were analyzed for PCB. In addition, samples collected from Well A and Well B of the Dartmouth Municipal Water Works and the sample taken from a private artesian well (23 Tolland Path) were analyzed for PCB. These analytical results are reported in Table 5. Figure 3 shows the location of the shallow groundwater samples.

TABLE 5. GROUND WATER

Test Well No.	Well Depth (m)	Aroclor 1016/1242 (ng/l)*	Aroclor 1254 (ng/l)*
1	3.7	<85	<110
3	4.7	<85	<110
5	2.1	<85	<110
7	6.4	90	150
9	2.1	230	530
12	1.8	<85	<110
Dartmouth Well A	—	<3	<1
Dartmouth Well B	—	<3	<1
Private Artesian Well	61	<3	<1

*Parts per trillion (ppt).

Aroclor 1016/1242 and Aroclor 1254 were detected in the two shallow groundwater samples taken on the north edge of the landfill between the landfill and the Paskamanset River. All other results, including those for the artesian aquifer (drinking water), were below the respective analytical detection limits.

Figure 7 is a chromatogram of the water sample taken from Test Well 9. Figure 8 shows chromatograms of Aroclor 1016/1242, and Figure 9 a chromatogram of Aroclor 1254. It can be seen that the well water sample (Figure 7) contains all the major peaks of Aroclor 1254, except the two latest eluting, and many earlier peaks matching Aroclors 1016 and 1242. It is not possible when Aroclor 1254 is present to definitively identify the earlier pattern as either Aroclor 1016 or 1242, since the elution patterns for these two Aroclors differ only with respect to the last few eluting peaks which coincide with Aroclor 1254 peaks.

The groundwater analytical results indicate no artesian aquifer (drinking water) contamination with PCB. There is PCB contamination of the shallow ground water to the immediate north of the landfill. This contamination consists of Aroclor 1016/1242 and Aroclor 1254, and seems to be highest toward the surface with decreasing concentrations with depth. The maximum PCB concentration measured was 0.76 ug/l. There is no apparent correlation of PCB concentration to conductivity or any of the other parameters (Fe, TOC, $SO_4^{=}$, Cl^{-}) measured in the shallow ground waters. PCB does not appear in shallow ground waters to the west, northwest, and east of the landfill.

Soil Borings

Soil core samples taken at Test Well 9 were analyzed in two sections. The results are shown in Table 6 along with a surface soil sample taken near Test Well 3. Figure 10 is the chromatogram of the 0- to 15-cm core at Test Well 9 showing that both Aroclor 1016/1242 and Aroclor 1254 are present.

The decreasing PCB concentration with core depth agrees with the same observation for the water taken from Test Wells 7 and 9. In these soil

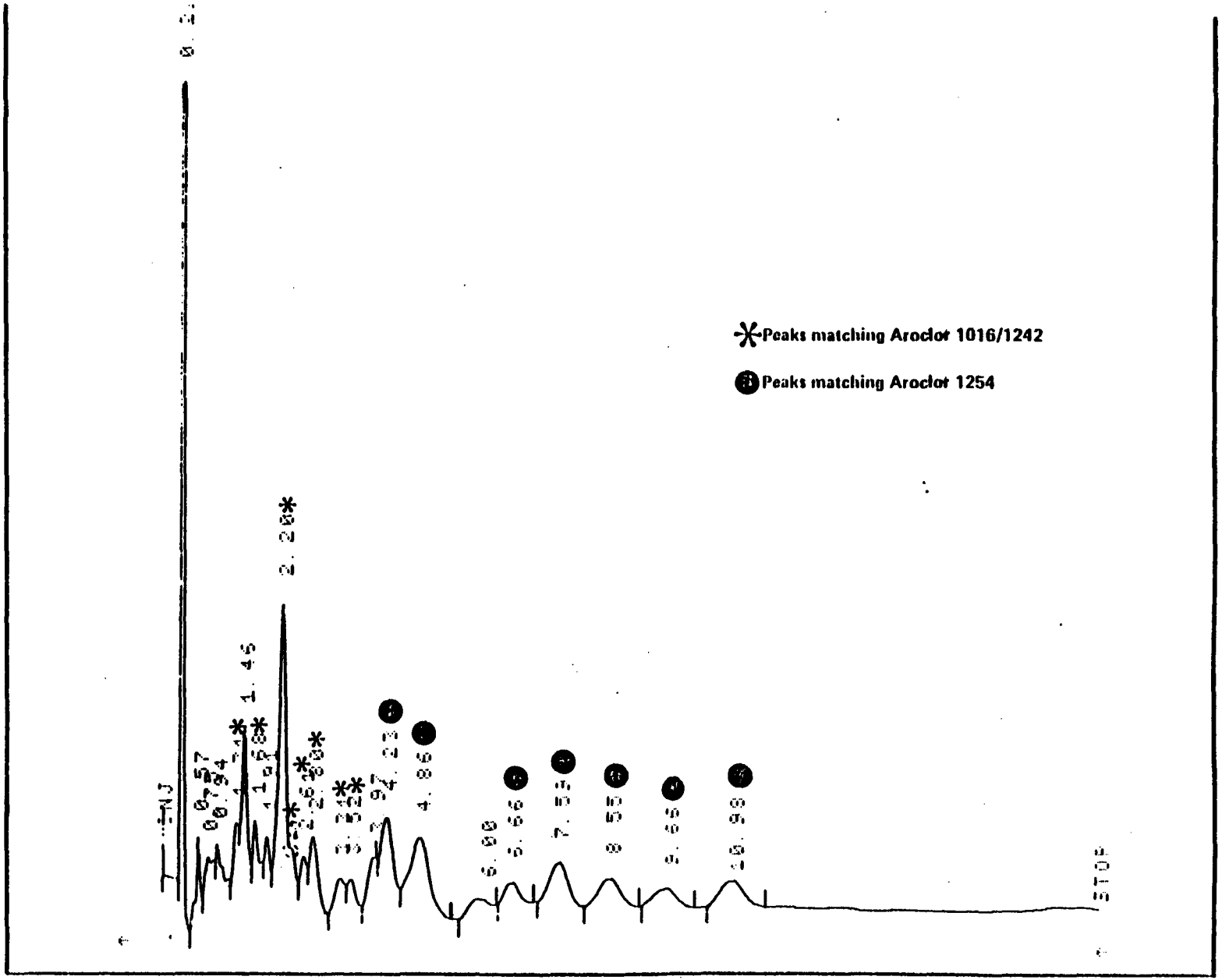


FIGURE 7

CHROMATOGRAM OF SHALLOW GROUNDWATER
SAMPLE FROM TEST WELL NO. 9

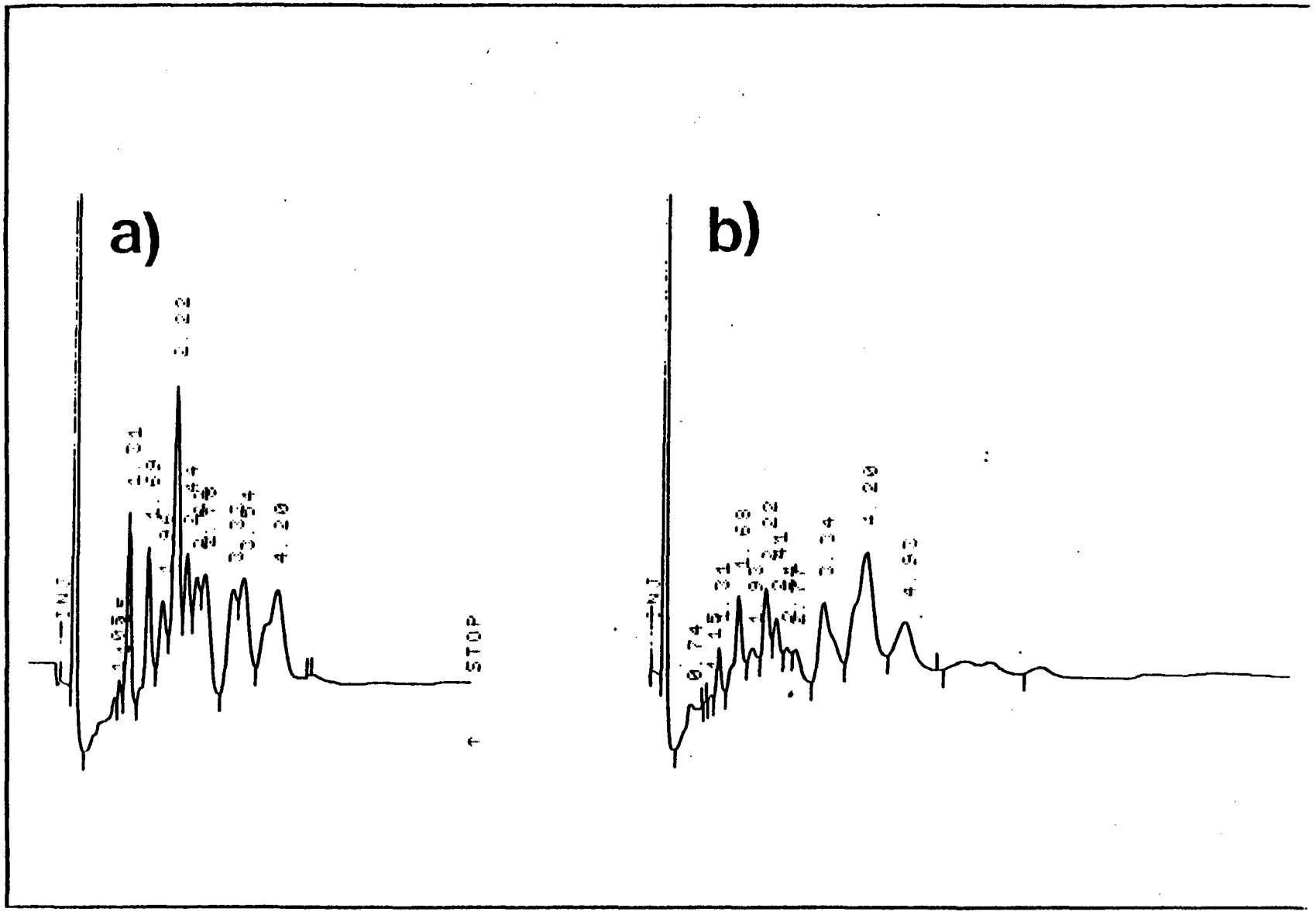
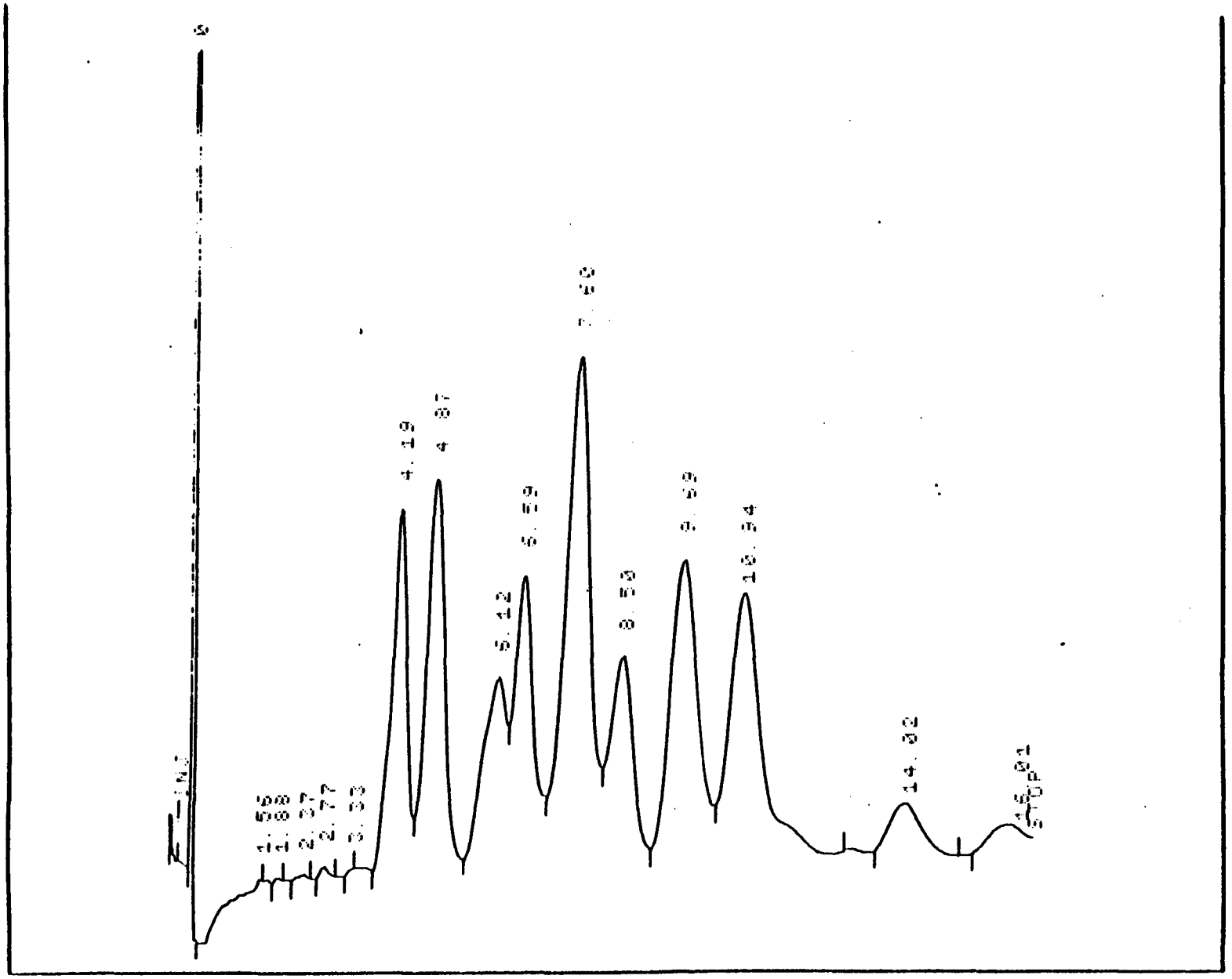


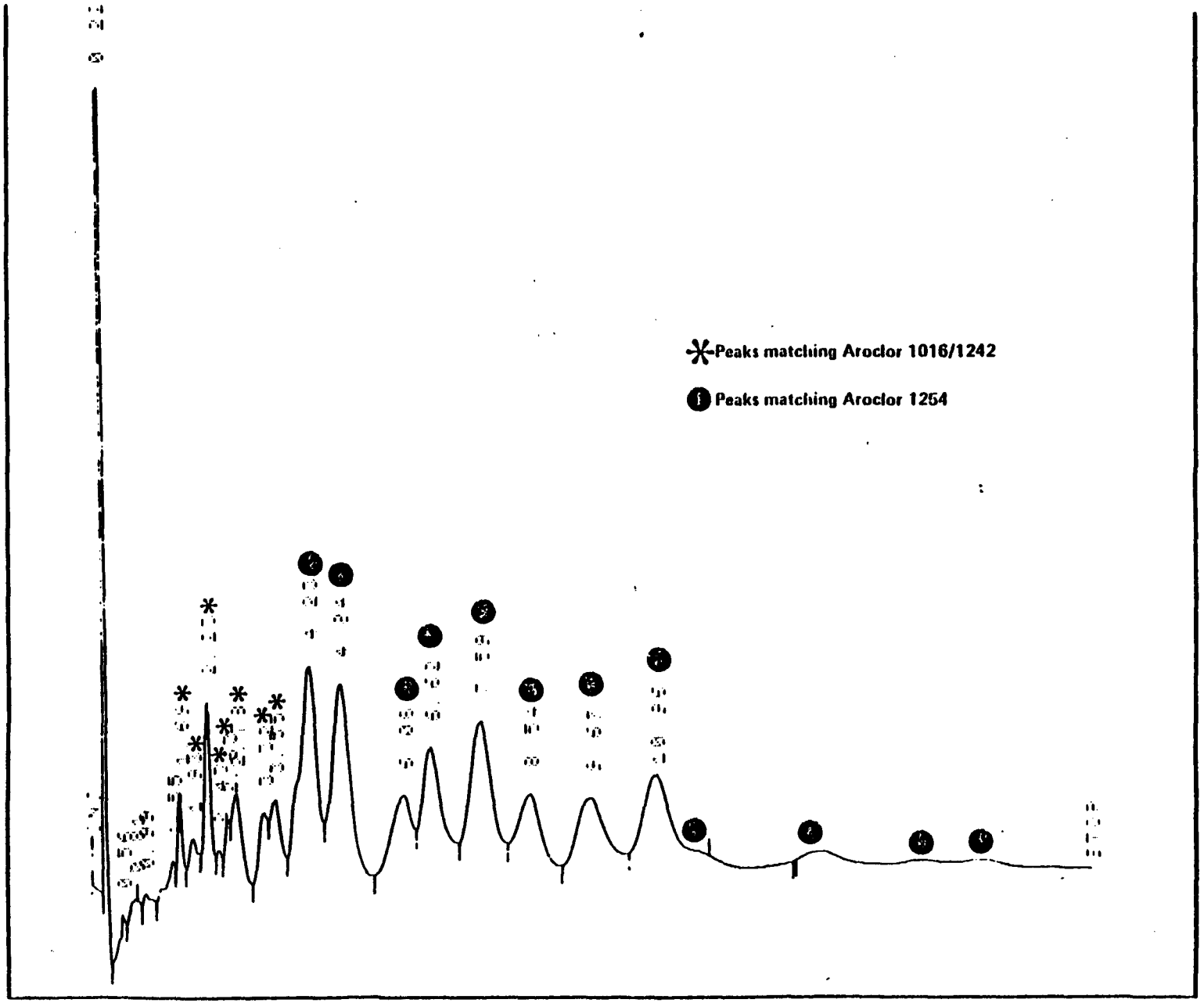
FIGURE 8

CHROMATOGRAM OF a) AROCLOR 1016 STANDARD
AND b) AROCLOR 1242 STANDARD



CHROMATOGRAM OF AROCLOR 1254 STANDARD

FIGURE 9



CHROMATOGRAM OF SOIL CORE (0-15 cm)
TAKEN AT TEST WELL NO. 9

FIGURE 10

TABLE 6. SOIL SAMPLE ANALYTICAL RESULTS

	Aroclor 1016/1242 (ppb)	Aroclor 1254 (ppb)
Core at Test Well 9 (0 to 15 cm)	32	183
Core at Test Well 9 (15 to 30 cm)	<7	27
Surface Sample near Test Well 3	97	343

TABLE 7. BOTTOM SEDIMENT ANALYTICAL RESULTS

	Aroclor 1016/1242 (ppb)	Aroclor 1254 (ppb)
Station 1	30	230
Station 3	<5	34
Station 5	<5	170
Station 8	<5	<10
Behind Lums	8	280

samples, Aroclor 1254 comprises approximately 82 percent of the total PCB present, while for the shallow ground water it comprised approximately 66 percent of the total PCB.

Stream Sediments

Bottom sediment samples were taken along the Paskamanset River at the locations shown in Figure 4. A sample of sediment was also taken from the stream passing through the property in the vicinity of Interstate 195 and the Holiday Inn (behind Lums), which is reported (Mr. Daniel K. Moon, personal communication, EPA Region I) to have been a previous PCB disposal site. The sediment samples listed in Table 7 were selected for analysis.

Figure 11 is the chromatogram of the extract from the bottom sediment sample taken from the stream behind Lums. This chromatogram shows a total of 288 ppb PCB, 98 percent of which is Aroclor 1254.

PCB, consisting of predominately Aroclor 1254 with lesser amounts of Aroclor 1016/1242, is present in stream sediments along the Paskamanset River north of Interstate 195. South of Interstate 195, PCB was not detected in bottom sediments.

Surface Water

The surface water sample from Sample Station 8 (Figure 4) was analyzed for PCB. The remaining surface water samples are being held pending a decision on further analyses. The surface water at Sample Station 8 did not contain detectable levels of PCB. Aroclor 1016/1242 was less than 0.08 ug/l (ppb), and Aroclor 1254 was less than 0.10 ug/l.

Biota

Analysis was conducted of a composite sample of benthic organisms taken from Apponagansett Swamp (Figure 5) along the periphery of the landfill and a second composite sample of benthic organisms taken from the Paskamanset River

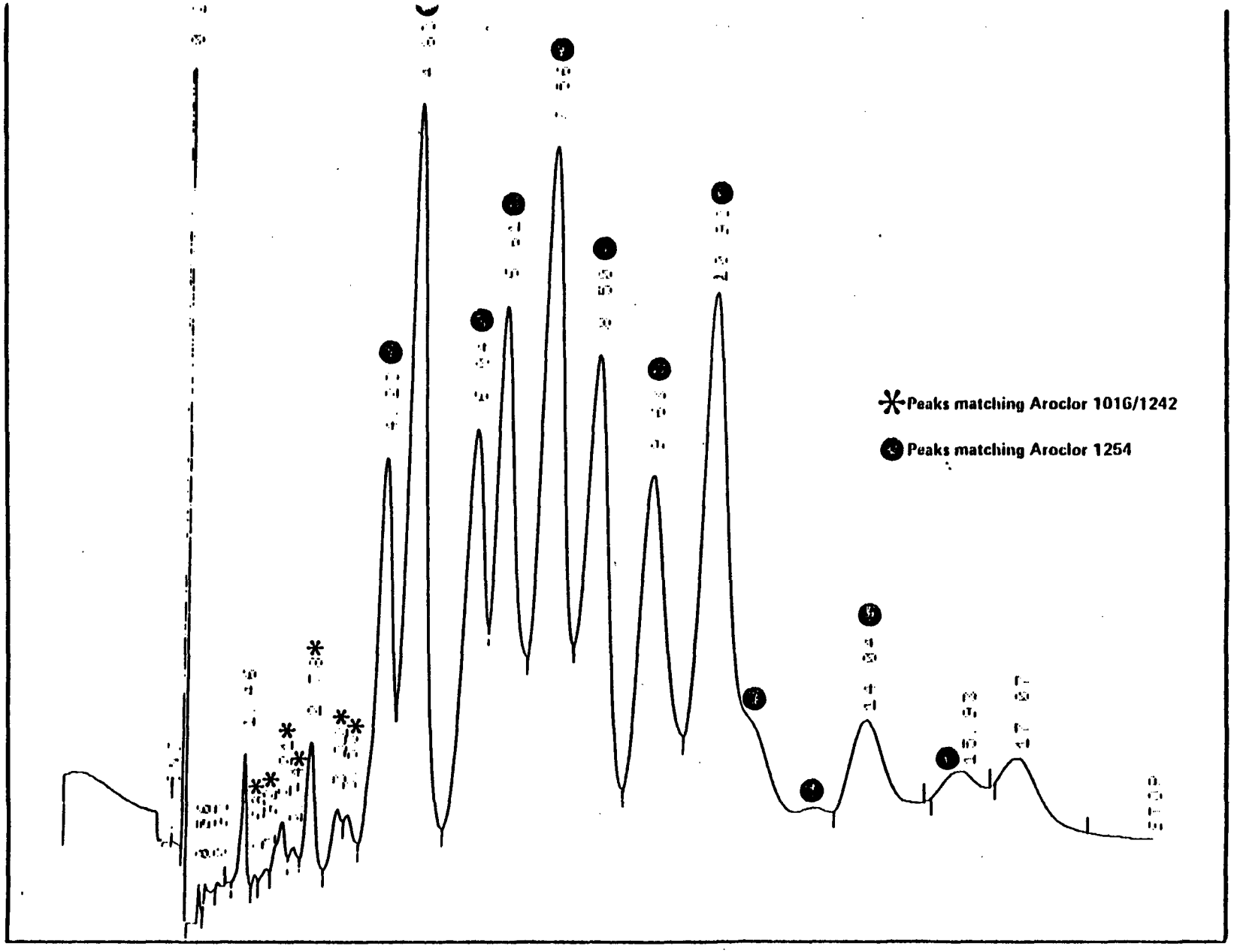


FIGURE 11

CHROMATOGRAM OF EXTRACT FROM SEDIMENT SAMPLE
TAKEN FROM BEHIND LUMS

north of Interstate 195 (Figure 4) at a distance of 1.6 to 2.0 km from the landfill. Fish samples taken at Sample Stations 1 and 8 (Figure 4) were also analyzed. The fish sample at Station 1 represents a single fish captured at that location, while the sample at Station 8 is a composite of 15 fish of mixed variety, principally Pumpkinseed (Lepomis gibbosus), all approximately 10 cm in length.

Twenty eggs of the herring gull (Larus argentatus) were collected at Ram Island, Mattapoisett, Massachusetts, on June 20, 1977, by Dr. I.C.T. Nisbet. Ten of those eggs were composited for analysis of PCB. Field mice (Peromyscus sp.) were analyzed on a whole-body basis after removal of fur and skin.

The analytical results for all the biota are summarized in Table 8. Benthic organisms in the marsh adjacent to the landfill contained a total PCB concentration of 2.53 ppm, of which 82 percent is Aroclor 1254. In the stream passing through the marsh at a distance of approximately 1.6 km from the landfill, benthic organisms had a total PCB concentration of 1.35 ppm, of which 84 percent is Aroclor 1254.

TABLE 8. ANALYTICAL RESULTS FOR BIOTA

	Aroclor 1016/1242 (ppb)*	Aroclor 1254 (ppb)*
Benthos		
Marsh Sample Composite	460	2,070
Stream Sample Composite	220	1,130
Fish		
Sample Station 1	<10	360
Sample Station 8	<10	330
Herring Gull Eggs		
Ram Island Colony	76	4,600
Terrestrial Organisms		
Field Mice (Peromyscus sp.)		
Trap Line #1	<10	11
Trap Line #2	<10	18

*Wet weight basis.

The fish samples contained only traces of Aroclor 1016/1242, but larger quantities of Aroclor 1254 (average 345 ppb). Figure 12 shows the chromatogram of the fish sample taken at Sample Station 8. It should be recalled that PCB was not detected in either the water or bottom sediment at this location.

The herring gull eggs contained substantial quantities (4.6 ppm) of Aroclor 1254, and lesser quantities (0.076 ppm) of Aroclor 1016/1242. Figure 13 is a chromatogram of the egg extract. The field mice contained an average of 16 ppb of Aroclor 1254, while Aroclor 1016/1242 was not detected in these organisms.

Ambient Air

Ambient air samples taken June 28 and June 30, 1977, over the landfill were analyzed for PCB. These samples were located on the landfill, as illustrated in Figure 5. The samplers were located about 2 meters above ground level. Additional air samples were taken in the area in January, 1978. All air analyses are reported in Table 9.

On June 28, 1977, airborne PCB concentration over the landfill averaged 1.19 ug/m^3. These samples were taken from 11:00 a.m. to noon while wind velocity was west-southwest at approximately 10 mph. A sample taken on June 30, 1977, yielded a concentration of 0.41 ug/m^3 when winds were from the northwest at 12 to 15 mph. As may be seen by comparison of the chromatogram of one of these air sample extracts (Figure 14) with the chromatogram of Aroclor 1242 standard (Figure 15), the pattern match is very good. Aroclor 1242 is clearly present in these air samples. The presence of PCB in these samples was confirmed by perchlorination. Further analysis indicated that the non-chlorinated species, biphenyl, was not present.

Ambient air samples were taken in January, 1978, upwind, on site, and downwind of the landfill, and upwind and downwind of three other possible sources in the area. The analytical results for these samples are also shown in Table 9. At the time of sampling, the ground was frozen and a light snow

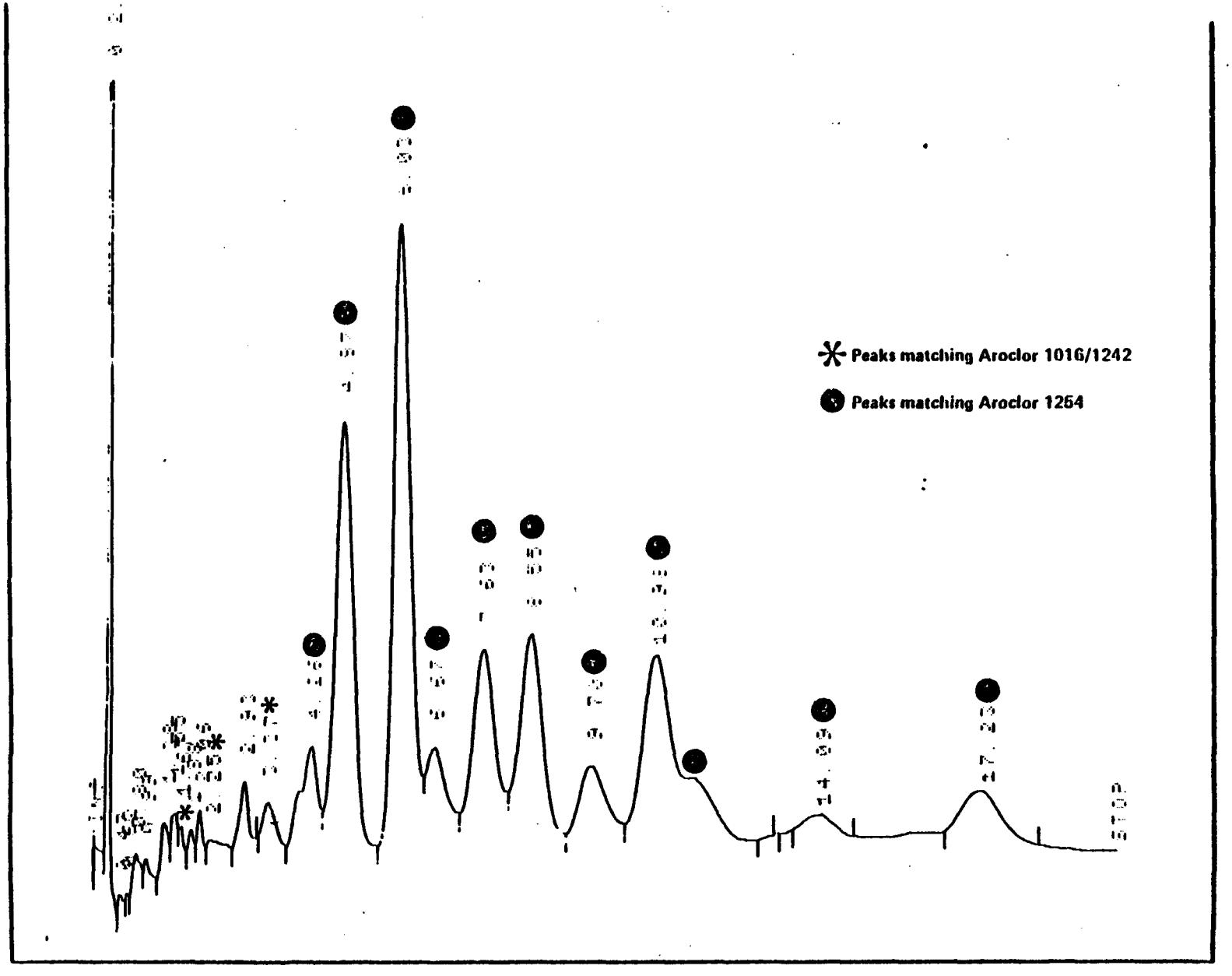


FIGURE 12

CHROMATOGRAM OF FISH SAMPLE EXTRACT
FROM SAMPLE STATION NO. 8

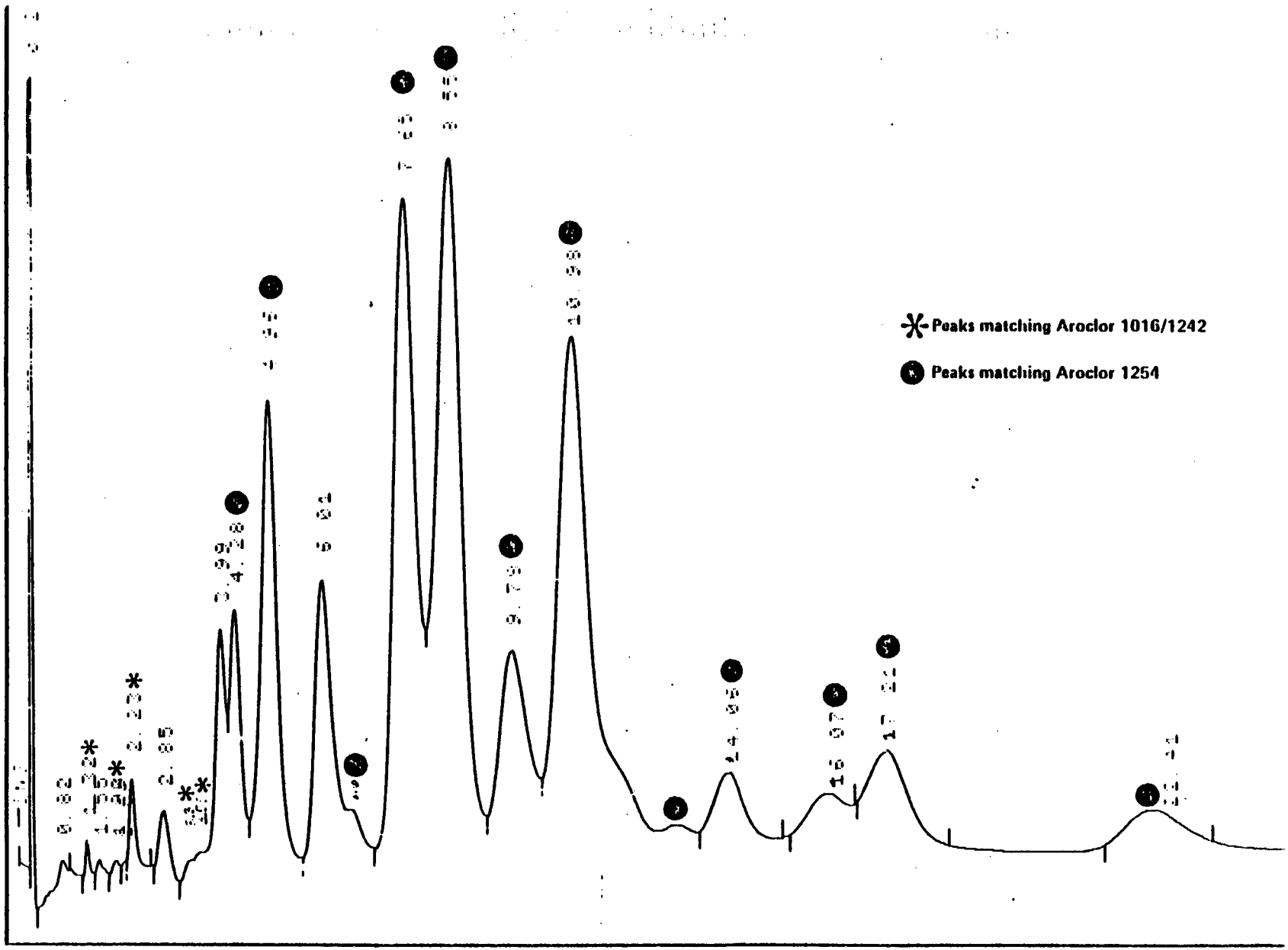
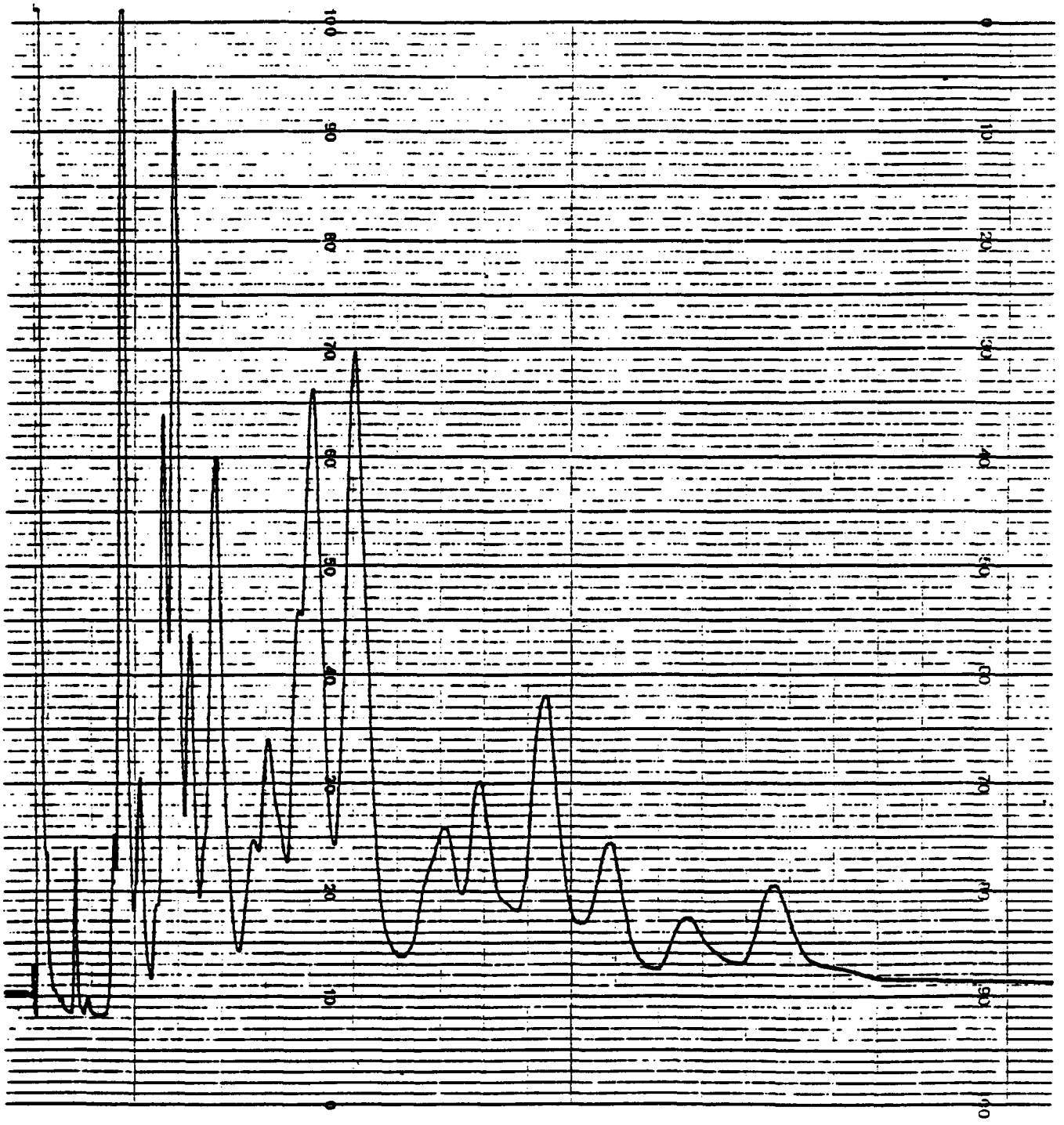


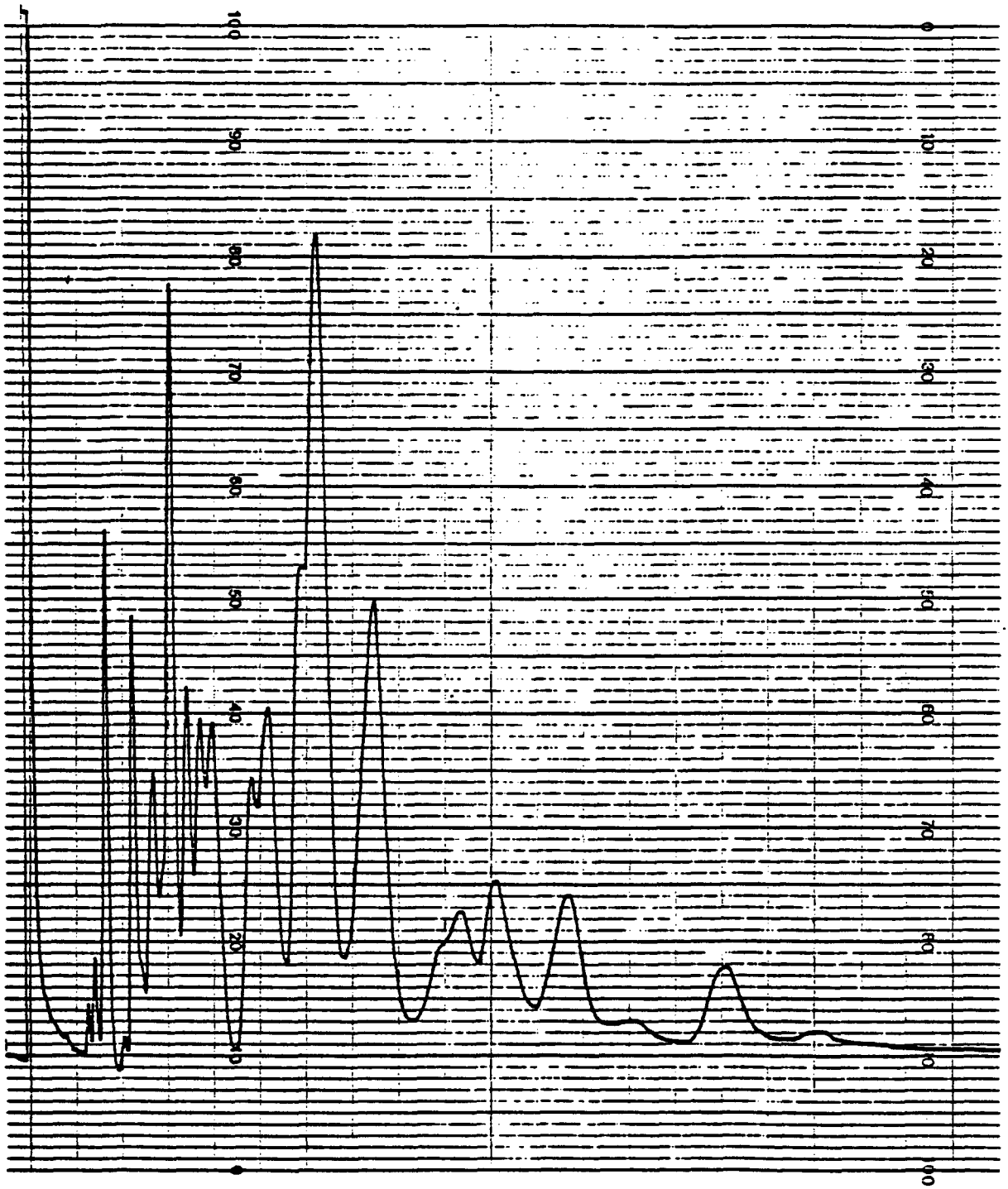
FIGURE 13

CHROMATOGRAM OF EXTRACT
FROM HERRING GULL EGGS



CHROMATOGRAM OF ONE-HOUR AMBIENT AIR SAMPLE
TAKEN AT THE LANDFILL SITE

FIGURE 14



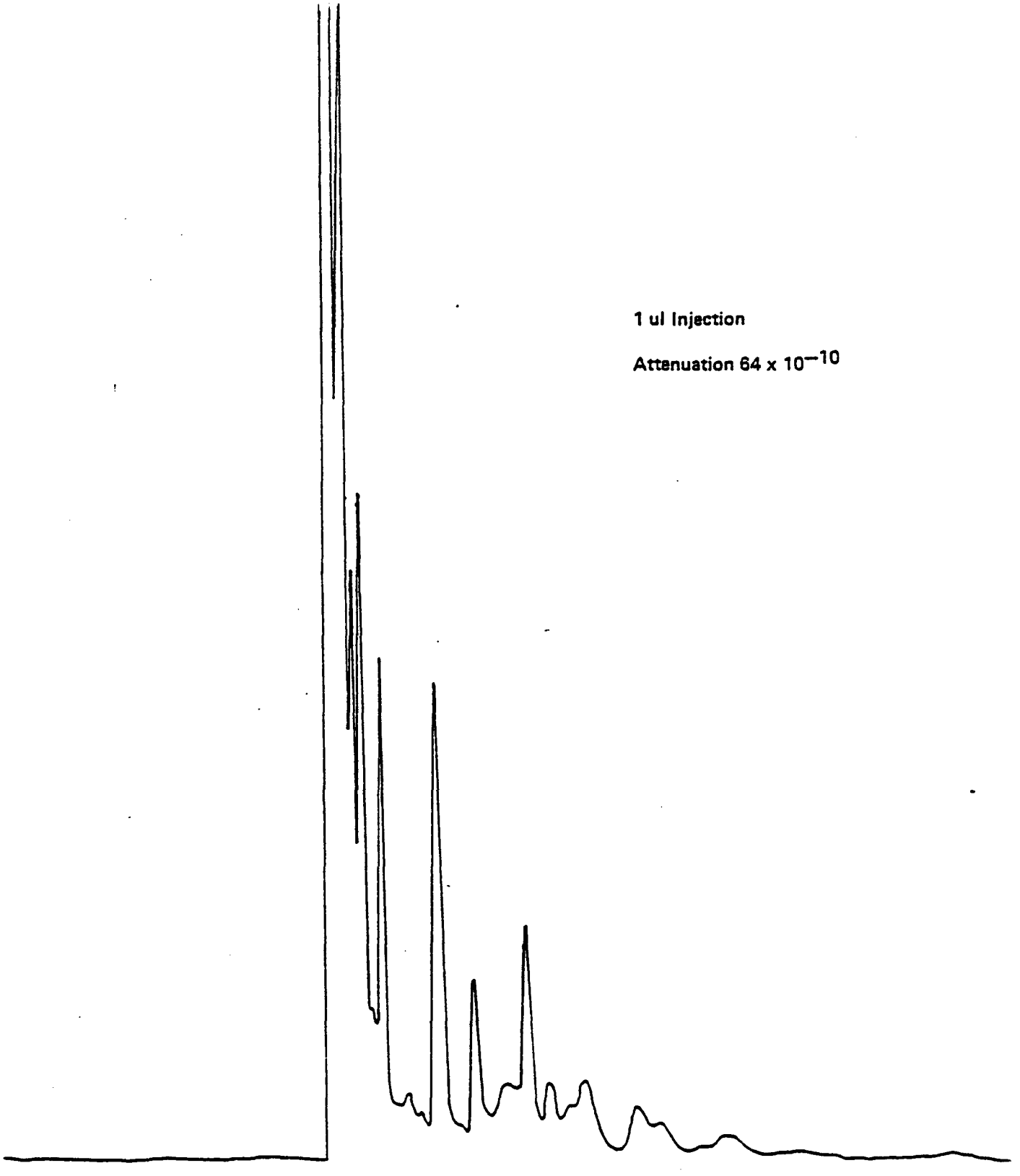
CHROMATOGRAM OF AN AROCLOR 1242 STANDARD

FIGURE 15

TABLE 9. ANALYTICAL RESULTS FOR AMBIENT AIR

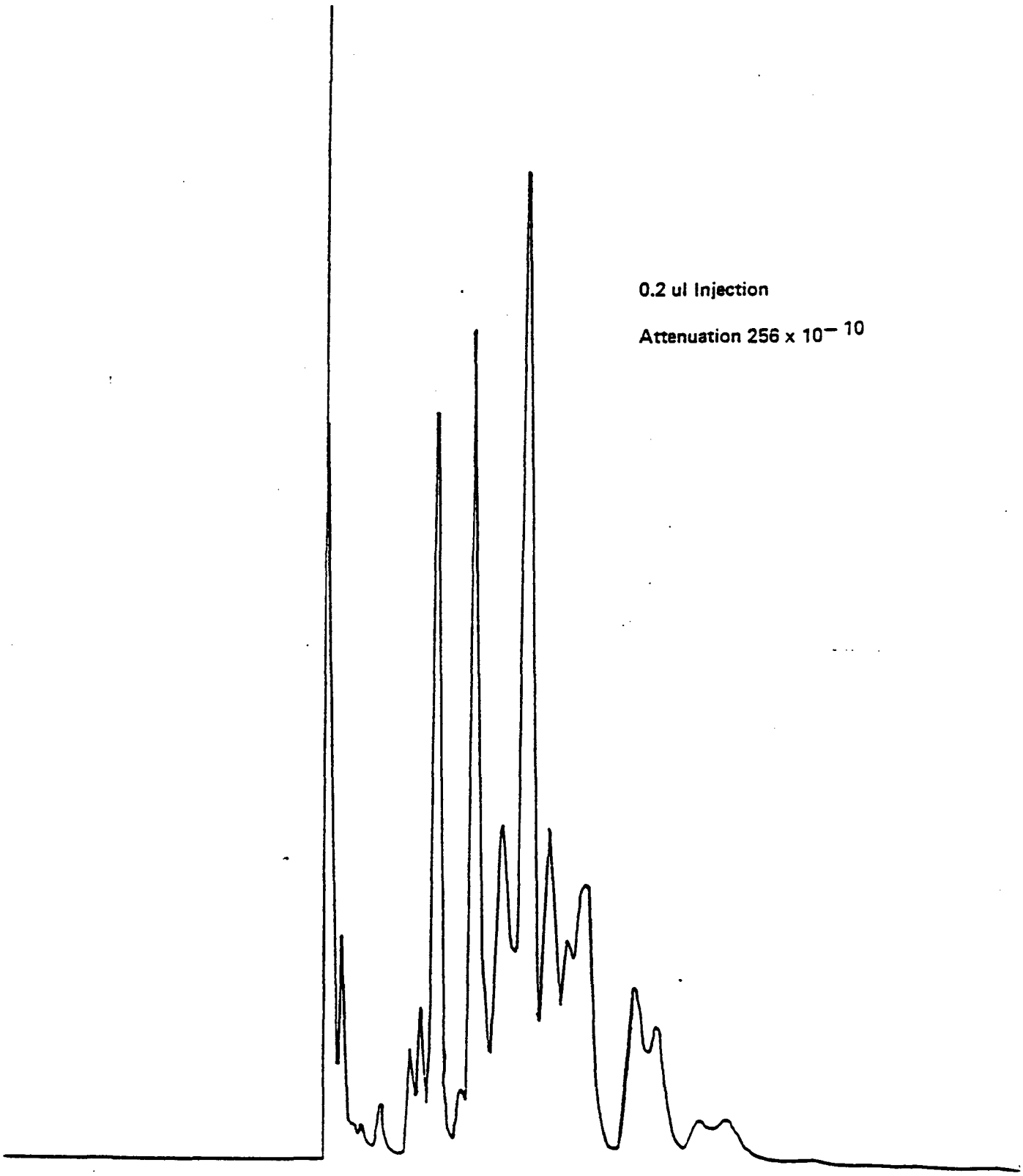
Sample Date	Site	Location	PCB Concentration (ug/m^3)	Aroclor
6/28/77	landfill	on site	0.89	1242/1016
	landfill	on site	1.5	1242/1016
6/30/77	landfill	on site	0.41	1242/1016
1/17/78	landfill	upwind	0.0085	1242/1016
		on site	0.021	1242/1016
		downwind	0.013	1242/1016
1/24/78	sludge incinerator	upwind	0.0043	1242/1016
		downwind	0.013	1242/1016
1/27/78	Aerovox Corp.	upwind	0.0056	1242/1016
		downwind	0.49	1016 only
1/19/78	Cornell-Dubilier	upwind	0.019	1242/1016
		downwind	0.0051	1242/1016

cover was present. A light snowfall was also occurring. The data show an increased airborne PCB concentration downwind of the New Bradford municipal sewage sludge incinerator, the landfill, and Aerovox Corporation facilities. Ambient levels over the landfill were substantially lower than during the summertime sampling. All samples but one indicated the presence of Aroclor 1016 and traces of Aroclor 1242. Downwind of the Aerovox Corporation, only Aroclor 1016 was detected. Figures 16 and 17 show the chromatograms of the upwind and downwind sample extracts, respectively, taken in the vicinity of the Aerovox Corporation. Note in these figures that the downwind sample is shown at a recorder attenuation twenty times greater than the upwind sample.



CHROMATOGRAM OF AIR SAMPLE
TAKEN UPWIND OF AEROVOX CORPORATION

FIGURE 16



CHROMATOGRAM OF AIR SAMPLE
TAKEN DOWNWIND OF AEROVOX CORPORATION

FIGURE 17

SECTION 5

CONCLUSIONS

The following conclusions may be drawn from the analyses conducted:

1. There is some movement of PCB from the landfill into the water table aquifer to the immediate north of the landfill within Apponagansett Swamp. PCB contamination appears to decrease with depth in the water table aquifer from 0.76 ug/l at a depth of 2.1 meters to 0.24 ug/l at 6.4 meters. Both Aroclor 1254 and Aroclor 1016/1242 are present in contaminated waters, with Aroclor 1254 predominant. The areal extent of the contamination of the shallow aquifer is probably very limited, since PCB contamination was not detected in other directions from the landfill.

2. The drinking water supply of Dartmouth, Massachusetts, and of a private artesian well south-southwest of the landfill contained no detectable traces of PCB at the few part per trillion level. Hence, PCB in the landfill does not seem to be contaminating the deeper aquifers from which drinking waters are withdrawn.

3. Soils within Apponagansett Swamp to the immediate north and northwest of the landfill are contaminated with PCB. The level of contamination seems to decrease rapidly with depth. The predominant material present appears to be Aroclor 1254, although Aroclor 1016/1242 is also present. A total of 0.44 ppm PCB at the soil surface was the maximum level measured. The source of this contamination is probably either erosion or leachate from the landfill.

4. Benthic organisms in Apponagansett Swamp along the periphery of the landfill and within the Paskamanset River are contaminated with PCB. The level of contamination is higher in the benthic organisms taken near the landfill (2.5 ppm) than those taken from the stream (1.4 ppm). These organisms probably accumulate the PCB by ingestion of contaminated soils and detrital particles.

5. Field mice captured in the swamp contain residual PCB levels of 0.016 ppm. This has probably accumulated as a result of the consumption of contaminated animal and vegetable matter. Levels are not high enough to indicate extensive bioaccumulation in these short-lived animals.

6. Bottom sediments along the Paskamanset River exhibit some PCB contamination, but only to the north of Interstate 195. The transport of PCB downstream is limited in distance to a reach of approximately 2.5 km.

7. Fish captured in the stream contained an average of 0.34 ppm PCB. Fish probably accumulate PCB by eating contaminated organisms. The fish captured were not of edible size; however, levels of contamination were considerably below the Food and Drug Administration action limit of 5 ppm for edible fish.

8. Herring gull eggs taken from the Ram Island colony contained substantial quantities of PCB (4.6 ppm), predominantly in the form of Aroclor 1254. Many of these gulls feed at the landfill; however, they also feed on fish and other organisms in the area which may contain PCB. Previous analysis of fish taken from New Bedford Harbor indicated substantial levels of PCB contamination (up to 290 ppm in an American eel). Hence, it is not possible to unequivocally identify the herring gull as a major mode of PCB transport from the landfill.

9. During the summer, airborne PCB levels at the landfill were in excess of 1.0 ug/m^3. These levels must be considered relatively high since they exceed the maximum permissible 8-hour exposure level for industrial workers (OSHA, 1977). Samples taken at the same location during the winter when the ground was frozen indicate that ambient air levels of PCB over the landfill are substantially lower than during the summer (0.02 ug/m^3). There is some evidence of low-level airborne emissions of PCB from the landfill even during the winter however.

10. Results of the air samples taken in January, 1978, indicate that the municipal sewage sludge incinerator is a low-level PCB emitter, while Aerovox Corporation appears to substantially increase downwind ambient levels of PCB. Cornell-Dubilier Electronics Corporation had no detectable emissions at the time of sampling.

The results of this survey indicate there is migration of PCB from the New Bedford landfill. Although PCB has migrated to shallow ground waters immediately adjacent to the landfill, the extent of groundwater contamination appears to be restricted to a very limited area. Transport of PCB in the ground water is probably limited by the high absorption capacity of the peaty soils in the area plus the likelihood the landfill is located on a groundwater discharge area rather than a recharge area.

PCBs have migrated from the landfill into the surface water and biological systems of Apponagansett Swamp. Soils, sediments, and benthic organisms in the swamp are contaminated with PCB. This contamination appears to be limited to the area north of I-195. Again, highly-absorptive, peaty soils probably limit physical transport of PCB. Bioaccumulation of PCB is demonstrated by the relatively high levels detected in benthic organisms within the swamp. Transport of this contamination up the food chain to the more mobile biological organisms (i.e., fish) is occurring. Herring gulls may be accumulating substantial levels of PCB contamination in their eggs as a result of their feeding at the landfill.

Ambient air analysis indicates volitization is a likely and possibly principal mode of transport of PCB from the landfill. There is insufficient data to determine the rate of this transport; however, it is substantially greater during the summer than during the winter, as may be expected since ambient temperatures are higher.

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

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15. SUPPLEMENTARY NOTES

16. ABSTRACT

A survey was conducted to assess the extent of transport of polychlorinated biphenyls (PCBs) from the New Bedford, MA municipal landfill. This landfill has been used for the disposal of PCB waste materials for many years. It is located in a wetland area. There is evidence of transport of PCBs in the shallow ground water to the northwest of the landfill, but the extent of transport is relatively minor, being confined to near surface waters very near the landfill. Drinking waters are unaffected. Aquatic and terrestrial organisms in the vicinity are accumulating some PCB; however, levels of contamination are not excessively high. There is evidence to indicate airborne transport may be a principal mode of movement of PCB from the landfill during the warm months. At one time, in excess of 1.0 ug/m^3 of PCB was detected in the ambient air over this landfill.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Polychlorinated Biphenyls, PCBs, solid waste landfill, Aroclor 1016, Aroclor 1242, Aroclor 1254	environmental contamination, air pollution	

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C O N N E C T I C U T

CONNECTICUT

PCB monitoring and research studies have generated considerable amounts of data regarding contamination sites within Connecticut.

The Housatonic River, which flows from Massachusetts into Connecticut, has for some time evidenced the presence of PCBs, and is most likely Connecticut's greatest "PCB problem". Recently, PCB contamination in the Housatonic has been found to extend further downstream to the Still River as well as Lake Lillinonah and possibly Lake Zoar.

Extensive amounts of PCBs found within the Housatonic are suspected of initiating from the General Electric Company located in Pittsfield, Massachusetts. G.E. has utilized PCBs at their Pittsfield facility since 1932 in the manufacture of capacitors and transformers; and since the early 1950's exclusively in transformers. The G.E. plant has released varying amounts of PCBs to the Housatonic in their industrial discharge from 1932 until March 1977, when G.E. voluntarily discontinued the use of PCBs within their transformers.

Although G.E. has stopped utilizing PCBs in their manufacturing process, the plant facility itself is contaminated with the substance. PCB residues have accumulated over the years in some of the plant's outlying pipes and drains, as well as having permeated the soil in certain areas of the plant's grounds. To recover PCBs from these sources, General Electric has installed six wells equipped with pumps. Six to 10 million gallons per day of oil-impregnated water is pumped up from the wells and passed through tanks of two oil-water separators. The PCB containing oil once successfully separated, can then be disposed of by high temperature incineration.

It is felt that release of PCBs to the Housatonic from the G.E. facility is due to the inefficiency of the oil-water separators, allowing as much as 3-4 ounces of PCBs to be discharged to the Housatonic per day. Leaching of PCBs from the plant's grounds is also a contributory source but the quantities released are unknown.

Prior to July 1, 1977, the General Electric Company had an NPDES permit allowing an average of 0.25 PCB/day to be discharged to the Housatonic. EPA is currently working towards the issuance of a new permit for G.E. which would restrict their PCB discharge to a daily maximum of 10 parts per billion (ppb or ug/kg), approximately 0.1 lb/day.

In an attempt to decrease PCB content of their non-process discharge permit, G.E. is involved in a self-initiated program to reduce point sources of PCB on their property by replacement, lining, removal or abandonment of process equipment and drainage property. G.E. has expressed hope that this work would obviate the need for end of pipe treatment by achieving a reasonable PCB concentration in the effluent. EPA and G.E. have not yet agreed to what is "reasonable". In the interim, G.E. will submit a proposed time schedule to EPA, defining their efforts to reduce PCB effluent concentration.

Other possible sources of PCB contamination to the Housatonic include landfills which exist within the river drainage area as well as the municipal sewage treatment plant sludge disposal sites located in the vicinity of the river.

In line with the above, the Massachusetts Department of Environmental Quality Engineering began a sampling program in August 1977 to define the extent of PCB contamination within the waters of the Housatonic River Basin, along with determining where and what the contributory sources of PCB contamination are. A copy of the sites to be sampled is included in the appendix.

Numerous data has been collected on PCBs in the Housatonic by both State and Federal agencies. The EPA laboratory in Gulf Breeze, Florida has generated data on PCBs in the Housatonic as part of a fish sampling program conducted in Connecticut on a yearly basis since 1972. All fish were sampled from the mouth of the respective river basins. The results are as follows:

		PCB CONTENT (1254)* Year Sampled				
River Sampled	Species	1972	1973	1974	1975	1976
Housatonic	Cunner	138	389	491,408	497	270,289
	Atlantic Silverside	-	-	324,360	-	-
	Bluefish	-	-	328	-	-
Thames	Cunner	434	293,181	461,618	134	-
	Atlantic Silverside	-	-	199	139	-
Connecticut	Cunner	592	153,678	1,065	-	-
	Atlantic Silverside	-	-	395,300	278	-
Quinssipiac	Cunner	272	588,294	409,413	396	-
	Atlantic Silverside	-	-	351	-	-

*All data expressed as ug/kg (ppb) based on whole body, wet weight juvenile fish.

The Environmental Protection Agency in Region I has conducted several studies to determine what the extent of PCB contamination is in and around the Housatonic River. Throughout 1972-1976, analyses were performed on various water, sediment, and fish samples which EPA had collected. The results of these studies are indicated in Tables 1,2 and 3.

Table 1

WATER SAMPLES

Sample Station	Location Description	Sample Date	PCB Level-micrograms per liter (ug/l) or ppb
GER04	Housatonic River at Meadow St. Bridge, South Lee, Ma.	8/26/75	L.03
GER05	Housatonic River at Rte 20 Bridge, Lee, Ma.	8/26/75	L.03
GER05A	Housatonic River at New Lenox Road Bridge, New Lenox, Ma.	8/26/75	0.06*
GER06	Housatonic River at Pomeroy Ave. Bridge, Pittsfield, Ma.	8/26/75	0.06*
GER07	East Branch of the Housatonic River at Pomeroy Ave. Bridge, Pittsfield, Ma.	8/26/75	0.42
GER08	East Branch of the Housatonic River at Hubbard Ave. Bridge near USGS Dalton Gage, Pittsfield, Ma.	8/26/75	L.03
GE005	General Electric Company, outfall #005. Oil-water separator effluent containing groundwater, runoff, incinerator scrubber water, and wastewater from power transformer department.	8/26/75	120
GE006	General Electric Company, outfall #006. Oil-water separator effluent containing groundwater and wastewater from the power and distribution transformer departments.	8/26/75	4.6

* interferences present
L = less than

Table 2

Sediment Samples

Sample Station	Location Description	Sample Date	PCB Level-ppm dry weight mg/kg (ppm)
HR01S	Housatonic R. approximately 300 meters (1000') upstream of Woods Pond Dam, Lee, Ma.	8/26/75	134
HR02S	Housatonic R. approximately 150 meters (500') downstream of New Lenox Rd. Bridge, New Lenox, Ma.	8/26/75	1.4
HR03S	Housatonic R. approximately 5 kilometers (3 mi) upstream from the Pittsfield WWTP outfall, Pittsfield, Ma.	8/26/75	53.9
HR04S	Housatonic R. 200 meters downstream of the Pomeroy Ave. Bridge, Pittsfield, Ma.	8/26/75	26.3
HR05S	East Branch of the Housatonic near Lyman St. bridge (immediately downstream of the G.E. Co's outfall #'s 005 and 006), Pittsfield, Ma.	8/26/75	139
HR06S	East Branch of the Housatonic near the center of Center Pond, Dalton, Ma.	8/26/75	0.05

Fish Samples

Sample Station	Specimen	Stream Location	Sample Date	PCB Level* wet weight, mg/l (ppm)
FS-1	3 trout	E. Housatonic St. Bridge	8/29/75	0.28
FS-2	1 catfish 1 perch 2 bluegills	East Street, 200 yards upstream of Fasce Place.	8/29/75	17.4
FS-3	4 bass	Outer base of Woods Pond Dam	8/29/75	34.0

*Value for fillet and skin only

Table 3

SEDIMENT SAMPLES

SOURCE	PCB level - ppb or (ug/kg) 1972	1973	1974	1975	1976
Housatonic R. at Stratford	--	--	29	43	14
" " " Stevenson (Monroe)	10	--	2	14	4
" " " Falls Village	70	40	--	--	--
" " " New Milford	--	--	130	68	94
" " near Canaan	--	--	130	60	76
Lake Lillinonah at Brookfield	--	--	240	430	1100
Lake Zoar at Riverside	--	--	32	52	78
Thames River at Mohegan	--	--	180	40	160
Peguabuck River at Farmington	--	--	0	50	740
Park River at Hartford	--	--	350	110	1000
Quinnipiac River at Meriden	--	--	200	0	270
" " " Wallingford	800	25	-	50	26
Naugatuck River at Ansonia	--	--	90	370	1600
Still River at Danbury	--	--	--	--	1300
" " " Brookfield	--	--	87	67	2400
Impoundment at Falls Village	--	--	--	--	5400

Connecticut's Departments of Environmental Protection and Public Health were mutually concerned over the possibility of PCB contamination of fish within the Housatonic since the portion of the Housatonic flowing through Connecticut had been annually stocked with game fish.

The Connecticut State Health Laboratory performed a few PCB analyses on fish in 1975; began expanded surveillance in 1976; and became involved in an extensive monitoring program to determine the extent of PCB contamination within the Housatonic and surrounding waterbodies in February 1977. This monitoring program has lasted from February to August 1977, and will remain in progress for as long as necessitated.

The results of Connecticut's sampling efforts are shown in Table 4.

Table 4

PCB Results

Date Reported	Sample	Location	PCB content mg/kg (ppm)
9/75	striped bass	Saugatuck River	4.2
9/75	" "	Black Rock Harbor	5.7
12/75	" "	Niantic River	2.0
1/76	" "	Housatonic River	1.5
"	" "	" "	3.6
"	" "	" "	2.0
"	" "	" "	0.19
"	" "	" "	0.15
10/76	" "	" "	0.54
2/76	" "	Stamford Harbor	0.33
"	" "	" "	0.07
"	" "	" "	0.2
4/76	oysters	Darien Bed #1214	0.1
"	"	New Haven Bed $449	0.2
5/76	yellow perch	Lake Lillinonah	2.0
11/76	" "	" "	0.82
1976	" "	" "	0.41
"	" "	Connecticut River, Hartford	0.3
"	" "	Crystal Lake, Ellington	0.3
2/76	striped bass	Connecticut River	5.1
9/76	" "	" " , Saybrook	0.7
"	" "	" "	2.6
11/76	" "	Long Island Sound, Sheffield Is.	4.6
10/76	" "	Black Rock Harbor	0.69
"	" "	Shee Is., Norwalk	0.98
9/76	black bass	Connecticut River	4.8
11/76	weak fish	" "	4.4
"	" "	Long Island Sound, Branford	0.69
"	common sucker	Farmington River	0.12
"	white sucker	Quinnipiac River, Meriden	0.36
"	sucker	Housatonic River	38
"	white sucker	Lake Lillinonah	2.4
5/76	sucker	Composite of Lake Lillinonah and Quinnipiac River	5.6
12/76	clams	Stratford (natural beds)	0.2

Table 4 (Continued)

Date Reported	Sample	Location	PCB content mg/kg (ppm)
West Cornwall Area			
2/8/77	brook trout - 10"	Falls Village	0.3
"	yellow perch - 11"	" "	4.7
2/16/77	oysters	Westport - Bloom's #207	0.25
2/28/77	water	Watertown	*N.E. - Chlorda
"	"	Canterbury	" - Pest
3/11/77	"	N. Branford	" - Chlordane
3/31/77	"	Bloomfield	" - Pest
4/26/77	oysters	Branford/Stony Creek Bed #D	0.19
4/29/77	water	Waterbury	*N.E. - Pest
"	"	"	" "
"	"	Stamford	0.03 chlordar
5/11/77	oysters	New Haven, State Shellfish Spawning Bed	0.60
5/11/77	"	New Haven Bed # 453	0.90
"	water	Mystic Valley	*N.E. - Pest
"	"	" "	" "
"	"	New Britain	0.001
"	"	Avon	*N.E. - Chlordane
5/27/77	striped bass	Thames River, Fort Shantock	2.7
"	" "	" " " "	1.5
"	" "	Niantic River	1.3
6/17/77	sm. mouth bass	Housatonic River	4.0
"	brown trout (holdover)	" "	13.8
"	brown trout (holdover)	" "	16.7
"	" " "	" "	13.8
Cornwall/West Cornwall Area			
6/24/77	brown trout (3 yrs)	Housatonic River	19.
"	" " "	" "	40.
"	" " "	" "	43.
"	" " "	" "	16.
"	" " "	" "	18.
"	" " "	" "	25.
"	" "	Burlington Hatchery	0.14
"	" "	" "	0.07 est.

Table 4 Continued

Date Reported	Sample	Location	PCB content mg/kg (ppm)
6/27/77	rock bass	Housatonic River (Falls Village)	1.0
"	" "	" " " "	1.0
"	large mouth bass	Candlewood Lake	1.8
"	yellow perch	" "	1.5
"	" "	" "	1.0
"	" "	" "	1.0
"	" "	" "	1.0
"	rock bass	Housatonic River (Falls Village)	1.5
"	" " 9 1/2"	" " " "	9.0
"	muds	" "	800 (ug/l)
"	"	" "	1200 "
"	"	" "	500 "
6/29/77	trout (11-13 mos. spent in river)	Cornwall	18.0 ppm
6/30/77	brown trout 11.4" (11-13 mos. spent in river)	Cornwall/West Cornwall	25.0
6/30/77	brown bullhead (fish fillet)	Candlewood Lake (New Milford)	4.2
7/7/77	large mouth bass (fish fillet)	Candlewood Lake (New Milford)	1.2
7/77	yellow perch (fish fillet)	" " " "	1.1
"	yellow perch	Lake Lillinonah (Housatonic Arm)	0.3
"	white catfish	" " " "	11.
"	white perch	" " " "	6.2
"	" "	" " " "	3.7
"	rainbow trout (stocked 1977)	Housatonic River	26.0
"	golden trout "	" "	4.6
"	brown trout "	" "	13.0
"	rainbow trout "	" "	9.1
8/8/77	sediment	Falls Village	5.4 ('76)
"	yellow perch	" "	4.7
"	brown trout	" "	0.3
"	sucker	" "	38.0
"	sediment	Canaan	0.076 ('76)
"	brown trout	Cornwall/West Cornwall	14.0
"	" "	" " "	17.0
"	" "	" " "	16.0
"	" "	" " "	18.0
"	" "	" " "	19.0
"	" "	" " "	25.0

Table 4 Continued

Date Reported	Sample	Location	PCB content mg/kg (ppm)
8/8/77	Brown trout	Cornwall/W. Cornwall	43.0
"	" "	" "	40.0
"	Rainbow trout	" "	26.0*
"	" "	" "	9.1*
"	Golden trout	" "	4.6*
"	Brown trout	" "	13.0*
"	Sediment	New Milford	0.094 ('76)
"	"	Lake Lillinonah	1.1 ('76)
"	yellow perch	" " (Bridgewater)	0.3
"	white catfish	" " "	11.0
"	white perch	Lake Lillinonah (Bridgewater)	6.3
"	" "	" " "	3.7
"	small mouth bass	" " "	2.7
"	" " "	" " "	5.8
"	" " "	" " "	4.1
"	large mouth bass	" " "	5.2
"	" " "	" " "	4.7
"	yellow perch	" " "	2.0 ('76)
"	" "	" " "	0.8 "
"	" "	" " "	0.4 "
"	white sucker	" " "	2.4
"	brown bullhead	Candlewood Lake	4.2
"	large mouth bass	" "	1.2
"	" " "	" "	1.1
"	yellow perch	" "	0.7
"	brown trout	" "	1.0
"	" "	" "	0.7
"	" "	" "	0.7
"	" "	" "	0.5
"	sediment	Brookfield (Still River)	2.4 ('76)
"	"	Danbury " "	1.3 "
"	"	Lake Zoar (Oxford-Newtown)	0.08 "
"	catfish	" "	4.4
"	sediment	Monroe	0.004 "
"	"	Naugatuck River at Ansonia	1.6 "
"	"	Stratford	0.014 "
"	striped bass	Housatonic River at Sound	1.5 "
"	" "	" " " "	3.6 "
"	" "	" " " "	2.0 "
"	" "	" " " "	0.2 "
"	" "	" " " "	0.2 "
"	" "	" " " "	0.5 "
"	" "	Cornwall/West Cornwall	13.0*
"	rainbow trout	" " "	10.0*
"	brook trout	" " "	10.0*
"	" "	" " "	9.6*

*April, May and June stock - 1977

On the basis of these results from Connecticut's monitoring program, the following health advisories were released by the State's Department of Health.

On June 24, 1977, State Health Commissioner, Dr. Douglas S. Lloyd made a general recommendation that fish taken from the Housatonic River not be eaten.

On July 5, 1977, State officials revised the June 24th blanket warning. Further analyses, according to Dr. Lloyd, revealed that, "PCB levels of trout caught in the Housatonic River north of the Route 341 bridge in Kent are high. We recommend that fish taken from that section of the river and north not be eaten.

"Based on sediment samplings for PCB content, the Housatonic River south of the bridge down through Lake Lillinonah are suspect and fish samples are being collected by the Fish and Water Life Unit of DEP for analysis by our Health Department Laboratory. Fish samples from Candlewood Lake at this time are at PCB levels indicating the fish are safe to eat. Right now, we have no reason to suspect high levels taken below Lake Lillinonah."

Continued monitoring during July and August, 1977 showed PCB contamination existing further downstream in the Housatonic than had previously been suspected. Results indicated that PCBs in the Lake Lillinonah stretch were at levels approximately equal to or exceeding the current federal safety standard of 5ppm.

Commissioner Lloyd subsequently advised against consuming fish from the Lake Lillinonah area, stating that eight of the nine fish samples taken in the last month (July) were of "high" or questionable levels. These results sharply contrasted sampling results taken in the same area in 1976.

Connecticut's monitoring efforts are being extended downstream, to the Lake Zoar region of the Housatonic. It is expected that a further health advisory will be issued if results continue to exceed the FDA 5ppm PCB standard.

Aside from the Housatonic River PCB contamination problem, Connecticut has several other areas of concern with respect to PCBs.

Universal Manufacturing Corporation, Connecticut's major user of PCBs, purchased its Bridgeport plant in 1959 and concurrently began using PCBs in the manufacture of capacitors. Previous owners of the Bridgeport facility had utilized PCBs for 2-3 years prior to Universal's 1959 purchase.

Universal classifies its products as sealed, metal-cased, oil-impregnated, paper/foil capacitors. Aroclors are used by Universal for impregnating its capacitors. Aroclor 1242 was used as the impregnant until 1016 was introduced in 1971. In 1972, Aroclor 1016 replaced Aroclor 1242 as the impregnate.

Universal was issued its NPDES permit from the State of Connecticut, Department of Environmental Protection. Universal's present permit was issued on September 27, 1976 and will expire on September 27, 1981.

Universal has two discharges, Serial No's 001 and 002. The receiving stream for both of these is the Long Island Sound. The amount of PCB to be discharged has been set at an average daily quantity of 0.00017 kg/day for discharge Serial No. 001 and 0.000023 kg/day for Serial No. 002. In both cases the average daily concentration of PCBs discharged is not to exceed 0.001 mg/l.

The Environmental Protection Agency, Region I, conducted a study in the early part of 1976 which was geared at analyzing discharges from the industrial sources of PCBs within New England. Results of the study were based on 8-hour composite samples taken from each Company. Results for Universal Manufacturing Company are given in Table 5.

The next monitoring program initiated by EPA, Region I involved surveillance of selected water supplies throughout New England for PCB contamination. Selection criterion of supplies was based upon known sources of PCBs existing in the vicinity of the supplies, and thus, possibly leading to PCB contamination of the water.

Bridgeport, Connecticut, the site of Connecticut's only known user of PCBs (Universal Manufacturing Corporation), had several of its water supplies sampled on January 29, 1976. Samples of raw and finished water were analyzed for PCB content from the following: Hemlock Reservoir, Easton Lake, Trap Falls Reservoir, Maples Well, Housatonic Well and Seymour Reservoir #1. The only other public water supply in Connecticut tested by EPA for PCBs was that of Westbrook. Raw water from the Westbrook Well was analyzed for PCBs on March 11, 1976. The results of this analysis and the Bridgeport water supplies detected less than 0.05 ppb (ug/kg) of PCB.

It should be noted, that the detection limit for these analyses was 0.05 ppb. Thus, all of the water supplies sampled in Connecticut were found to have PCB levels below the limit of detection for the analysis.

A further monitoring effort involved EPA Region I's Solid Waste Program, which conducted a PCB sampling program in New England. Four municipal landfills within the State of Connecticut were sampled and subsequently analyzed for PCB content.

Two of the landfills sampled: the Bristol, Conn. landfill and the New Britian landfill in Berlin, Conn., were sites whose main contributions come from industrial sources. The remaining landfills studied, a private landfill in Beacon Falls, Conn. and a municipal landfill in Windham, Conn. were sites receiving primarily residential wastes. Results of these analyses are listed in Table 6.

Table 5

UNIVERSAL MANUFACTURING CORPORATION

PCB Sampling Results

Station	Date Sampled	Sample Type	Time (hours)	Flow Rate m3/day	Flow Rate GPD	Station Description	Total PCB ug/l (ppb)	Daily Quantity of PCB[2] from Company Grams	Daily Quantity of PCB[2] from Company Ounces
UNIV 01	1/28/76	FC	09:45 - 16:45 (8hr. composite)	6.1	1600	Vacuum pump non-contact, cooling water effluent sampled at temperature equilization tank in the basement of the building. Discharges to municipal sanitary sewer system.	13	0.08	0.01
	1/29/76	FC	07:30 - 14:30 (8hrs. composite)	6.1	1600		17	0.10	0.01
UNIV 02	1/28/76	TC	09:55 - 16:55	20	5300	Sanitary wastes discharging to municipal sewer system.	20	0.40	0.01
	1/29/76	TC	07:35 - 14:35	20	5300	Company installed spigot for sampling.	89	1.80	0.06
UNIV 03	1/28/76	G	11:15	--	--	Air compressor cooling water.	8.3	--	--
UNIV 04	1/28/76	G	11:20	--	--	Influent water from municipal water supply	0.5	--	--

NOTES: 1 - FC = flow composite - hourly samples collected and composited proportional to flow.
TC = time composite - equal aliquots of sample composites hourly.
G = grab sample.

2 - Assumes constant flow and discharge for 24 hours.

Table 6

REGION I - SOLID WASTE PROGRAM

PCB Sample Results
of
Selected Landfills

Site Location Sampled	Type of Sample Collected	Sample Method	Sample Date	Analytical Results 1016	1254	1260
Bristol, Conn. Municipal Landfill	Leachate (composite - 2 leachate seeps)	Grab sample	4/6/76	N.D.[1,2,3]	N.D.	N.D.
New Britain Municipal landfill Berlin, Conn.	Groundwater	Pump existing wells	4/6/76	24ppb	22ppb	N.D.
Beacon Falls, Conn. Private Landfill	Surface leachate	Grab sample	4/6/76	N.D.	N.D.	N.D.
Windham, Conn. Leachate pond municipal landfill	Leachate pond	Grab sample	4/6/76	N.D.	N.D.	N.D.

NOTES: 1. Not detected. This indicates that the PCB level was below the detection limit. The detection limit when extracting 1,000 ml of water is 0.001 ug/ml (1ppb). However, the detection limits of some of the Aroclors in these samples are higher because large amounts of one of the other aroclors in a sample required that dilution of the sample extract be used for quantification.

2. PCB analysis performed by EPA National Enforcement Investigation Center.

3. See attachment 1 of this report (appendix) for maps indicating the exact locations of the landfills sampled.

The last major undertaking by EPA Region I in the State of Connecticut involved PCB analysis of the Stamford, Connecticut Incinerator in late April, 1976. Monitoring of the incinerator consisted of three sequential test runs. The essential difference between the three tests being that test number 2 had less sludge fed into the incinerator than test 1 or 3. In essence, tests 1 and 3 were duplicate runs. (See Table 7.)

Table 7

PCB Results
Stamford, Connecticut Incinerator

Test Sample	Air Vol. sampled m^3	Total Air Flow During Sampling Period DSC FH	ug PCB based on Aroclor 1254*	ug Aroclor 1254/m3 of Sampled Air
# 1		6,590,018		
Impinger (1R+1L)	1.93		102 m.s.	53
Impinger (2R+2L)	1.93		21	11
Filter	1.93		3.9	2.0
Wash	1.93		2.6	1.3
#2		5,681,933		
Impinger (1R+1L)	1.70		108	64
Impinger (2R+2L)	1.70		1.2	0.7
Filter	1.70		1.7	1.0
Wash	1.70		0.9	0.5
#3		6,654,000		
Impinger (1R+1L)	1.93		53	27
Impinger (2R+2L)	1.93		ND	ND
Filter	1.93		ND	ND
Wash	1.93		3.2	1.6

NOTE: The gas chromatograph/mass spectrometer was used to show the absence of biphenyl (an interference) in impinger samples Test #1 and Test #2 impinger 1R + 1L. The Decachlorobiphenyl peak from perchlorination of the samples (Test #1 and Test #2, impingers 1R + 1L) was determined to be free of interference by gas chromatograph/mass spectrometry.

* =These values were determined by perchlorination of the samples and quantitation of the resulting decachlorobiphenyl compound.

m.s. =The presence of PCB confirmed by gas chromatograph/mass spectrometry.

ND =Not detected.

The results of the incinerator tests also indicated the following:

Test #1 - found an emission rate of 0.437 oz. of PCB(1254)/hr from the stack.

Test #2 - found an emission rate of 0.373 oz. of PCB(1254)/hr from the stack.

Test #3 - found an emission rate of 0.193 oz. of PCB(1254)/hr from the stack.

NOTE: The published analytical methodology for measuring stack emissions of PCBs is less than satisfactory. Due to nature and conditions of the Stamford pyrolysis (burning), EPA's laboratory found that the normal G.C. patterns for detecting PCBs were masked. Therefore, the samples were perchlorinated to give a single G.C. peak compound called decachlorobiphenyl. The lab then proved that this decachlorobiphenyl did not result from either an interference or pure biphenyl. Therefore, the lab could quantitate the decachlorobiphenyl peak with confidence that they were measuring polychlorinated biphenyls.

Due to the nature of the pyrolytic process, the laboratory was not able to identify the exact or specific PCB being burned. It is doubtful that the technology exists that could identify the particular PCB being pyrolyized in a chamber containing municipal and solid wastes.

The results of monitoring the Stamford incinerator led EPA Region 1 to express concern over possible health ramifications stemming from discharge of PCB at the concentrations determined.

The Stamford incinerator operates in the 1000°F range. As such, PCB destruction does not occur in the same manner as with high temperature incineration, and measurable amounts of PCBs are thus discharged.

Region I asked the Health Effects Research Laboratory in Research Triangle Park, North Carolina, if based upon the incinerator test results of emissions amounting to 0.5 pounds per day (ppd) of PCBs, they could assess the health effects of this discharge and determine the ambient air quality impact.

Carl G. Hayes, Ph.D., Chief, Air Pollutants Branch for Research Triangle Park responded:

"Data provided by EPA Region I, have been used to estimate incremental ambient air coneentrations of PCBs from the subject sludge/refuse incinerators. Modeled (AQDM) estimates of annual concentrations ranged only up to 6 X 10^{-6} ug/m^3 within 8 km of the stacks.

"Limited data suggest that this source probably contributes a small increment to levels existing regionally from other sources and does not alone constitute a substantial hazard to public health. However, when properly considered in the context of relatively higher exposures from dietary sources which are thought to allow a narrow margin of safety, even small additions to environmental burdens should be avoided whenever possible."

Other areas within Connecticut which have been suspected of containing PCBs include the Still and Connecticut Rivers. Extensive studies of these two waterbodies have never been undertaken. However, in early 1976, the Housatonic Valley Association (a private organization) took samples of sediment at three locations in the Still River, the results of which indicated the existence of PCBs within the River.

	LOCATION	QUANTITY OF PCBs (ppm)
(1)	Danbury, Ct., approx. 1/4 mile south (upstream of the landfill)	0
(2)	Danbury, Ct., near I-84	24
(3)	Brookfield, Ct., near Rt. 133	20

These results led the Housatonic Valley Association to believe that the Danbury landfill was the likely source of PCB pollution within the Still River. Unfortunately, no further studies were performed by either State or Federal agencies on either the landfill or the river.

All present PCB data indicates the need to do further sampling to determine the extent of PCB contamination within Connecticut. Further sampling is needed to determine sources of PCB pollution - especially to the Housatonic.

Universal Corporation is long overdue for an on-site inspection to determine its possible role as a site and source of contamination. Sewage treatment plants and landfills within the vicinity of the Bridgeport facility also need to be monitored for PCB content.

Finally, as techniques become more sophisticated for determining the ambient air concentration of PCBs, studies should be performed around the sources and sites of contamination within the State.

A P P E N D I X

Connecticut

APPENEIX CT-1

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION
State Office Building Hartford, Connecticut 06115

April 15, 1976

19 APR RECD

Mr. Dan Moon
Chemical Engineer
Solid Waste Program
U.S. Environmental Protection Agency
J.F. Kennedy Federal Building
Boston, Massachusetts 02203

Dear Mr. Moon:

Enclosed you will find maps documenting Connecticut's landfill PCB samples. I think all the information you need is given on the maps.

If you have any questions, please do not hesitate to call.

Very truly yours,

John J. Housman, Jr.
Senior Environmental Analyst
Solid Waste Management
203/566-5847

JJH/aj
Enclosures

Bristol, Conn.
ed: Bristol Municipal Hospital
from: topographic map (Quadrangle)

1 MILE
1 KILOMETER

ROAD CLASSIFICATION

Heavy duty — Light duty
Medium duty — Unimproved dirt
Interstate Route — U S Route — State

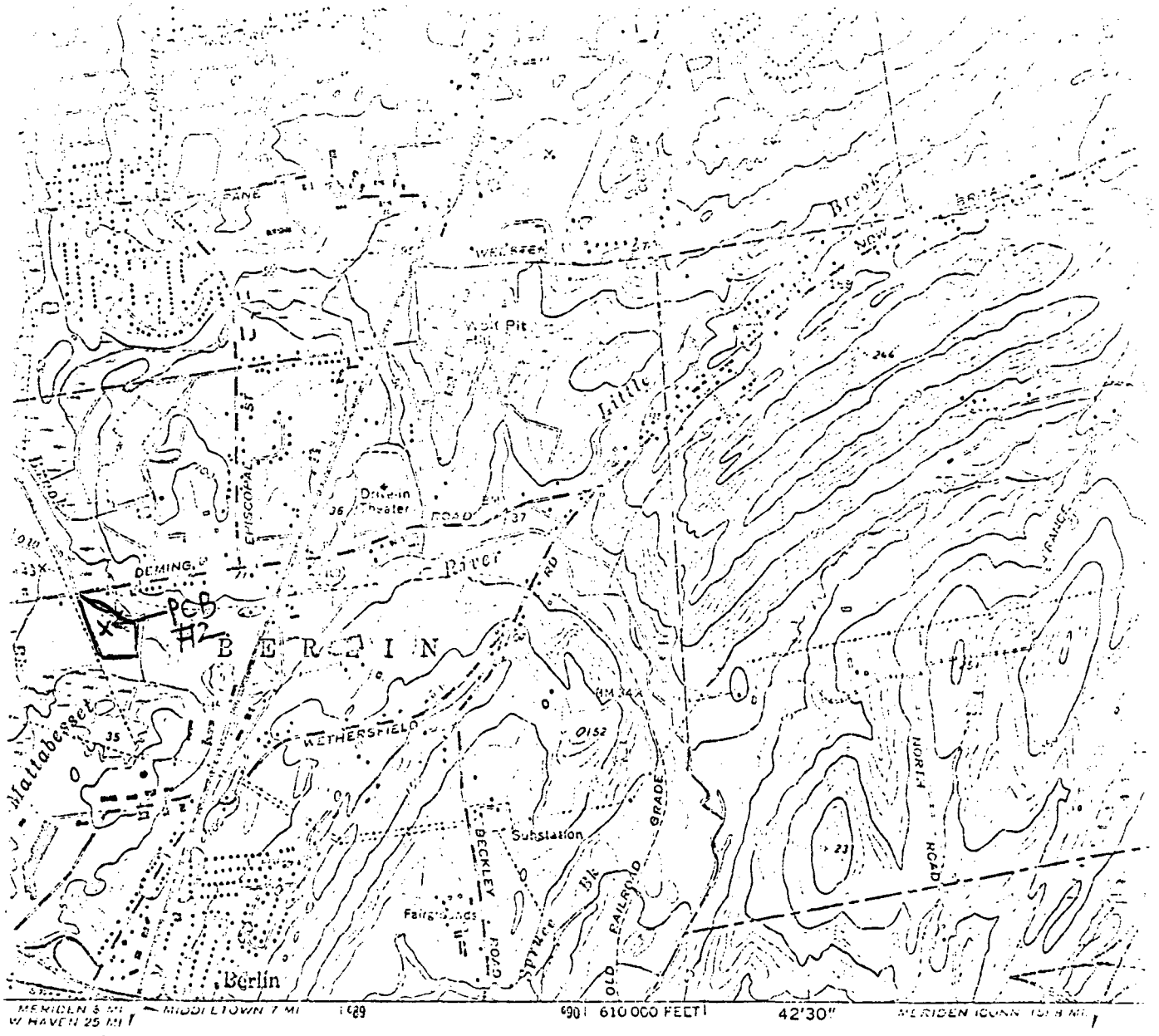
CONNECTICUT
QUADRANGLE LOCATION

BRISTOL, CONN.
N4137.5—W7252.5/7.5

1969
PHOTOREVISED 1973

ACY STANDARDS
INGTON, D. C. 20242
S IS AVAILABLE ON REQUEST

Revisions shown in purple compiled in cooperation with Connecticut Highway Department from aerial photographs



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PHOTOREVISED 1972

AMS 6467 II NW -SERIES V816

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ot grid

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station in blue

MN GN

13½°

240 MILS

1°32'

27 MILS

UTM GRID AND 1972 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

1 1

1000 0 1000

1 5

CO

DEPTH CURVES AND S

SHOREL NE SHOWN

THE MEA

FOR SALE BY U.S.

A FOLDER DESCRIBING TOPO

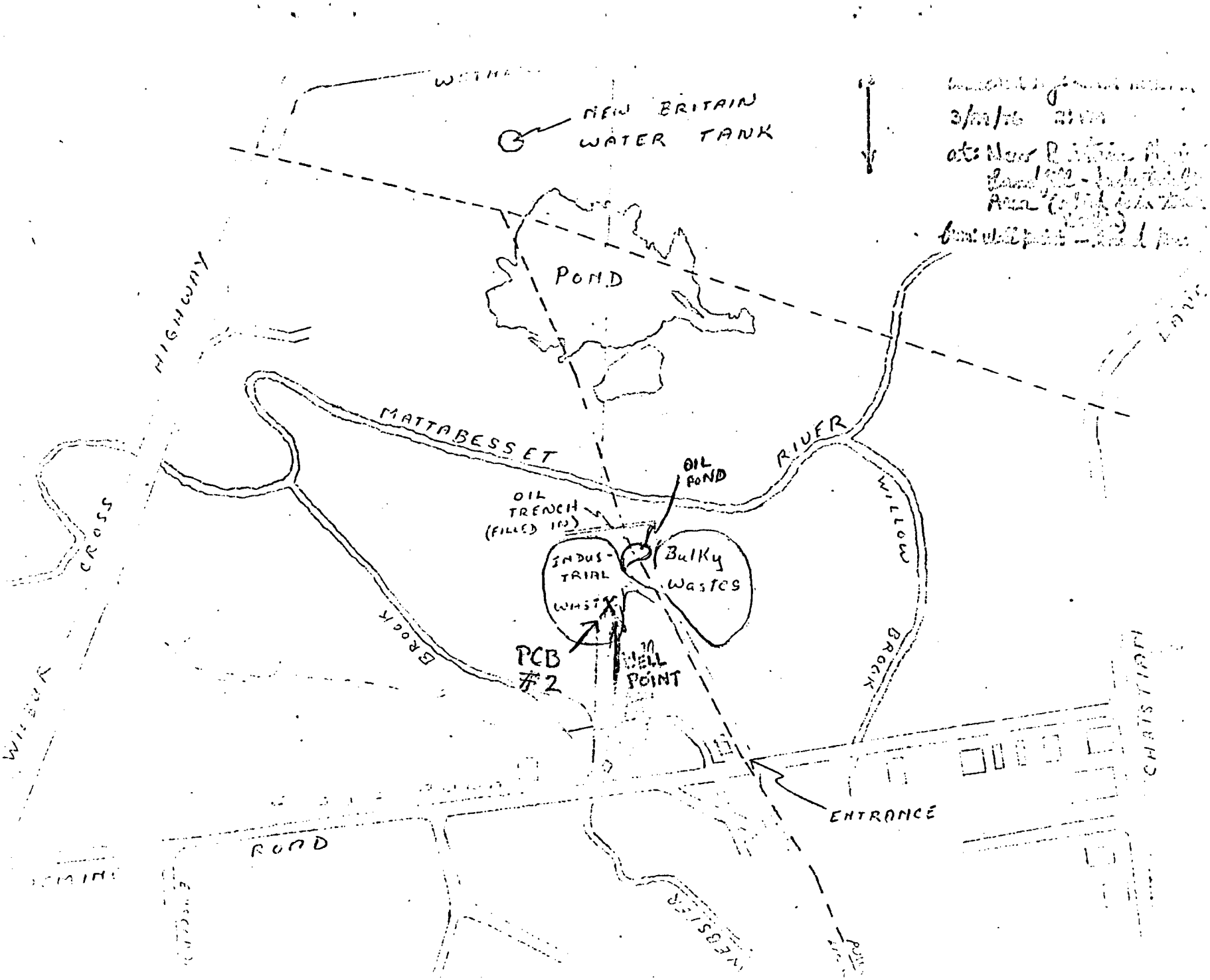
3/3/92 1:PM

a.k.: Windham Municipal Complex

for: Landfill Road

NAUGATUCK, CONN.
N4122.5—W7300/7.5

1964


NEW BRITAIN
WATER TANK
POND
HIGHWAY
MATTABESSET
RIVER
OIL
POND
OIL
TRENCH
(FILLED IN)
INDUS-
TRIAL
WASTES
Bulky
Wastes
PCB
#2
WELL
POINT
BROOK
BROOK
WILLOW
CROSS
ENTRANCE
ROAD

MEMORANDUM OF CALL

TO: Bob [illegible]

☐ YOU WERE CALLED BY— ☐ YOU WERE VISITED BY—

[illegible] Dunbar

OF (Organization)

☐ PLEASE CALL → PHONE NO. CODE/EXT.

☐ WILL CALL AGAIN ☐ IS WAITING TO SEE YOU

☐ RETURNED YOUR CALL ☐ WISHES AN APPOINTMENT

MESSAGE

You talked with a — (Ray Dunbar — how [illegible] would like to [illegible] with you — .

RECEIVED BY	DATE	TIME
Barb	2/8	2:35

STANDARD FORM 63
REVISED AUGUST 1967
GSA FPMR (41 CFR) 101-11.6

63-108

CEM DWN No.: 811

Contract No.:

Charge No.: 4197

Assigned to:

APPENDIX
CT-2

1 copy

PCB General

CEM DRAFT WORKING NOTE

PCB'S IN THE HOUSATONIC RIVER

Lynn E. Johnson

May 1976

Updated Version to be Sent 3/

CEM The Center for the ENVIRONMENT & MAN, Inc.
275 Windsor Street Hartford, Connecticut 06120 203 549-4400

1.0 BACKGROUND

PCB's have been identified as a possible hazard to human health in the Housatonic River downstream of the General Electric plant in Pittsfield.

PCB stands for polychlorinated biphenyls, a family of chlorinated hydrocarbons closely resembling DDT, which was banned by the Environmental Protection Agency in 1972 because of its persistence in the environment, sometimes up to fifteen years after application. PCB's are even more persistent than DDT, and in addition are known to have serious human health effects. PCB's are essentially unalterable by any naturally-occurring biological, chemical, or physical process. In fact, the only known way to destroy them is by incineration at a temperature of 2700°F. This extraordinary stability allows PCB's to bioaccumulate in fish by a factor of up to 7,500. Small fish may eat small amounts of the chemical, larger fish eat the smaller fish; and man, as the last link in the food chain, ingests all of the PCB's accumulated in all the fish down the chain. This can be a toxic amount.

The health effects associated with PCB's include eye discharge, acne, ulcers of the uterus, abnormal skin pigmentation, and reproductive failure. Concentrations as low as 2.5 and five parts per million (ppm) have produced adverse effects in monkeys including loss of facial and neck hair and development of rough skin texture and acne. Pregnant females showed an abnormally high incidence of miscarriage, resorbed fetuses, still births, and undersized infants. Reproductive failure has also been noted in birds and mink that feed on PCB-contaminated fish. These animal effects were confirmed for humans in Japan in 1968, where over 1,000 people suffered adverse health effects after using rice oil that had been contaminated with PCB.

PCB's have had numerous industrial applications including brake fluid, fire proofing, paint and ink solvents, textile coatings, epoxy glues and cements. However, since 1972, the use of PCB's has been limited to closed electrical systems. PCB's are still used by General Electric and other producers of electrical equipment in transformers and in making printed circuit boards, because no other known chemical has the same stability, plus high resistance to heat and explosions. Useful as these materials are, they will probably be phased out in the U.S. in the near future.

2.0 EPA ACTIVITIES

2.1 Monitoring

The EPA has initiated a major monitoring and enforcement program which includes: (1) collection and analyses of fish, water, and sediment samples;

(2) a survey of New England industries to discover previously unsuspected sources of PCB's; (3) review and possible modification of federal "clean-up" permits to reduce or eliminate PCB discharges; (4) monitoring of selected landfill sites; (5) monitoring of selected public drinking water supplies; and (6) air monitoring at selected municipal incinerators.

Analyses of fish recently collected in the Housatonic River below Pittsfield, Massachusetts have revealed concentrations approximately three and seven times the five parts per million (ppm) tolerance level established by the U.S. Food and Drug Administration (FDA). The Massachusetts Division of Fisheries and Wildlife collected specimens from the Housatonic River, site of the General Electric plant in Pittsfield, Massachusetts. The specimens were analyzed by EPA's Needham Laboratory, and the results are of concern. Two of the three composite samples taken showed FDA standard violations. A composite of the fillet and skin sections of three trout taken upstream of the General Electric outfall showed PCB levels of .28 ppm, well below the FDA standard. However, a similar composite taken one and one-half miles downstream had PCB concentrations exceeding the standard by a factor of more than three; and a composite sample of bass taken at Woods Pond, an impoundment about ten miles downstream, showed levels almost seven times the standard.

Ambient water values in the Housatonic ranged from approximately .03 parts per billion (this is about the lowest detectable limit) upstream of the General Electric outfall, to .42 parts per billion below the outfall, and down again to the detection level further downstream. Sediment readings taken from the river bottom ranged from .05 ppm upstream, to 139 ppm, 26 ppm, 54 ppm, and 1.4 ppm successively downstream, with an anomaly of 134 ppm occurring at the inner dam face in Woods Pond.

2.2 Regulation

The General Electric discharge is the only known industrial source of PCB's in New England waters. The discharge is well within the average 0.25 pounds per day limit specified by the company's federal discharge permit. For purposes of comparison, prior to September 10, 1975, the General Electric plant in New York discharged an average of thirty pounds per day into the Hudson River. The Pittsfield plant disposes of almost all of its waste PCB's through a special incinerator. The less than one pound per day that is discharged is dissolved in the water and cannot be removed by any known process. The residue is not due to any current production process at General Electric but to the disposal of PCB contaminated oil which has leaked into the ground over the years. GE pumps water

and from the ground, separates the oil and burns it, along with the PCB's, in the incinerator.

However, the monitoring data are extremely difficult to interpret according to EPA Region I Administration, John McGlennon (1976):

> "On the basis of our sampling, we suspect that PCB's in sediment are entering the food chain, but we need to do additional testing to confirm this connection. More important, we have no idea how to remove and dispose of PCB's in sediment. Even if all PCB discharges were eliminated tomorrow, the PCB's that have already accumulated in the sediment may persist for decades to come. In my opinion, this situation is another illustration of the need for toxic substances control legislation which would allow us to restrict dangerous substances before they enter the environment."

The EPA is conducting a comprehensive review of all federal "clean-up" permits, with the goal of modifying those permits to eliminate as much PCB discharge as possible. They will be meeting with the head of all companies in New England known to be using PCB's to discuss how they can eliminate PCB's from their waste water discharges. Other aspects of the monitoring program, noted above, are being carried out by EPA. Most recently, EPA sampled a number of municipal water supplies, including that of Pittsfield, and found no PCB's.

In summary, EPA does not think that PCB's represent any immediate cause for alarm in New England. There is no need for New Englanders to stop eating striped bass or any other fish because of possible PCB contamination (EPA, October 1975). However, the EPA notes that the PCB problem is a serious and complex one. A great deal of research remains to be done on the extent of the problem, on the health and ecological effects of PCB's, on the development of acceptable substitutes for industrial use, and on control technology (EPA, February 1976). This research has a high priority throughout EPA. Sources of PCB's to the Housatonic River have been identified and EPA is working closely with General Electric representatives to minimize the threat of PCB's through high temperature incineration.

3.0 SEDIMENT TRANSPORT

Questions remain, however, concerning the length of time of residence, and ultimate fate of sediments contaminated with PCB's. Review of time-of-travel and flow velocity data sheds some light, albeit dimly, on these questions. Time-of-travel data have been collected only during low flow periods, but equivalent data for higher flow conditions can be generated using the relation developed from the Manning equation (LMS, 1975):

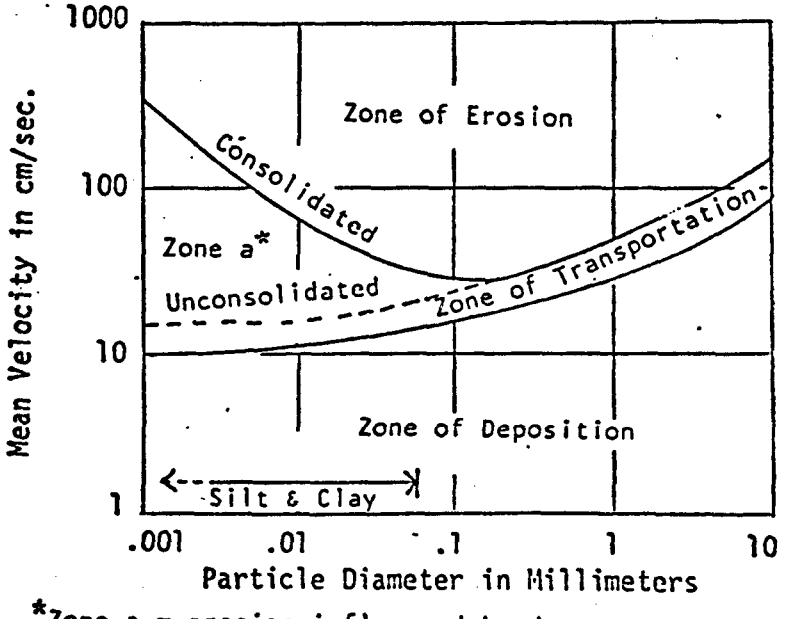
where

t_1, Q_1 = travel time and average flow of a given reach for future conditions, respectively.

t_2, Q_2 = travel time and average flow of a given reach for known conditions.

Application of the above relation was made to several reaches of the Housatonic River in order to develop flow versus velocity relations for various reaches (velocity = reach length divided by t_i). The results of this analysis are summarized in Figure 1.

Using the flow-velocity relation, the frequency of velocities above a given threshold level at which net deposition ceases and net scour begins can be determined. Although this critical erosion velocity varies according to the character of the sediments and other factors, a rough estimate ranges from 10 to 30 centimeters per second (0.36 to 1.08 kilometers per hour). The relations between erosion, transportation, and deposition velocities and the grain sizes of sediments are summarized in Figure 2.



*Zone a = erosion influenced by degree of consolidation.

Figure 2. Erosion-deposition criteria for different grain sizes (Postma, 1968).

The frequency at which critical erosion velocities are reached can be obtained from flow duration and flood frequency curves developed at USGS gaging stations in the watershed. Relating the reach flows to flows at the Great Barrington gage

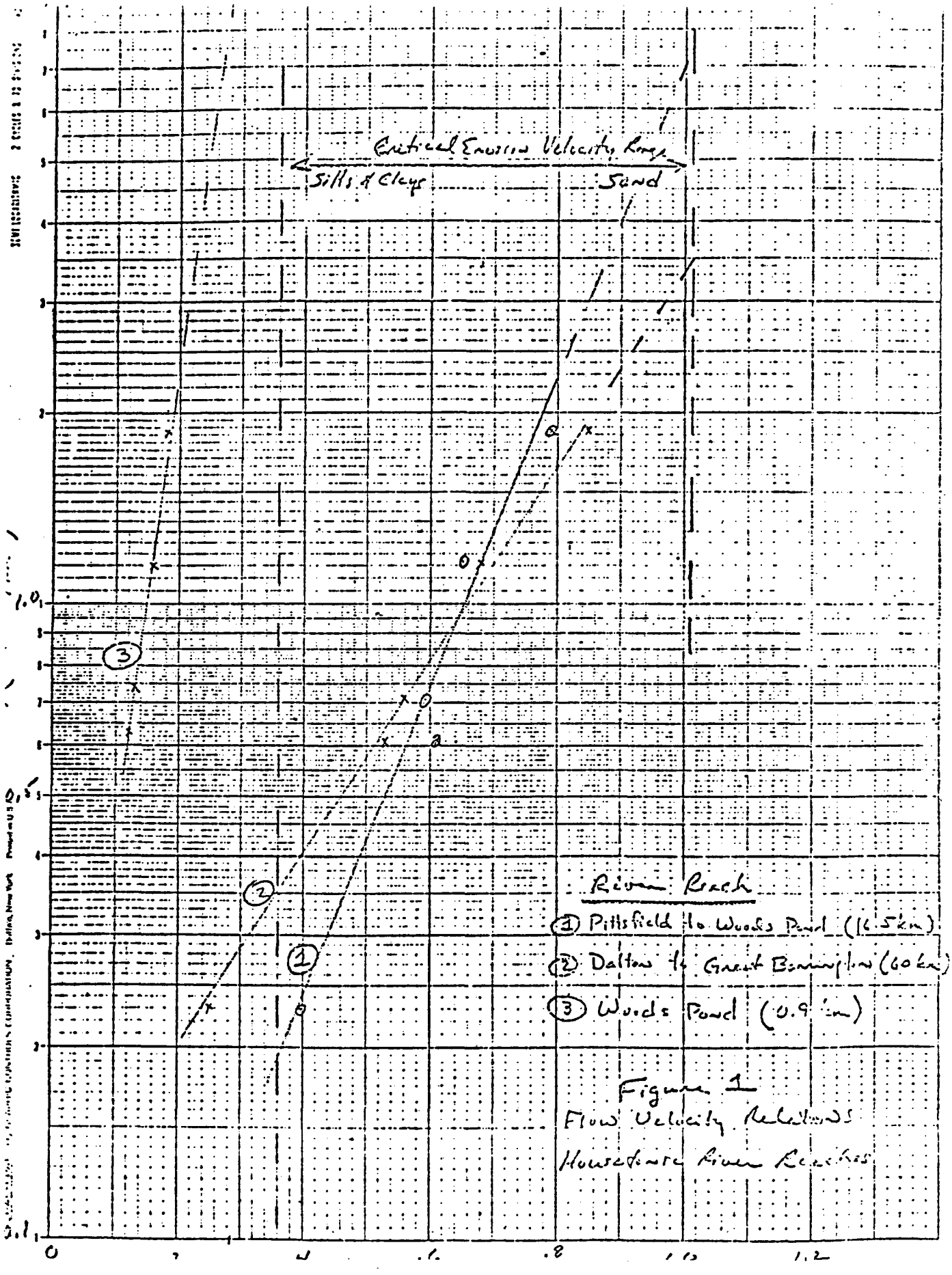


Figure 1
Flow Velocity Relationships
Housatonic River Reaches

permits the determination of velocity frequency. Table 1 summarizes the reach characteristics, flow levels at which the critical erosion velocity range is reached and the estimated frequency of occurrence of these flow levels.

TABLE 1

SUMMARY OF FREQUENCY OF OCCURRENCE OF CRITICAL EROSION VELOCITY

Reach	Length (km)	Flow at V_c ($m^3/min/km^2$)	Frequency of Occurrence
1. Pittsfield to Woods Pond	16.5	0.2 to 7.0	95% of day to once per year
2. Dalton to Great Barrington	60	0.35 to 3.5	80% of days to 10% of days
3. Woods Pond	0.9	> 35.	Greater than 100 year flood

Several conclusions can be drawn from the results of this analysis. Over a long reach of the river (exemplified by Reach 2) one could conclude that sediments would be eroded and transported out of the system quite readily. Even flow velocities which would erode the sand sized particles are achieved about 10 percent of the days. However, a closer look at slower velocity sections, such as Woods Pond, shows that scouring velocities for even the fine grained elements (e.g., silts and clays) are not achieved except during relatively rare flood events. Therefore, during lower flow conditions, sediments would tend to accumulate in Woods Pond. That this occurs is indicated by the gradual development of emergent marsh deposits near the inlet to Woods Pond. Woods Pond, and other quiescent water bodies along the Housatonic River, such as Lakes Lillinonah and Zoar in Connecticut, act as sediment traps and sediments contaminated with PCB's would tend to be concentrated in these river reaches. It is likely, however, that these sediments would be progressively covered as further deposition takes place and thereby be removed from the recycling activities of bottom organisms--at least, until a large flood resuspends these sediments. The rate of travel of PCB contaminated sediments from their source to Woods Pond (Reach 1) can be expected to be relatively rapid with even the coarser sized particles being eroded and transported at least once per year. Thus, the river sediments above Woods Pond should be cleared of contamination within a year or two upon cessation of discharge.

REFERENCES

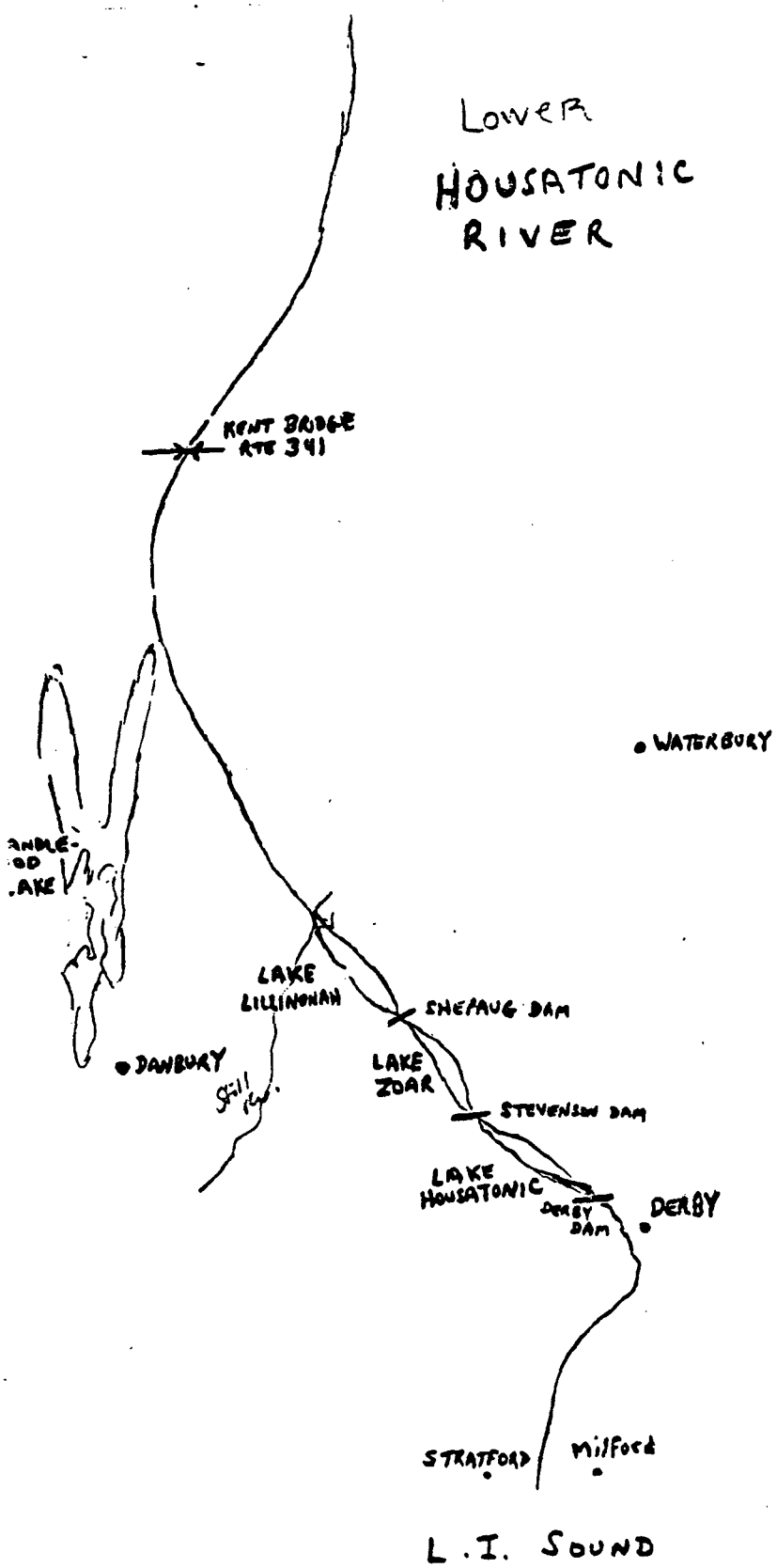
EPA, October 1975, PCB's in the Environment, in EPA's Region I, Environment News, pp. 17-18.

EPA, February 1976, Region I and PCB's, in EPA's Region I, Environment News, pp. 10-11.

EPA, January 1976, PCB Data for Housatonic River, May and June 1972, and August 1975. Letter to Mr. Richard Holmes, BCRPC (with enclosures) from Mr. Ray E. Thompson, EPA Sanitary Engineer.

Lawler, Matusky and Shelly, Engineers, 1975, Housatonic River Water Quality and Quantity and Environmental Impact Assessment Studies, Draft, prepared for the National Commission on Water Quality.

Postma, H., "Sediment Transport and Sedimentation in the Estuarine Environment," in Estuaries, edited by G. H. Lauff, Michigan State University, Publication No. 83, AAAS, Washington, D.C., 1967.


Lower
HOUSATONIC
RIVER
KENT BRIDGE
RTE 341
WATERBURY
LAKE
LILLINONAH
SHEPAUG DAM
DANBURY
LAKE
ZOAR
STEVENSON DAM
LAKE
HOUSATONIC
DERBY
DERBY
DAM
STRATFORD
Milford
L. I. SOUND

M A I N E

MAINE

A scrap yard located on the north side of Rt. 17 (Togus Rd.), Augusta,- the F. O'Connor Co. had evidently been the recipient of PCBs from reject capacitors and transformers from local utilities. First investigated in 1972 by Maine's DEP Oil Division due to an alleged oil spill in Riggs Brook, (that originated within the O'Connor yard) the on-scene investigation showed uncontained oil from a transformer recovery operation had overflowed a holding pond within the Riggs Brook drainage.

A subsequent visit to the site in the summer of 1976, found two lagoons constructed. Each lagoon covering approximately 2,000 sq. ft. and fitted with an inverted "U" shaped overflow pipe to prevent the loss of floating oil. Drainage is from the O'Connor Co. yard to the first lagoon to the second lagoon to Riggs Brook, which meanders in a northerly direction to the Kennebec River. During this visit a sample of oil from the first lagoon was procurred. Analysis by the U.S. Environmental Protection Agency laboratory indicated PCB levels of 10,000 to 20,000 ppm (1 - 2%) in the oil.

On the basis of the initial results, further sampling was conducted by members of Maine's DEP, Laboratory and Field Services Division and Oil Division on December 2, 1976. The samples were analyzed by the EPA Region 1 laboratory for PCBs. The results were as follows:

Sediment 1st lagoon	:	200 ppm (dry weight)
Discharge 1st lagoon	:	0.48 ppb
Sediment 2nd lagoon	:	44 ppm (dry weight)
Discharge 2nd lagoon	:	0.35 ppb
Sediment 2nd lagoon	:	45 ppm (dry weight)

On the basis of these results, Maine DEP made the following assumptions:

Assuming a flow in Riggs Brook of 1 cfs on the low side and 10 cfs on the high side, and furthermore, assuming that the entire PCB discharged from the second lagoon reaches the brook, then the range of PCB in Riggs Brook is calculated to be 0.4 to 4 ppt (parts per trillion). Dilution in the Kennebec River renders the PCB unmeasurable for all practical purposes.

Additional samples were last taken on March 15, 1977 during runoff. The estimated flow in the lower lagoon at that time was 0.4 cfs. The results of samples taken from the overflow pipes of the upper and lower lagoon indicated that they contained less than 2 ppb PCB. It should be noted that 2 ppb is the detection limit for the analytical procedure employed.

According to Gardner Hunt, Chief, Water Quality Division for Maine's DEP, the State is taking enforcement action against O'Connor's scrap yard in order to rectify the existing PCB problem.

As of April 1977, transformers were no longer being dumped at the Augusta site. They are instead sent out to a site in Ohio equipped with incineration facilities. The O'Connor dump site was also reconstructed such that stormwater would not enter the lagoon area and overflow from the lagoons has been eliminated.

Samples taken from a storage tank on the O'Connor facility were sent by Maine DEP to EPA's Regional laboratory in late April. Subsequent analysis of the sampled transformer oil showed PCB levels of 2160 and 2170 ppm, mostly as Aroclor 1242 with some Aroclor 1260 present.

Oil waste in the lagoons and on surrounding ground is being removed for disposal and should be completed by the end of the Summer of 1977. Maine's DEP has asked for advice from EPA on disposal of diluted PCB liquid in the lagoons and PCB sediments in the stream.

The only other sampling in Maine for PCBs was performed by EPA Region 1's Solid Waste Program. In March 1976, two municipal disposal sites (receiving primarily residential wastes) were sampled and analyzed for PCBs. Surface leachate was collected from both the Bangor and Waterville municipal disposal areas. Subsequent analysis failed to detect the presence of PCBs in either sample.

Maine's Department of Human Services has informed EPA Region I that beginning in the Fall of 1977, they will start sampling the public water supplies that have surface supplies in compliance with the Safe Drinking Act. Maine plans to sample between 80 and 150 water supplies for the chemicals and will concurrently monitor for PCBs.

N E W H A M P S H I R E

NEW HAMPSHIRE

PCBs were first analyzed in New Hampshire as a result of the U.S. Bureau of Sport Fisheries and Wildlife having sampled fish near the Lowell water intake in Lowell, MA. These samples were collected on October 6, 1970 from the Merrimack River four miles south of Tyngsboro Bridge on Route 3A near Lowell, MA as part of the National Fish Monitoring Program.

These samples were analyzed by a commercial laboratory and found to have from 1.87 to 6.12 ppm (wet weight) of PCB. At this time no standard for PCBs in fish had been set, but the guideline value was 5.0 ppm.

The relatively "high" values of PCBs found in the Merrimack fish samples prompted Congressman F. Bradford Morse to request that EPA - Region 1 sample water from the Merrimack River in both New Hampshire and Massachusetts. Concern with the Merrimack was rooted in the fact that it serves as the source of drinking water for many communities.

In accordance with the above mentioned request, water samples of the Merrimack River were taken on August 13, 1971 from above Nashua, New Hampshire to the Lowell water intake. Subsequent analysis showed all of the water sampled to be negative with respect to PCBs.

In addition to the water sampled, sediment samples were obtained on August 31, 1971 from above Nashua, New Hampshire to the Lowell, Massachusetts water intake area. Results indicated PCB content in the Merrimack sediment ranging from 0.33 to 11.1 ppm of PCB as 1232 (calculated on a wet weight basis).

Simultaneously, several industrial plants in Massachusetts and New Hampshire which were suspect users of PCBs were inspected. Inspections failed to detect any PCB users within the area of concern. Since at this time PCBs were being used in a variety of open systems ranging from printing ink to hydraulic fluid, as well as closed systems, it was speculated that the PCB contamination in the Merrimack was due to the contribution of numerous small sources.

It should be noted, that at the time the Merrimack was analyzed for PCBs - only two previous determinations of PCB values in water had been recorded - one in Florida and the other in Arizona. Thus, at the time of analysis neither the analytical procedure employed or an understanding as to the significance of results was fully developed.

The next assessment of the existence of PCBs in New Hampshire did not take place until the early part of 1976 when Governor Thomson at the prompting of then EPA Administrator, Russell E. Train, requested that appropriate steps be taken in order to evaluate the PCB situation in New Hampshire.

The Fish and Game Dept. of New Hampshire reported PCBs to be present at low levels in most of the fish and wildlife within the State. All data, however, failed to indicate levels in excess of the 5.0 ppm FDA standards.

The Granite State Electric Company which serves New Hampshire and is a subsidiary of New England Electric; reported that transformers using askarel, (a synthetic insulating oil containing PCBs) numbered approximately 275, and were located in Massachusetts and Rhode Island - not in New Hampshire.

Virtually all capacitors in service within the State contain askarel. These were considered to present a minimum threat to the environment since all were in enclosed systems. Both failed and obsolete units are held for proper future disposal and are thus considered not to serve as sources of PCB contamination.

The overall picture depicted by New Hampshire was that there were no serious PCB problems within the State and further, that no potential sources of PCB contamination appeared to exist within New Hampshire.

Finally, it should be noted that in 1976 when this assessment was performed, New Hampshire had neither the capability nor facilities to test for PCBs. New Hampshire's DEP laboratory was set-up to perform PCB analyses as of Spring 1977. To date, no data has been generated on PCBs from that facility but the capability now exists if the need should arise in New Hampshire.

R H O D E I S L A N D

RHODE ISLAND

To date, Rhode Island does not appear to have any appreciable problems associated with PCB contamination.

The State Department of Health, Division of Water Supply & Pollution Control performed limited sampling of shellfish within Rhode Island as part of EPA Region I's Background Station Program.

Shellfish samples taken on May 20, 1973 at Sakonnet River in Island Park, Upper Narragansett in Longmeadow and Pawcatuck River in Watch Hill, Rhode Island all showed PCB levels of less than 0.1 ppm as Aroclor 1248; less than 0.04 ppm as Aroclor 1254 and less than 0.05 ppm as Aroclor 1260. These concentrations were all based on 20 grams of shellfish meats.

Shellfish and sediment samples were also collected on May 26, 1974 for pesticide analysis by EPA's Pesticides Monitoring Laboratory, Bay St. Louis, Mississippi. The results are as follows:

Location	Sample	PCB Content in ppm (Aroclor 1254)
Pawcatuck River, Watch Hill, R.I.	Oyster and mud	0.167 (167 ppb)
Sakonnet River, Fogland Pt., R.I.	Hard clam and mud	*N.D.
Greenwich Bay, Sally Pt., R.I.	Hard clam and mud	N.D.

* Not Detectable - the sensitivity of the test is 0.01 ppm (10 ppb).

Rhode Island's Dept. of Health also performs routine scans on drinking water and river water samples for chlorinated pesticides; and thus far, PCBs have not been encountered.

The EPA laboratory in Narragansett, Rhode Island was also contacted and reported that if any analyses for PCBs were performed for Rhode Island, the EPA lab in Gulf Breeze, Florida would be the place to contact.

Dr. Phil Butler from EPA Gulf Breeze did do a study of fish in New England for PCBs which included samples from Rhode Island. This study was part of a nationwide program (The Cooperative Ocean Monitoring Program) performed in

conjunction with the Division of Marine Fisheries. The University of Rhode Island did the fish sampling and sent samples to Gulf Breeze for subsequent analysis.

All Rhode Island samples were taken from Narragansett Bay in the West Passage. Results are in Table 1.

EPA Region I was involved in monitoring PCB land disposal sites within New England. Sanitary Landfill Inc., located in Cranston, Rhode Island which receives PCB waste from major PCB users was sampled on April 8, 1976 as part of the above program. Two groundwater samples were ascertained by EPA and subsequently analyzed for PCBs. Results indicated a concentration of 2 parts per billion (ppb) PCB as Aroclor 1254 in one sample while the other sample's PCB level was below the limit of detection (0.001 ug/ml or 1 ppb) for the analysis.

The only other data available on Rhode Island is that of test results on ambient air sampling found in the New England PCB Waste Management Study, conducted by the Solid Waste Program, EPA Region I.

Table 7 of their report indicates the following results:

Location of Tests	Date of Testing	Agency Sponsoring Tests	Concentrations (ng/m^3*)	Concentrations (lbs/scf)
URI - Kingston	Jan/Feb '73	University of R.I.	2.1 to 5.8	1.3 to 3.6 X 10^{-13}
Providence, R.I.	May 1973	University of R.I.	9.4	5.9 X 10^{-12}

* ng/m^3= nanograms per cubic meter.

Evaluation of the results on ambient air testing is difficult; environmental significance cannot be determined due to the "lack of a standardized test procedure and the absence of health effects information for non-occupational exposures."[1]

1. New England PCB Waste Management Study, EPA Region 1, Nov. 1976 pg. 39.

Table 1

Year	PCB (1254)* White Flounder	Little Skate
1972	406	477
"	460	465
1973	274	511
"	416	797
"	---	---
"	---	---
1974	239	524
"	162	374
"	200	184
"	170	171
1975	234	241
"	232	214
"	---	---
"	---	---
1976	335	217
"	221	356

* All data is expressed as mg/kg or parts per billion (ppb); whole body weight; juvenile fish.

V E R M O N T

VERMONT

A major report on the impact and status of PCBs in Vermont was completed in April 1976 by James W. Morse, II, Aquatic Biologist and Virginia Garrison, Environmental Technician under the Agency of Environmental Conservation, Department of Water Resources, Water Quality Division. This report is attached in its entirety and represents the most up-to-date assessment performed by the State of Vermont.

In addition to the State's report, EPA Region I has over the past several years, acquired data on the occurrence of PCBs within Vermont.

Jard Company, Inc., located in Bennington, Vermont was formed in 1970 by former employees of Sprague Electric Company, North Adams, Massachusetts. The plant was constructed in 1970 and is the most modern of the New England capacitor manufacturing plants.

In January 1976, 8-hour composite samples were taken by EPA from each major user of PCBs within New England. Results for the Jard Company, Inc. samples were as follows:

Company	Date Sampled	Total PCB Discharged (ounces)	Amount of PCB to Municipal STP (ounces)	Amount PCB Discharged Directly to Environment
Jard Co., Inc.	1/21	.31	.31	--
Bennington, Vt.	1/22	.09	.09	--

The PCB level in the wastewater effluent from the Bennington, Vermont sewage treatment plant was analyzed for and found to be less than the minimum detectable level of the analysis (0.5 and 0.1 parts per billion, depending on the standard used).

During January, March and May, 1976, EPA Region I's Solid Waste Program conducted a PCB sampling program of land disposal sites.

The Municipal Landfill at Bennington was extensively sampled including various groundwater, leachate, private wells and industrial lagoons. Results of this sampling program are contained in the "New England PCB Waste Management Study" report and are indicated in Table 1.

No further sampling or analysis for PCBs has been performed in Vermont either by State or Federal agencies since 1976. The only other action taken on PCBs in Vermont is that their Water Quality Standards are currently undergoing revision by the Agency of Environmental Conservation, Water Resources Board.

The recommendation is to have PCBs fall under "Rule 12: Chemical, Radiological Constituents". In essence, this would allow for no discharge of PCB above background levels, i.e., no discharge of wastes containing PCBs in detectable amounts would be allowable, "either to waters of the State or to a municipal waste collection and/or treatment system provided that in those cases where a process water contains an incoming level of PCB due to natural or other causes, the concentration in the actual waste discharge shall not be increased."*

Active monitoring for PCBs has not been undertaken since 1976; therefore, several areas of concern should be addressed:

Jard Company, Inc. (Vermont's only major user of PCBs) is due for an on-site inspection to determine if PCBs have been contained or if the plant is serving as a source of contamination.

The Bennington Landfill serves as the recipient for all faulty, unusable capacitors containing significant amounts of PCBs which are manufactured by Jard. As such, it should be monitored periodically to determine whether PCBs are leaching from the landfill.

1976 results for PCB analyses of water pumped from sample wells in the vicinity of the landfill did not indicate any groundwater contamination by PCBs. Vermont did, however, point out the need for future monitoring of the landfill as it is a potential source of contamination. Samples taken from an industrial lagoon in the Bennington Landfill indicated high concentrations of PCBs (60-120 ppm) in the liquid sampled. On the basis of these results, further sampling was indicated but never performed. Additional sampling of the lagoon would help in determining the sources and extent of contamination to the area.

Kittle Brook, which flows from the Bennington Landfill, was used as an indicator in 1976 as to whether PCBs were leaching. It should again be sampled for PCB contamination.

Other waterbodies which need to be monitored include the Hoosic and Walloomsac Rivers in Vermont. Surveying these two rivers serves to distinguish between two possible sources of PCB contamination: Sprague Electric Co., a major user of PCBs located in North Adams, MA., which discharges into the Hoosic River in Massachusetts before the river flows into Vermont, and Jard Company, Inc., which discharges to the Bennington, Vermont wastewater treatment plant and eventually to the Walloomsac River in Vermont.

Sampling fish, water and sediment in the Hoosic and Walloomsac should be performed periodically, and will help in assessing whether PCB contamination is existent and if so, to what extent within the State.

* Proposed Revision (5/24/77), State of Vermont, Agency of Environmental Conservation, Water Resources Board.

Table 1

PCB Land Disposal Site Monitoring Results

Site Location Sampled	Type of Sample Collected	Sampling Method	Date Sample Taken	Analytical Results 1016	1254	1260
Bennington, Vermont Municipal Landfill	1. Groundwater (L-1)	pump existing wells	1/20/76	N.D.[1,2,3]	N.D.	N.D.
	2. Groundwater (D-2)	" " "	1/20/76	N.D.	N.D.	N.D.
	3. Groundwater (D-3)	" " "		N.D.	N.D.	N.D.
	4. Leachate Seep-A	grab sample	"	N.D.	N.D.	N.D.
	"	"	3/31/76	1300ppb	N.D.	N.D.
	5. Leachate Seep-B	"	5/4/76	liquid[4] 1ppb	N.D.	N.D.
				sediment 72ppb	52ppb	N.D.
	6. Leachate seep-C	"	5/4/76	liquid 5ppb	5ppb	N.D.
				sediment 110ppb	38ppb	N.D.
	7. Leachate seep-D	"	5/4/76	liquid 85ppb	N.D.	N.D.
				sediment 3900ppb	N.D.	N.D.
	8. Leachate seep-E operating lift	"	5/4/76	sediment 760ppb	N.D.	N.D.
	9. Leachate seep-F	"	5/4/76	liquid N.D.	N.D.	N.D.

PCB Land Disposal Site Monitoring Results

Site Location Sampled	Type of Sample Collected	Sample Method	Date Sample Taken	Analytical Results 1016	1254	1260
	10. Private Well	pump existing well	5/4/76	N.D.	N.D.	N.D.
	11. Industrial Lagoon	"	3/18/76	liquid 210000ppb	N.D.	N.D.
				sediment 4.0×10^7	N.D.	N.D.
	12. Industrial lagoon	"	3/31/76	liquid 60,000ppb	N.D.	N.D.

4

Footnotes

1. Not detected. This indicates that the PCB level was below the detection limit. The detection limit when extracting 1,000 ml of water is 0.001 ug/ml (1 ppb). However, the detection limits of some of the Aroclors in these samples are higher because large amounts of one of the other Aroclors in a sample required that dilutions of that sample extract be used for quantification.

2. Unless otherwise indicated, PCB analysis performed by EPA National Enforcement Investigation Center, Denver, Colorado.

3. The gas chromatographic pattern of Aroclor 1016 greatly resembles that of Aroclor 1242 and it is not always possible to distinguish one from the other, especially in the presence of other Aroclors.

4. Samples with high solids content were centrifuged with the resultant liquid and solid fractions separately analyzed for PCBs.

APPENDIX

Vermont

APPENDIX VT-1

PCBs IN VERMONT

by

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Aquatic Biologist

Virginia Garrison
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AGENCY OF ENVIRONMENTAL CONSERVATION
DEPARTMENT OF WATER RESOURCES
WATER QUALITY DIVISION

April 1976

Table of Contents

Purpose

The possible detrimental environmental impact of the widespread use of polychlorinated biphenyls (PCBs) has been under study for several years. In the light of recent developments concerning PCB contamination in neighboring states, the Vermont Agency of Environmental Conservation directed the Water Quality Division of the Department of Water Resources in September 1975, to initiate a program to investigate the possibility of PCB contamination in Vermont. Although this program has not yet been completed, the authors feel it is necessary that the Agency of Environmental Conservation and the public be brought up-to-date on the results of the program.

SUMMARY

1. PCBs have recently been shown to be a substantial problem to the environment in New England. In one instance, the problem has resulted in litigation to stop industrial discharges of PCBs.

2. In September, 1975, the State of Vermont, Agency of Environmental Conservation initiated a program to investigate the possibility of PCB contamination in Vermont. Although this is a continuing program, a portion of the data has already been received and is discussed herein.

3. To date, none of the fish taken from Vermont waters and analyzed under this program have shown PCB concentrations above the present FDA limit of 5.0 ppm PCB in edible fish flesh. The concentrations of PCBs found in fish flesh have ranged from a trace in most cases to 1.3 ppm total PCBs in white suckers taken from the Hoosic River in Southern Vermont.

4. It appears that the highest levels of PCBs found in fish may be associated with influences from neighboring states.

5. There is one known industrial user of PCBs in Vermont-JARD Company, Inc. of Bennington.

6. One area of the State which has shown excessive amounts of PCBs is the Bennington Landfill. Further sampling is being done to verify preliminary results and determine the source. Leachate samples taken from wells located at the periphery of the landfill have not indicated that substantial amounts of PCBs are presently leaching from the landfill.

Background on PCBs

In the past few years the widespread use of a certain class of chemicals known as polychlorinated biphenyls, or PCBs, has become a cause for concern. PCBs have been produced commercially since 1929, however their presence in the environment was not discovered until 1966. Since that time PCB contamination has been found to be almost universal appearing in such diverse places as marine plankton from the Baltic Sea, peregrine falcons in California, and human milk.

There is only one company presently producing PCBs in the United States- Monsanto Chemical Company of St. Louis, Missouri. The compounds are marketed under the trade name Aroclor, which is usually followed by a four digit number such as 1254. Generally, the first two digits indicate the number of carbon atoms in the compound and the last two the approximate percentage of chlorine in the compound. The exception to this is Aroclor 1016, which is indistinguishable analytically from Aroclor 1242 and is usually reported as such in the data.

PCBs have had many applications in the past, including both closed and open-system uses. Closed-system uses are those where it is possible to control the collection and regeneration or incineration of spent material. These would include the use of PCBs as a dielectric fluid in transformers and capacitors. Open-system applications involve the use of PCBs in paints, lacquers, lubricants, sealers, plasticizers, printing inks and carbonless reproducing paper, to name just a few. In order to reduce the amount of PCBs entering the environment, Monsanto voluntarily restricted the sale of PCBs in the United States in 1970 to closed-system uses only. Today PCBs are mainly used as dielectric fluids for transformers and capacitors. PCBs have unique properties such as good fire resistance, high resistivity, a high dielectric strength, a relatively high dielectric constant and a very low power factor, which make them irreplaceable at the present time in such applications. Users of PCBs have been encouraged to switch to the less chlorinated PCB compounds, which are more toxic, but more easily degraded and thus less persistent.

The same properties that make PCBs useful in industry also cause them to persist in the environment, i.e., thermal stability, resistance to oxidation and hydrolysis, solubility in many organic solvents, and insolubility in water. PCBs are even more stable and persistent than DDT. They are readily absorbed into fatty tissue and resist metabolism, which means they accumulate in animal tissue. Due to a low acute toxicity,

PCBs also accumulate in the food chain, unnoticed. Eventually, concentrations are reached in individuals where chronic effects such as thin-shelled eggs in wildfowl become evident. Species at the top of the food chain are most susceptible to bio-accumulation. Peregrine falcons from off the California coast have been found to have as much as 2,000 ppm PCBs in their lipid tissue. In man, the ingestion of, or direct contact with, large quantities of PCBs can cause skin problems (chloracne) and liver ailments.

In 1973, the Food and Drug Administration established temporary tolerance levels for PCBs in foods under the authority provided in Section 406 of the Federal Food, Drug, and Cosmetic Act. These tolerance levels were based on experimental data then available which showed a "no-effect level" (the dose level below which the effects looked for were not observed) of 10 ppm for dogs and rats. Taking into account the 100-to-1 safety factor generally used when applying the results of animal experiments to human health standards, and calculating levels based on body weight and allowable daily intake, the following list of PCB tolerance levels in foods (expressed as parts per million) was developed:

1)	milk (fat basis)	2.5
2)	dairy product (fat basis)	2.5
3)	poultry (fat basis)	5.0
4)	eggs	0.5
5)	complete and finished animal feeds	0.2
6)	animal feed components	2.0
7)	fish and shellfish (edible portion)	5.0
8)	infant and junior food	0.2
9)	paper food - packaging material	10.0

The validity of these FDA tolerance levels is now being questioned (Highland 1976). Recent studies involving non-human primates have failed to establish a "no-effect level" in monkeys indicating that dogs and rats may not be as sensitive as primates to many of the toxic effects of PCBs. Also, low dosage levels over long time periods in the diets of dogs and rats may cause certain subtle changes in metabolism which were not observed in the original tests. The FDA is presently reevaluating the PCB tolerance levels established in 1973 and may lower them. The Canadian government has established a tolerance limit of 2.0 ppm PCB in edible fish flesh, which is substantially lower than the present 5.0 ppm FDA limit.

Although efforts to curtail their release into the environment have been stepped up in recent years, PCBs inadvertently enter the ecosystem in several ways. Products containing

PCBs such as plastics, carbonless reproducing paper, and spent ballasts from fluorescent light fixtures, are taken to municipal dumps for incineration or landfills for burial. PCBs do not burn at the temperatures common in open dumps, but rather are vaporized. They are then carried into the atmosphere where they collect on particulate matter and are eventually redeposited on the surface of the earth. Runoff from landfills may be another point of entry. Many of the products manufactured prior to 1970 in open-system uses are still around today, adding to the solid waste problem.

Accidental leaks of PCBs in industrial equipment and large-scale accidental spills account for additional losses of PCBs to the environment. PCB interaction with food products due to the former use of PCBs in paint, plastic, and paper, provides another source of environmental contamination.

One important source of PCBs in the environment is the point of their manufacture and the plants where PCBs are used in the manufacture of other products. PCBs can escape through plant ventilation and exhaust systems, and through waste treatment systems into sewers or directly into waterways. It may be signfiicant that the incidence of PCBs in environmental samples is highest in industrialized and urbanized areas.

PCBs in New England

New England has had its share of PCB contamination (Table I). Significant concentrations of PCBs have been found at sampling stations throughout the region in fish, water and sediments. It should be noted, however, that many of the areas sampled have shown no PCB contamination, or only trace amounts.

TABLE I
PRESENCE OF PCBs IN NEW ENGLAND SAMPLES

DATE COLLECTED	LOCATION	TYPE OF SAMPLE	PCB CONC.
1970	Lowell, Mass.-Merrimack R.	Fish	1.87-5.45 ppm 1254
1970(?)	Maine, Little Androscoggin R. below Marcal Paper Co.	Water	1.8 ppb
1971	Pittsfield, Mass.-Housatonic R., successive samples downstream of G.E.	Sediments	139,26,54,1.4 ppm
1970	New Bedford Harbor, Mass.	Menhaden	6.0 ppm

PCBs initially became a concern to the State of Vermont when their presence was discovered at high concentrations in Lake Champlain, a body of water shared by New York State and Vermont. In August of 1975 the State of Vermont was appraised of the PCB situation by members of the New York Department of Environmental Conservation. The data presented at an August 1975 meeting in Albany had been compiled from throughout New York State during several years. Of interest to Vermont, one walleye collected in 1972 from South Bay, Lake Champlain demonstrated a very high PCB level of 55.46 ppm. Samples collected from the Hudson River were often found to be high, particularly around two General Electric plants in upstate New York. Based on this data, litigation is presently underway concerning these plants.

Due to the fact that existing PCB data in New York was somewhat sketchy, an intensive sampling program was initiated throughout the state in the fall of 1975. Two stations were located in Lake Champlain--one at Ticonderoga and one at Plattsburgh. In all the fish species tested from these stations, the PCB level did not exceed 5.0 ppm, although a smallmouth bass sample from Plattsburgh approached this level.*

The pertinent New York data has been included in Appendix I-A.

Vermont PCB Monitoring Program

In the light of the New York State data, the Vermont Department of Water Resources established a PCB monitoring program in September 1975. The program consisted of three main phases, and was designed to ascertain the level of PCBs in the aquatic environment in Vermont. The first phase, intended initially to ensure the safety of the fisheries of the state, established various areas for fish sampling around the state. These areas included:

1) Walloomsac River
2) Hoosic River
3) Bennington Landfill - Kittle Brook
4) Mouth of Otter Creek
5) Burlington Harbor
6) Mouth of Winooski River
7) Mouth of Missisquoi River
8) Mouth of Lamoille River

*Due to the occurrence of some fish in the earlier New York State Lake Champlain samples which exceeded or approached the present FDA tolerance limit of 5.0 ppm PCBs in the edible flesh, the Vermont State Health Department issued a warning in late December of 1975, urging pregnant women and nursing mothers to avoid eating large quantities of walleye pike, smallmouth bass, and channel catfish taken from Lake Champlain. This warning will be reviewed when the results of the Vermont PCB sampling program are complete.

9) Lake Memphremagog
10) Connecticut River - Vernon Pool
11) Sterling Pond

These areas were selected for varying reasons. The mouths of rivers may be expected to accumulate more PCBs than other areas, and therefore fish from these areas would be the first to show significant PCB concentrations. Lake Champlain was emphasized as it is not only an important fishery, but also a water supply. Furthermore, 46.5% of the land area in Vermont drains to Lake Champlain and therefore many substances may eventually accumulate in the lake.

The Vernon Pool was selected as fish are collected from this area quite frequently in conjunction with other surveillance programs.

Significant concentrations of PCBs have been found in fish taken from the Walloomsac/Hoosic River in New York. The Hoosic and Walloomsac Rivers in Vermont were selected to distinguish between two possible sources of PCB contamination on these river -Sprague Electric Co., of North Adams, Mass., which discharges into the Hoosic River in Massachusetts before the river flows into Vermont; and JARD Company, Inc., which discharges to the Bennington, Vermont Wastewater Treatment Facility and eventually to the Walloomsac River in Vermont.

Kittle Brook, which flows from the Bennington Landfill, was chosen in order to determine whether PCBs were leaching from the landfill. JARD Co. disposes of all the faulty capacitors from its manufacturing plant in this landfill, which amounts to approximately 38,500 pounds of PCBs each year. (See JARD Co.).

Lake Memphremagog was chosen for many of the same reasons as Lake Champlain. This lake is also an important fishery, a Canadian water supply, and receives runoff from 583 square miles of land in Vermont.

Sterling Pond, on Sterling Mountain, was chosen as a control sight due to its remote location. This pond was also one of the control sights used in the mercury program.

Immediately after collection, fish samples collected from these areas were wrapped in hexane-rinsed aluminum foil and frozen whole for storage. Groups of samples were taken to the Food and Drug Administration Laboratory in Boston, Mass., for analysis throughout the winter of 1976. Edible flesh was analyzed for PCBs, pesticides and heavy metals. Those results which have been received are included in Appendix I-C. A few of the samples are still outstanding.

Phase II of the PCB monitoring program involves the collection and analysis of sediment samples from many selected stations. These areas (Table II) include many of the existing water quality monitoring stations, the areas where fish were collected in Phase I, and several special areas. The information obtained from the sediment analyses is intended to show whether various areas of the State have a PCB buildup.

Fourteen sediment samples have presently been collected under the second phase of the program. These samples have been frozen and are being stored until further samples are collected and a means of analyzing them is established.

The third phase of the PCB monitoring program will be dependent on the results of the first two phases. If fish analyses show significant buildups of PCBs or sediment analyses indicate PCB accumulations in localized areas then further sampling and analyses will be conducted in those areas of greatest concern. The extent of Phase III has therefore not yet been determined.

Analytical Procedures

In the past the Department of Water Resources has not had the capability to clean up and analyze samples for PCB residues. Therefore, samples collected to date have been sent to various private and federal laboratories for analysis. The Food and Drug Administration (FDA) agreed to analyze twenty-four fish samples for the Vermont Department of Water Resources. Twenty-three fish samples collected under Phase I of the monitoring program were sent frozen whole to the FDA laboratory in Boston for edible flesh analyses. The extraction procedures for PCBs used by the FDA are described in Appendix II-A.

Water samples collected at JARD in September 1975 by the Department of Water Resources were first analyzed by Woodson-Tenent Laboratories in Tennessee, and again later by the U.S. Environmental Protection Agency. The U.S. E.P.A. collected additional samples at JARD in January 1976 for analysis in their Region I Needham, Mass. laboratory. (See JARD Company, Inc). The method used for PCB extraction at the EPA laboratory is described in Appendix II-B.

The sediment samples collected under Phase II of the monitoring program are presently being stored, frozen, awaiting analysis. The Department of Water Resources has been expanding its capabilities to include the preliminary extraction and

TABLE II

PHASE II - PCB SEDIMENT SAMPLING STATIONS

WATERWAY	LOCATION	# OF SAMPLES	+STATUS OF SAMPLES
Steven's River	Mouth	1	N
Missisquoi River	Mouth	1	N
Lamoille River	Mouth	1	C
Winooski River	Mouth	1	N
Winooski River	Stevens Branch-Above & Below	2	N
Black River	Mouth	1	C
Barton River	Mouth	1	C
Passumpsic River	Mouth	1	C
Passumpsic River	Above & Below EHV Weidman	2	C
Waits River	Mouth	1	C
Ompompanoosuc River	Mouth	1	N
Ottauquechee River	Mouth	1	N
Black River	Mouth	1	N
Black River	Above Springfield	1	N
Saxtons River	Mouth	1	N
Williams River	Mouth	1	N
Sacketts Branch	Mouth	1	N
West River	Mouth	1	N
Deerfield River	State Line	1	N
Poultney River	State Line	1	C
Otter Creek	Mouth	1	N
Otter Creek	Above & Below Rutland	2	C
LaPlatte River	Mouth	1	N
South Bay - Lake Memphremagog	PMN Station	1	C
Lake Memphremagog	NWQSS Station	1	C
Missisquoi Bay	NWQSS Station	1	C
South Lake Champlain	PMN Stations	4	N
Stevens Branch	Above & Below Barre	2	N
Sterling Pond	Lake	1	N
Vernon Pool-Connecticut R.	Pool	1	N
Burlington Harbor	Lake	1	N
Hoosic River	State Line	1	N
Bennington Landfill	Seepage Pools	1	C

+N = Not Sampled
C = Sample Collected and Stored

TABLE II (cont.)
PHASE II - PCB SEDIMENT SAMPLING STATIONS

WATERWAY	LOCATION	# OF SAMPLES	+STATUS OF SAMPLE
Wastewater Treatment Facilities			
Newport		2*	N
Burlington -	North End	2	N
Brattleboro		2	N
St. Albans		2	N
Rutland City		2	N
Springfield		2	N
Bennington		2	N

* One sample from digester and one from unfiltered effluent

cleanup procedures for PCB analysis. To complete the analyses, the U.S. E.P.A. has agreed to accept cleaned PCB samples at their Region I Needham Laboratory for final gas chromatographic determinations. The Phase II sediment samples will most likely be analyzed by this route.

In October, 1975, the authors, from the Department of Water Resources, traveled to Needham for a two-day orientation program which explained the procedures involved in the extraction and cleanup of PCBs in fish flesh. The method learned was that used by the EPA in their PCB analyses (Appendix II-B). Subsequent to this meeting the EPA supplied the Department of Water Resources with a portion of the equipment necessary for the extraction procedure, and the Department purchased the remainder directly. A work area was set aside in the Water Resources Biology Laboratory to be used exclusively for PCB and future pesticide extraction work. At the present time a hood is being installed in the laboratory and the extraction equipment is being set up. It may be several months, however, before the Department will be able to extract actual samples, as extensive work must still be done to calibrate and ready the elution columns and the analysts must be trained.

Results of Vermont PCB samples to date

A few fish collected from western Lake Champlain during New York Department of Environmental Conservation surveys have contained PCB concentrations which exceeded the FDA 5.0 ppm PCB limit for edible fish (notably one walleye pike and one channel catfish from the southern part of the lake). However, none of the fish from Vermont waters analyzed to date have exceeded the FDA tolerance level, or even approached that concentration.

The concentrations of PCBs found in Vermont fish range from trace levels in most fish to 1.3 ppm total PCBs in white suckers taken from the Hoosic River at the New York-Vermont state line. Trace levels of PCBs were found in white suckers from the Walloomsac River both above and below the Bennington Wastewater Treatment Facility, in brook trout and brown trout from Kittle Brook below the Bennington Landfill, in yellow perch from Lake Champlain off the mouth of the Lamoille and Missisquoi Rivers, and in the control sample of brook trout from Sterling Pond. Slightly higher levels were found in smallmouth bass and yellow perch from Lake Champlain off the mouth of the Winooski River.

One possible source of the higher level of PCBs found in the fish from the Hoosic River is Sprague Electric Company of North Adams, Massachusetts, which discharges PCBs into the Hoosic River upstream from Vermont waters. Detectable

levels of PCBs were also found in perch taken from the Connecticut River, which borders on New Hampshire and receives discharges from several industrial towns.

The results of the analyses of the fish taken from the mouth of Otter Creek and Lake Memphremagog have not yet been received. The results of fish analyses received to date would indicate that Vermont does not have a serious problem with regard to PCB contamination in fish. In fact, it appears that the highest levels of PCBs found in the fish can be associated with influences from neighboring states.

JARD Company Inc.

In order to investigate the possible sources of PCBs in Vermont waters, a special study of the JARD Company in Bennington, Vermont was combined with the three-phase program for PCB Monitoring described earlier. JARD is the only known PCB user in Vermont, receiving an average of 550,000 pounds of PCBs each year (1971-1974 average) from Monsanto. The company in part manufactures capacitors which contain PCBs as a dielectric fluid. Prior to 1971, Aroclor 1242 was used in the process, however, since that time JARD has switched to Aroclor 1016.

JARD has made many efforts to prevent environmental contamination with PCBs. The company worked closely with Monsanto during plant construction to ensure that all available safety precautions were incorporated into the building plans. As is usual for companies using PCBs, the liquid PCB wastes from JARD's manufacturing process are sent to Monsanto Company in St. Louis for proper incineration. Non-contact cooling water used in the manufacturing process is discharged to a wet well near the plant. Solid wastes containing PCBs are enclosed in steel containers and disposed of at the Bennington Landfill, located on East Road in Bennington. A large part of the solid waste material sent to the landfill is unuseable capacitors (approximately 60,000 each year). On the average, a JARD capacitor contains 0.4 pounds of PCB - Aroclor 1016. Since 1971 a yearly average of 38,425 pounds of PCBs have been disposed of in the Bennington Landfill. All sanitary wastes from JARD go to the Bennington Wastewater Treatment Facility for treatment before discharge into the Walloomsac River. Previous industrial discharges into the sanitary effluent from the plant have been stopped, however, residual PCBs in these pipes or small amounts of PCBs settling into the water from the air in the plant may account for the low levels of PCBs found in the sanitary effluent samples collected since 1974.

The State of Vermont undertook a special sampling program at JARD, with their cooperation, on September 23-25, 1975 at the request of Mr. Larry Nadler of the New York State Department of Environmental Conservation. Separate eight-hour composite water samples were collected on two days from the JARD sanitary discharge and the Bennington Wastewater Treatment Facility effluent. Grab samples were taken from the Roaring Branch of the Walloomsac River both above and below the JARD plant on September 25.

Although results of the samples collected by the Vermont Department of Water Resources have been discussed here, the reliability of this data is suspect. The samples were sent to a private firm, Woodson-Tenent Laboratories in Memphis, Tennessee, for PCB analysis. To date, the Department of Water Resources has not been able to obtain a copy of the analytical procedure used by these laboratories. Also, the JARD samples collected by the Department of Water Resources were submitted to the Woodson-Tenent Laboratories during the same time period as many of the General Electric samples being used as evidence in the New York State-General Electric Company hearings. Evidently there was some personnel problem and procedural mix-up at the laboratories during that time, and Woodson-Tenent will not stand behind any data generated then. It seems that the data could be in error by several orders of magnitude (R. Rollins, JARD, pers. comm.).

Having serious reservations regarding the results of the September sampling program, the Department of Water Resources cooperated with the U.S. Environmental Protection Agency when they decided to sample JARD as part of a Region I PCB survey program. On January 6, 1976, representatives from the Department of Water Resources met with Mr. Rollins, vice-president of engineering at JARD, and several representatives from the E.P.A. The manufacturing procedures and waste disposal methods used at JARD were reviewed at the meeting and the EPA decided to return to sample the plant effluent and study the Bennington Landfill on January 21 and 22. The samples collected at that time were analyzed at the EPA Region I Laboratory in Needham, Mass. The results of these samples indicated concentrations of PCBs in the same range as the earlier samples collected by Monsanto, JARD and the Department of Water Resources.

Water samples collected recently from the sanitary effluent from JARD indicate that although the company no longer discharges PCBs in their effluent, some residual PCBs may have remained in the sanitary wastewater lines or are entering the lines by some undetermined method. PCB concentrations ranging from 12.9 to 286 ppb total PCBs have been found in the sanitary lines. However, no significant levels of PCBs have been found in the effluent of the Bennington Wastewater Treatment Facility, fish taken from the Walloomsac River near the treatment

facility, and water from the Roaring Branch of the Walloomsac River near the JARD plant, and the residual PCBs in the sanitary lines do not appear to be a problem at this time.

One area of concern is the Bennington Landfill . JARD disposes of a large number of unuseable capacitors containing significant amounts of PCBs in the landfill. Preliminary results of PCB analysis of water pumped from sample wells in the landfill area have not indicated any groundwater contamination by PCBs. However, considering the persistency of PCBs and the problems which have already been associated with this landfill (involving leachates), groundwater contamination may be found in the future.

The most recent samples taken from a chemical dump area in the Bennington Landfill indicate extremely high concentrations of PCBs. Further sampling is being done to verify these results and determine the source.

SELECTED BIBLIOGRAPHY

Ahmed, A.K. 1976. PCBs in the environment. Environment 18(2): 6-11.

Boyle, R.H. 1975. Poisoned fish, troubled waters. Sports Illustrated. September 1975, pp. 14-17.

Boyle, R.H. 1975. The spreading menace of PCB. Sports Illustrated. December 1975, pp. 20-21.

Food and Drug Administration. 1971. Pesticide Analytical Manual. Vol. I. Methods which detect multiple residues. Revised 1973 ed. USDHEW, FDA, Rockville, Maryland.

Food and Drug Administration. 1972. Final environmental impact statement rule making on polychlorinated biphenyls. USDHEW. 18 December 1972. 29 pp.

Gardner, Sherwin. 1973. Polychlorinated biphenyls (PCBs). Contamination of animal feeds, foods and food-packaging materials. 38 FR (129):18096;6 July 1973.

Gustafson, C.G. 1970. PCBs - prevalent and persistent. Environmental Science and Technology 4(10): 814-819.

Highland, J. 1976. PCBs in foods. Environment 18(2):12-16.

Hutzinger, O., S. Safe, V. Zitko. 1972. Polychlorinated biphenyls. Research Notes 12(2):1-15.

Monsanto Chemical Company. The aroclor compounds. Organic Chemicals Division, St. Louis, Missouri. 43 pp.

Severo, R. 1975. G.E. witness concedes errors in his data on PCB in Hudson. The New York Times. Wednesday, 10 December 1975.

United States Department of Agriculture. 1972. Agriculture's responsibility concerning polychlorinated biphenyls (PCBs) USDA, Office of Science and Education. Washington, D.C. September 1972. 39 pp.

United States Department of the Interior. 1975. PCB in water - a bibliography. Vol. 2. USDI, Office of Water Research and Technology. Washington, D.C. 295 pp.

United States Environmental Protection Agency. 1971. Preliminary report on polychlorinated biphenyls in New England. Xerox report. 8 pp.

APPENDIX I-A

PERTINENT NEW YORK STATE DATA

DATE COLLECTED	LOCATION	DESCRIPTION OF SAMPLE	PCB(ppm)
1972*	Lake Champlain, South Bay	1 walleye pike	55.46 as 125
		1 walleye pike	0.84 as 125
		1 northern pike	0.80 as 125
		1 chain pickerel	0.15 as 125
		1 freshwater drum	0.70 as 125
		1 yellow perch	trace as 12
		1 carp	1.94 as 125
		1 whitefish	0.87 as 125
1972*	Lake Champlain, Whitehall, New York	1 landlocked salmon	0.98 as 125
		1 black crappie	1.45 as 125
		1 channel catfish	7.85 as 125
		1 brown bullhead	0.68 as 125
		1 common white sucker	0.50 as 125
8/29/75+	Lake Champlain, Ticonderoga	4 smallmouth bass	0.2 as 1242
			0.3 as 1254
		5 smallmouth bass	0
		5 smallmouth bass	0.4 as 1242
			0.4 as 1254
		5 walleye	0.3 as 1242
			0.2 as 1254
		2 northern pike	0.1 as 1242
			0.6 as 1254
		2 northern pike	0.3 as 1242
			0.2 as 1254
		6 yellow perch	0.4 as 1242
			0.2 as 1254
		6 yellow perch	0.4 as 1242
			0.8 as 1254
8/29/75	Lake Champlain, Ticonderoga	5 brown bullhead	0.4 as 1242
			0.3 as 1254
		4 brown bullhead	0.7 as 1242
			1.2 as 1254
8/29/75	Lake Champlain, Plattsburgh	6 smallmouth bass	0.1 as 1242
			1.4 as 1254
		5 smallmouth bass	3.0 as 1242
			1.9 as 1254
		4 smallmouth bass	1.0 as 1242
			3.5 as 1254
		5 brown bullhead	0
		5 yellow perch	0.4 as 1242
			0.8 as 1254

*Date analyzed. Collection date was not indicated. Presented at an inter-agency August 19, 1975 N.Y. State PCB Meeting in Albany, N.Y.
+August 1975 samples were analyzed by the N.Y. Department of Health

APPENDIX I-B

HISTORICAL VERMONT DATA+

DATE COLLECTED	LOCATION	DESCRIPTION OF SAMPLE	PCB (ppm)
1970*	Lake Champlain-Burlington, Vermont (Shelburne Bay)	pumpkinseed	est. 0.32
		chain pickerel	est. 1.22
		yellow perch	est. 0.57
		yellow perch	est. 0.99
1971*	Lake Champlain-Burlington, Vermont (Shelburne Bay)	pumpkinseed	est. 0.29
		pumpkinseed	est. 0.45
		yellow perch	est. 1.08
		yellow perch	est. 0.40
		chain pickerel	est. 1.35
		chain pickerel	est. 0.36
1972*	Lake Champlain-Burlington, Vermont (Shelburne Bay)	5 pumpkinseed	est. 0.60
		5 chain pickerel	est. 0.66
		5 yellow perch	est. 1.20
1973#	Lake Champlain-Burlington, Vermont(Shelburne Bay)	5 pumpkinseed	0.28 as 1254
		5 chain pickerel	1.5 as 1254
		5 yellow perch	1.8 as 1254
		5 yellow perch	0.62 as 1254

+Collected by the Bureau of Sport Fisheries and Wildlife, Region 5, for the National Pesticide Monitoring Program.

*1970-1973 samples were analyzed at WARF Institute, Inc., Madison, Wisconsin.

#1973 samples were analyzed at the Denver Research Laboratory of the Bureau of Sport Fisheries and Wildlife.

APPENDIX I-C

VERMONT 1975-1976 DATA

DATE COLLECTED	LOCATION	DESCRIPTION OF SAMPLE	PCB(ppm)
12/9/75	Walloomsac River, below Bennington Wastewater Facility outfall	12 white suckers	Trace as 1242 Trace as 1254
12/9/75	Walloomsac River, above Bennington Wastewater Facility outfall	18 white suckers	Trace as 1242 Trace as 1254
12/9/75	Hoosic River	12 white suckers	0.9 as 1242 0.4 as 1254
12/9/75	Bennington Landfill Kittle Brook	4 brook trout	Trace as 1242 Trace as 1254
		4 brown trout	Trace as 1242 Trace as 1254
10/1/75	Winooski River	10 smallmouth bass numerous yellow perch	0.13 as 1254 0.1 as 1254
1/21/76	Lamoille River	12 yellow perch (5½-7½")	Trace as 1254
		6 yellow perch (8-9½")	Trace as 1254
1/20/76	Missisquoi River	13 yellow perch (6½-8")	Trace as 1254
		6 yellow perch (8-9½")	Trace as 1254
12/29-30/75 1/8-9/76	Connecticut River-Vernon Pool*	15 yellow perch 7 white suckers 16 smallmouth bass 1 walleye pike 9 white perch	0.54 as 1254 Trace as 1254 Trace as 1254 Trace as 1254 0.32 as 1254
10/24/75	Sterling Pond	12 brook trout	Trace as 1254

*Collected by Aquatec, Inc. of South Burlington, Vermont.

APPENDIX II-A

FDA PCB EXTRACTION PROCEDURE

The Food and Drug Administration uses the extraction and cleanup procedure for PCBs outlined in the Pesticide Analytical Manual (PAM), Volume I, published by the Food and Drug Administration. The following are excerpts from Sections 212.13a and 211.14d of that manual.

212.13a (AOAC)"Extraction and Cleanup. High Moisture Products. Chop or blend representative sample after preparing according to 141. Weigh 100 g sample into high speed blender jar and add 200 ml acetonitrile (10 g Celite may be added as a filter aid). Blend 2 min at high speed and filter with suction through 12 cm buchner funnel fitted with sharkskin paper into a 500 ml suction flask. Transfer filtrate to a 250 ml graduated cylinder and record volume (F). Transfer measured volume of filtrate to a 1 L separatory funnel. Carefully measure 100 ml petr ether in the same 250 ml graduate used to measure the volume of extract and pour into the 1 L separatory funnel containing the extract. Shake vigorously 1-2 min. Add 10 ml saturated NaCl soln and 600 ml H_2O. Hold separatory funnel in horizontal position and mix vigorously 30-45 sec. (Note: inadequate mixing may lead to low recoveries of some pesticides, e.g., BHC, TDE. (Porter, M., Burke, J.A., Bertuzzi, P., JAOAC 50, 644-645 (1967)). Let layers separate, discard the aqueous layer, and gently wash the solvent layer with two 100 ml portions H_2O. Discard washings, transfer solvent layer to 100 ml glass-stoppered graduate, and record volume (P). Add about 15 g anhyd Na_2SO_4 and shake vigorously. Do not let extract remain with Na_2SO_4 1 hr or losses of organochlorine pesticides by adsorption may result. Transfer solution directly to Florisil column, 212.14, or concentrate to 5-10 ml in Kuderna-Danish concentrator for transfer.

Calculate g sample placed on Florisil column according to the following formula:

$$g = S \times (F/T) \times (P/100) \text{ where}$$

S - g sample extracted
F - volume of filtered acetonitrile extract
T - total volume (ml H_2O in sample + ml acetonitrile added - correction in ml for volume contraction). Contraction volume of 5 ml is used for 80-95 ml H_2O/200 ml acetonitrile.
P - ml petr ether extract recovered
100 - ml petr ether into which residues were partitioned."

(In this equation the water content is determined by FDA tables for each fish species analyzed).

211.14d (AOAC) "Florisil Column. Prepare 22 mm i.d. column that contains four inches (after settling) (or weight determined by Lauric Acid value, 121.32) activated Florisil topped with about ½" anhydrous Na_2SO_4. Prewet column with 40-50 ml petr ether. Place Kuderna-Danish concentrator with volumetric or graduated collection vessel under column to receive eluate. Transfer petr ether solution of sample extract to column letting it pass through at about 5 ml/min. Rinse container(and Na_2SO_4 if present) with two, about 5 ml portions petr ether, transfer rinsings to column, and rinse walls of chromatographic tube with additional small portions petr either. Elute column at about 5 ml/min with 200 ml of 6% ethyl ether/petr ether eluant. Change receivers and elute at about 5 ml/min with 200 ml of 15% ethyl ether/petr ether eluant. Concentrate each eluate to a suitable definite volume in Kuderna-Danish concentrator. When volume less than 5 ml is needed, use two ball micro Snyder or micro Snyder or micro Vigreaux column during final evaporation in the collection vessel.

The first eluate (6%) is usually suitable for gas or thin layer chromatography without further cleanup. If further cleanup is necessary, repeat Florisil chromatography using new Florisil column."

APPENDIX II-B

EPA(Region I) PCB EXTRACTION PROCEDURE

The following is an outline of the PCB extraction and cleanup procedure used by the E.P.A. Region I Laboratory in Needham, Mass. This is also the method the State of Vermont will be using when preparations are completed.

EXTRACTION AND PARTITIONING WITH ACETONITRILE-HEXANE

1. Make sure all glassware has been prewashed with acetone and then hexane. This applies to equipment used in blending fish.

2. Blend or chop whole fish into creamy mixture and transfer 50 grams into a 500 ml Erlenmeyer flask.

3. Add 200 ml of acetonitrile to sample and place on automatic shaker at medium speed for four hours.

4. Transfer 50 gram extract into a 500 ml separatory funnel by filtering thru glass wool and small funnel.

5. Add 50 ml of hexane after sample extract has passed into the 500 ml separatory funnel.

6. Shake acetonitrile/hexane mixture for three minutes, let settle and then drain lower layer into 500 ml separatory funnel.

7. Add exactly 100 ml of acetonitrile saturated with hexane to the original funnel, shake well, and allow to settle.

8. Repeat Steps 6 and 7 one more time, draining all lower layers (400 ml total) into the same 500 ml funnel.

9. Add 25 ml of hexane (saturated with acetonitrile) to the 400 ml of acetonitrile for a backwash.

10. Shake, allow layers to separate and drain acetonitrile(lower) into a 500 ml Erlenmeyer flask.

11. Discard upper (hexane) layer.

12. Add boiling beads and concentrate acetonitrile to about 10 ml on an explosion-proof hotplate.

13. Add 100 ml of hexane to flask.

14. Boil down to a volume of about 10 ml on an explosion-proof hot plate or rotoevaporator.

15. Repeat Steps 13 and 14 two more times.

16. Cool the flask and then rinse sides with a small amount of hexane, allowing it to drain back into the flask.

17. Quantitatively transfer the contents of the flask into a 15 ml capped teflon lined centrifuge tube and dilute to 15 ml with hexane.

18. Fish sample is now ready for Florisil clean-up.

FLORISIL CLEAN-UP

1. Prepare Florisil Column by adding to a chromaflex column 300 mm x 19 mm id, 5" of Florisil topped with 1" of anhydrous sodium sulfate.(Na_2SO_4)

2. Wash prepared Florisil Column with 400 ml of hexane.

3. Place a 500 ml Erlenmeyer Flask equipped with a 24/40 ground glass joint under the column and transfer the contents of the 15 ml centrifuge tube (sample) to the Florisil Column. Rinse tube which contained sample with small amount of hexane and add to column once sample has just reached the sodium sulfate.

4. When the extract has just reached the top of the Na_2SO_4 layer add gently 5 or 10 ml of a 200 ml portion of hexane, drain to Na_2SO_4 layer and add another 5 or 10 ml of hexane. Drain to Na_2SO_4 layer and gently add the remaining hexane.

5. Collect the first 200 ml of hexane.

6. Concentrate on a rotoevaporator to 5 ml and quantitatively transfer to a graduated 15 ml centrifuge tube.

7. Concentrate to 1 ml on an N-Evap concentrator(dry nitrogen stream).

8. Sample is now ready for silicic acid treatment or direct GLC analysis.