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GE Corporate Research
and Development

John F. Brown, Jr., Ph.D.
Manager
Environmental Toxicology

Building K1, Room 3C7
P.O. Box 8, Schenectady, NY 12301-0008
Phone: (518) 387-7987 Fax: (518) 387-7611
Dial Comm: 8*833-7987

November 30, 1999

Dear Colleague,

I enclose a copy of our Poster PHA032, "Local Spatial Variabilities and Overall Regional Trends Indicate Local Sources for the PCBs in Lower Hudson River Sediments," which you requested at the recent SETAC meeting in Philadelphia.

Currently, Ken Fish and I are planning to update and simplify the survey data shown in Panel 5; to explore the possibilities of using dechlorination indices as measures of the contributions of upper Hudson PCB sources to lower Hudson sediments (as was done for lower Hudson fish PCBs in SETAC '99 paper 337) and then to submit a report along the general lines of the poster for publication. Meanwhile, we would welcome any comments you might have regarding our approach, or other lines of data that merit consideration.

Thank you for your interest.

Sincerely,

John Brown

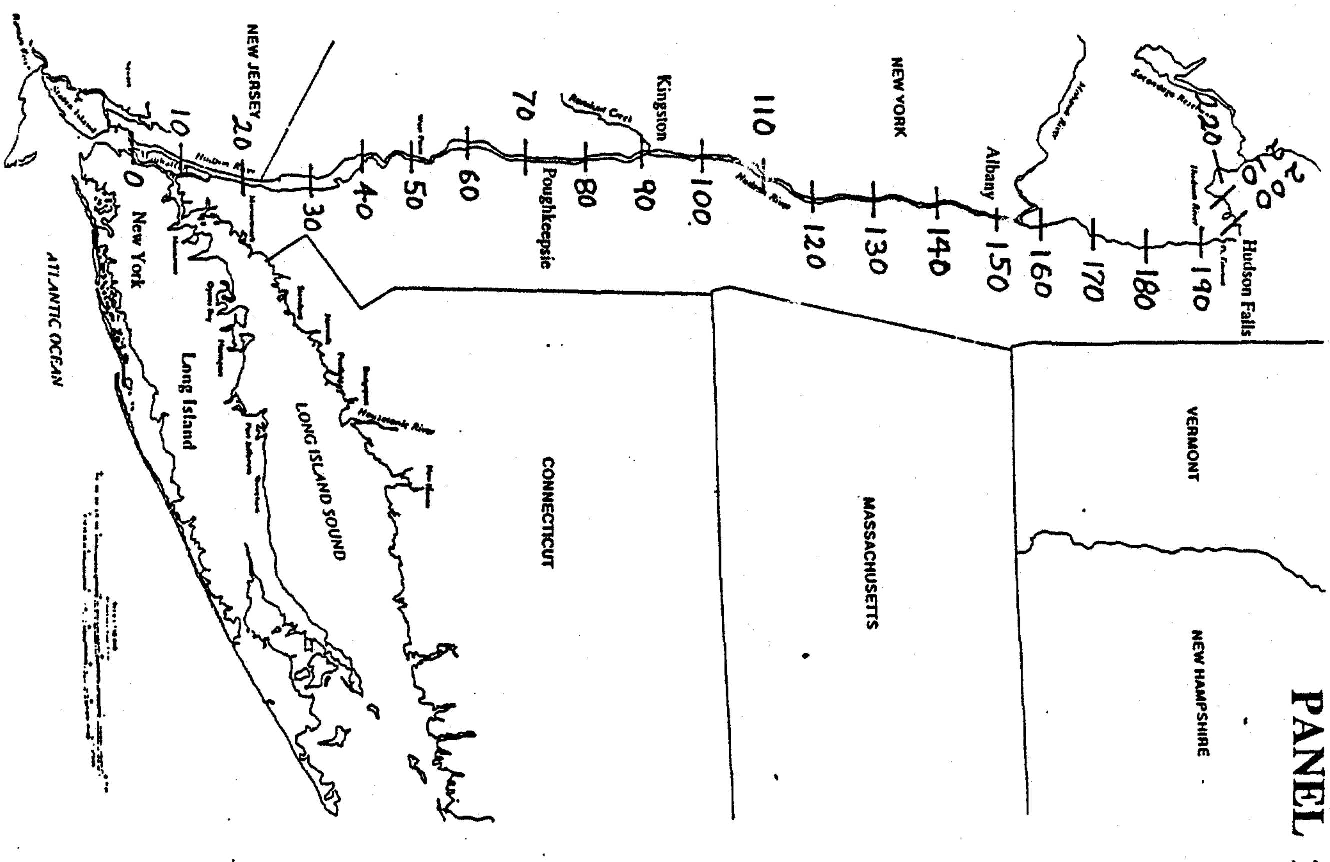
John F. Brown, Jr.

JFB:amt

Poster PHA032, as presented at 20th Annual
Meeting of the Society of Environmental Chemistry
and Toxicology, 14-18 November, 1999,
Philadelphia, PA. Abstract Book, p. 277.

PANEL 1 ABSTRACT

Local Spatial Variabilities and Overall Regional Trends Indicate Local Sources for the PCBs in Lower Hudson River Sediments. Brown, J.F. Jr.*, and Fish, K.M., General Electric Corporate R&D, Schenectady, NY. The repeatedly surveyed levels of PCBs in upper Hudson River sediments show a characteristic exponential decay with distance for the first 40 miles downstream from known PCB sources at Hudson Falls/Ft. Edward, NY. This rapid decline ends abruptly in the Troy/ Albany area, below which no statistically significant trends in mean regional sediment PCB levels were seen by any of the five surveys conducted (US EPA in 1976, 1981 and 1992; RF Bopp in 1977; and Harza/GE in 1988-89). The three earlier surveys, which collected only one core per station, showed marked variances in both total PCB levels and Aroclor 1254/1242 ratios among samples collected at the same station by different investigators. Statistical analysis of the data from the 1988-89 survey, which collected 5-10 surficial sediment samples at each of 38 stations, now shows that such variances arose from spatial variabilities in both PCB level and composition ("patchiness") that often occurred on a 100 meter scale. In 1992 EPA high resolution cores similar compositional variabilities appeared between successive depositional strata. At least half the upper estuary sediment PCB appeared to be present in patches having Aroclor compositions different from that of the homogenized regional average, indicating derivation from local NAPL PCB releases (as in the Acushnet Estuary). The NAPL deposits appeared largely derived from Aroclor 1242/48-based hydraulic and heat transfer fluids, which were extensively used in local facilities before 1972. Individual deposits of Aroclors 1254, 1260, 1262, 1268 and 1270 were also seen. Our conclusion that the elevations in tidal Hudson sediment PCBs arose primarily from local releases rather than a "dominant upstream source" affirms that of the original US EPA survey.



OVERALL VIEW OF PCB SURVEY AREA, SHOWING RIVER MILES ALONG THE HUDSON RIVER

PANEL 2

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PANEL 3

KNOWN SOURCES OF HUDSON RIVER PCBs

UPPER HUDSON RIVER

Capacitor plants at Hudson Falls/Fort Edward (RM 197) used 15% of US PCB production. Usage shifted from Aroclor 1254 to 1242 to 1016 over 1946-1976 period. Most releases 1951-71. Continuing slow seepage (> 90% Aroclor 1242) from rock fractures since then.

TIDAL HUDSON RIVER (HUDSON ESTUARY)

Available Monsanto sales records, which list only the purchaser's address, indicate significant PCB usage in many installations along the tidal Hudson (RM 153-0). Most usage was for Aroclor 1242/48-based "Pydraul" and "Therminol" hydraulic and heat-exchange fluids purchased before 1972. (See next chart)

NEW YORK METROPOLITAN AREA

Sales records indicate dozens of PCB purchasers. Aroclor usage probably similar to overall national pattern, but with some excess consumption of Aroclors 1254 and 1260, which were widely used locally in substation and railroad transformers.

PANEL 4

1958-1977 Monsanto Sales of PCB-based Products[a] to Customers in Communities Bordering the Hudson Estuary

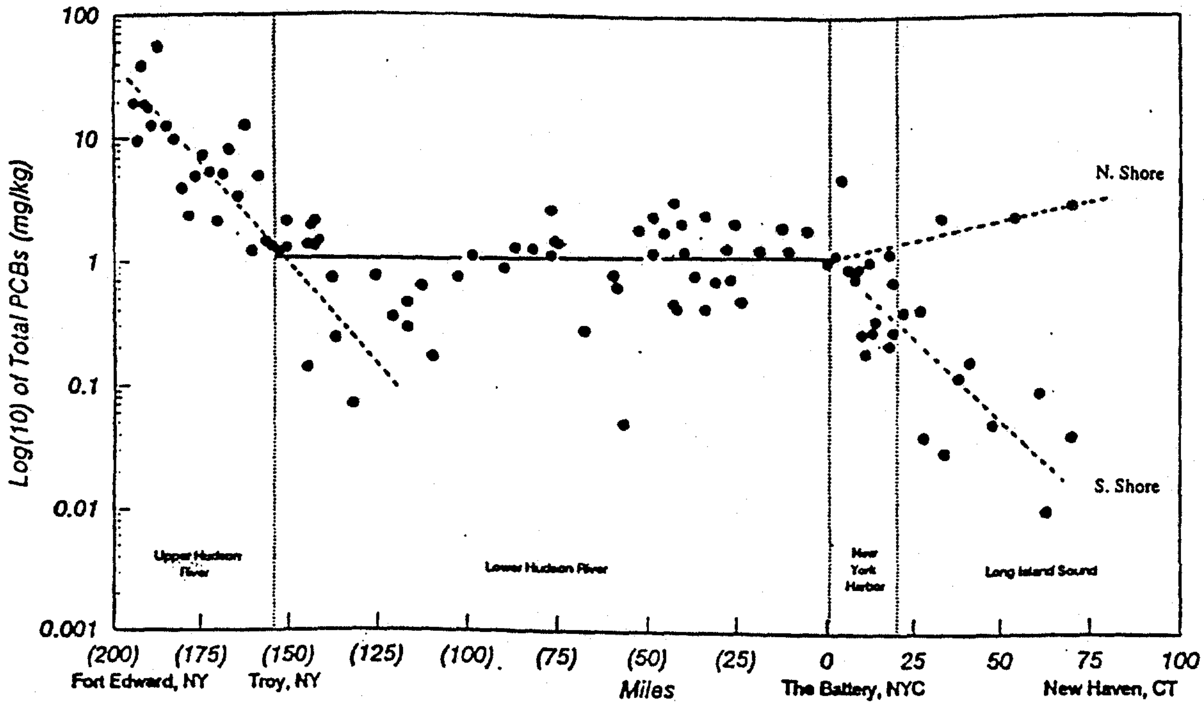
Customers' Address	Approx. RM	1958-1977 lbs. Sold	Major product types sold[b]
Green Island	153	330	Aro 1242
Troy	152	27,110	Therminol FR-1
Albany	146	2,129,489	Pydrauls A-200 et al.; Pyranols A13B3B et al.
Selkirk	135	40,060	Aro 1268; Aro 1254
Ravena	131	25,400	Therminols FR-1 et al.
Cementon	107	29,400	Theminols FR-1; FR-2
Saugerties	102	60	Aro 1254
Kingston	90	23,640	Therminol FR-1
Poughkeepsie	75	1,923	Aro 1248; Pydraul 135
Beacon	58	1,333	Pydraul F-9
Newburgh	58	204,600	Aroclor 1262
Croton-on-Hudson	38	675	Pyranol A13B3B
Nyack	27	2,700	Pyranol A13B3B
Tarrytown	27	300	Santovac 2 (Aro 1254)
Hastings-on-Hudson	20	29,175	Aroclor 1254
Yonkers	17	2,422	Pydraul F-9
Bronx	15	42,410	Therminols FR-0, 1; Aro 1232
Edgewater	9	45,500	Pyranol A13B3B
New York	6	3,574,778	Aro 1260, 1254, 1248, 1232; Pydraul A-200; Pydraul F-9
Hoboken	3	11,465	Therminol FR-2; Aro 1248
Jersey City	-1	100,098	Therminol FR-2
Bayonne	-4	309,110	Aroclor 1254
Brooklyn	-5	2,253,361	Aroclors 1016, 1221, et al ; Pydraul F-9; Therminols, Pyranols, Inerteens

a. Pydrauls and Therminols were hydraulic and heat-exchange fluids based on Aroclors 1242, 1248, et al. The Pyranols and Inerteens were dielectric fluids containing 40-99% PCB; Pyranol A13B3B was a transformer dielectric fluid containing 60% Aroclor 1254 that was used 1971-77, after transformer usage of Aroclor 1260-based fluids was discontinued.

b. Largest volume products listed first.

PANEL 5

MEAN TOTAL SURFICIAL SEDIMENT PCBs IN HUDSON RIVER AND ADJACENT WATERWAYS



DATA from 1988-90 surficial sediment surveys by BK Shephard, Harza Engrg. Co.

PANEL 6

Comparisons of PCB Levels and Compositions in Tidal Hudson River Sediment Core Tops From Stations Sampled in Both 12/76 and 7/77

Station	R.M.		% of total sediment PCB deposition PPM Aroclors		1254/1242 Ratio		
Name	12/76	7/77	12/76	7/77	12/76	7/77	agree?
Albany (N)	144.4	-	5.6	-	1.15	-	
	144.3	144.2	11.3	11.5	1.35	0.14	-
Albany (S)	143.6	143.4	33.4	35.1	1.01	0.05	-
Inboyt Bay	109.6	109.5	0.1	4.9	0.	0.11	-
N. Germantown	108.1	108A	2.9	0.1	0.61	0.1*	-
	-	108B	-	0.2	-	0.1	-
Stattsburg	86.7	87C	1.6	4.3	1.61	0.16	-
Foundry Cove	53.8	53.8	11.7	8.5	0.16	0.13	+
Peekskill Bay (N)	44.3	44.4	11.6	9.6	0.07	0.12	+
Peekskill Bay (S)	43.0	43.2	0.3	4.5	0.	0.14	-
Stony Point	40.0	40WC	3.0	2.5	0.30	0.39	+
Piermont	24.4	24A	56.8	4.1	0.03	0.22	-
	-	24B	-	1.3	-	0.38	-
	-	24C	-	1.3	-	0.19	
	-	24D	-	3.1	-	0.44	-

12/76 Data: USEPA, Surveillance and Analysis Division, Region 2, Edison N.J. *PCBs in Lower Hudson Sediments. A Preliminary Surry.* USEPA Region 2, New York, NY, February 23, 1977
7/77 Data: Bopp, RF, Simpson, HJ, Olsen, CR, and Kostyk, N. *Environ. Sci. Technol.* 15,210-216 (1981).

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PANEL 7

EXAMPLES OF VARIABILITIES SEEN IN INDICES OF PCB CONCENTRATION AND COMPOSITION IN SURFICIAL SEDIMENT SAMPLES COLLECTED *ca.*200m APART ALONG BOTH SIDES OF RIVER AT TIDAL HUDSON RIVER SAMPLING STATIONS IN 1989

Station HR-8
RM 125
Coxsackie

Sample	ppm PCB	% Cl_{10}
169	0.75	15.72**
170	0.36	0.72
171	0.29	2.69**
172	2.14*	0.04
173	1.16	0.17
174	0.71	0.13
175	0.11	0.00
176	0.37	0.16
177	1.54	0.05
178	0.12	0.15

Significant Addend
169: Aro 1270, 30%
172: 1242/48, >40%

Station HR-15
RM 90
Kingston

Sample	ppm PCB	% Cl_5
153	0.52	11.41
155	1.41	14.54*
156	3.27**	13.19
158	0.58	8.45
159	0.74	10.62
160	0.14	16.84*
161	0.13	32.28**
162	0.49	17.50*
168	0.70	9.94

Significant Addend
156: 1242/48, > 35%
161: Aro 1254, 35%

Station HR-24
RM 48
Con Hook

Sample	ppm PCB	% Cl_7
258	2.93*	2.33
397	1.30	1.56
398	1.86	2.22
399	0.65	32.32**
400	0.05	3.16
257	0.37	2.53

Significant Addend
258: 1242/48, NQ.
399: Aro 1262, 70%

*, $p < 0.05$
**, $p < 0.001$

PANEL 8

APPROACH USED FOR DATA ANALYSIS

Observation. Tidal Hudson Sediment PCBs appear to be derived from two sources: (a) regionally homogenized suspended sediments, from either upstream sources or local resuspension; and (b) localized deposits of individual Aroclors, presumably as poorly dispersed PCB non-aqueous phase liquids (NAPL), mostly denser than water (DNAPL).

Assumptions. (a) Variations in level of regionally homogenized PCB deposition, resulting from local hydrodynamic variations (or analytical imprecision) are normally distributed. Likewise (b) variations in any indicator of the composition of locally homogenized PCB deposition, resulting from local variations in lower congener wash-out or biodegradation, are also normally distributed.

Implication. If parameters (eg., means and standard deviations) characterizing normal distributions of indicators of PCB composition and total PCB level can be established for samples not showing gross (>20%) contamination with atypical Aroclors, deviations from such distributions may be used to identify and quantify any local contribution from unhomogenized Aroclor (NAPL) deposition.

Illustration. The next chart lists the observed standard deviations for 19 indices of surficial sediment PCB composition. The following chart indicates how they are used for the identification of PCB compositions indicative of local NAPL releases.

PANEL 9

Descriptors of Regression Lines Characterizing Dependencies of Indices of Lower Hudson River Sediment PCB Composition or Concentration on River Mile (RM)[a]

Parameter	Coef. ± SD	ΔParam./ΔRM+SD	Outliers[b]	PSD[c]	PSD,adj[d]
% Aro 1221+1242	71.1 ± 2.078	+0.106 ± 0.02192	7	11.90	3.28
% Aro 1254	18.5 ± 1.013	-0.0613 ± 0.0107	5	5.41	2.40
% Aro 1260	8.25 ± 0.0336	-0.0336 ± 0.0132	4	7.33	1.47
% Aro 1268	2.16 ± 0.388	-0.0114 ± 0.00410	3	2.28	0.40
100/% $C\ell_6BP$	10.3 ± 0.973	+0.0748 ± 0.01026	7	5.63	2.89
100/% $C\ell_7BP$	23.0 ± 4.212	+0.2225 ± 0.04442	3	24.36	10.97
$C\ell_4BP/C\ell_3BP$	1.26 ± 0.0457	-0.0035 ± 0.00048	4	0.26	0.11
$C\ell_3BP/C\ell_4BP$	0.82 ± 0.0349	+0.0033 ± 0.00368	5		0.13
$C\ell_4BP/C\ell_5BP$	1.75 ± 0.0058	+0.0058 ± 0.00104	7	0.52	0.34
$C\ell_5BP/C\ell_6BP$	1.93 ± 0.0835	+0.0016 ± 0.00088	7	0.46	0.27
%$C\ell_2BP$	4.82 ± 0.0879	+0.0879 ± 0.00685	5	3.63	2.62
%$C\ell_3BP$	26.6 ± 1.236	+0.0529 ± 0.01303	7	6.60	2.65
%$C\ell_4BP$	31.1 ± 0.892	-0.0314 ± 0.00094	5	4.87	2.42
%$C\ell_5BP$	18.0 ± 0.653	-0.0525 ± 0.00689	4	3.37	1.83
%$C\ell_6BP$	9.71 ± 0.540	-0.0317 ± 0.00570	7	3.12	1.03
%$C\ell_7BP$	5.08 ± 0.639	-0.0192 ± 0.00674	4	3.73	0.88
%$C\ell_8BP$	2.01 ± 0.311	-0.0105 ± 0.00328	3	1.84	0.36
%$C\ell_9BP$	2.25 ± 0.641	-0.0121 ± 0.00672	4	3.85	0.35
%$C\ell_{10}BP$	0.77 ± 0.475	-0.0013 ± 0.00502	3	2.88	0.36
Total PCB, ppm	1.18 ± 0.182	-0.0009 ± 0.00191	5	1.09	0.63

a. Regression equations of form: (Parameter) = (Coefficient) + (ΔParam./ ΔRM) X (RM).
b. No. of data points (of 106 or 115) deviating by > 2 SD.
c. Pooled Standard Deviation of individual data points from site mean
d. Ditto, after removing 24 data points for samples showing > 20% addition of atypical Aroclor composition.

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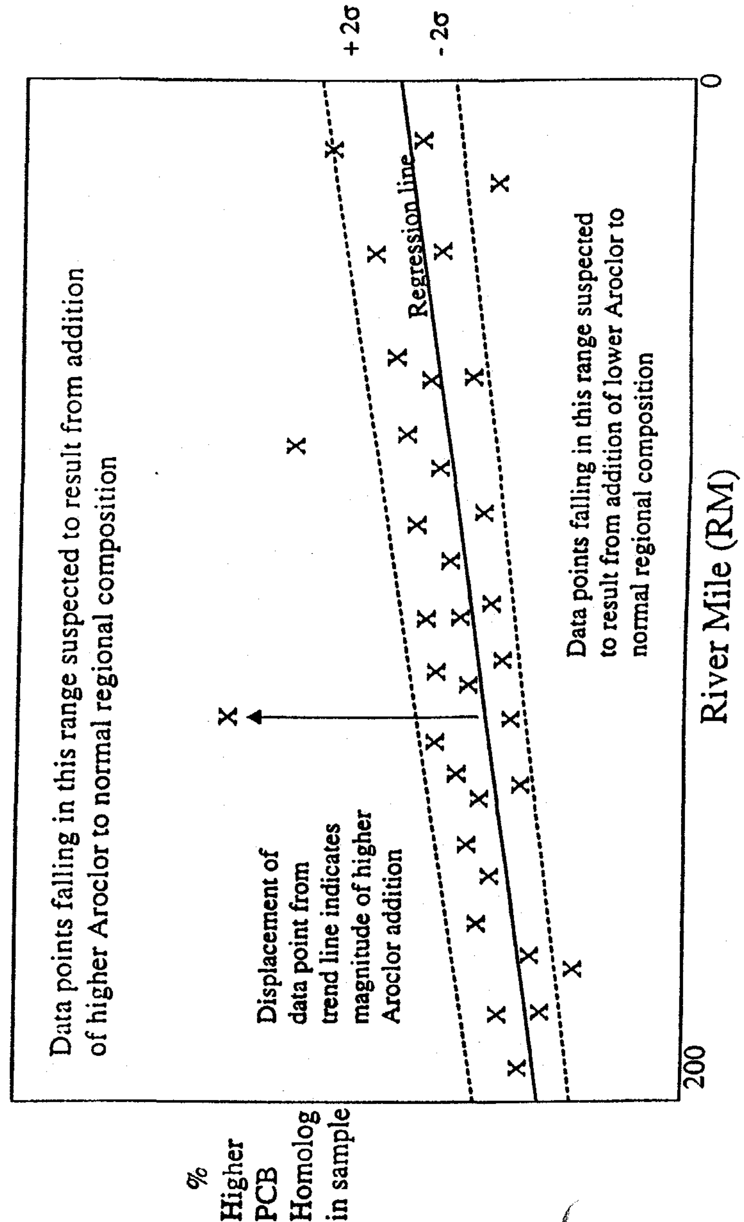
PANEL 10

SCHEMATIC OF PROCEDURE USED FOR IDENTIFYING AND QUANTIFYING PRESENCE OF ATYPICAL AROCLORS



PANEL 11

PROCEDURE FOR NAPL AROCLOR CONFIRMATION AND QUANTITATION

<u>Confirmation.</u> Any added Aroclor should change several indices of composition (eg., proportions of major homologs added or depleted, or of analytical "Aroclor" values calculated from indicator peaks) in characteristic proportions. If the addition be large enough it should make a significant change in the total PCB level as well. The probability that the changes in both PCB composition and PCB concentration (i.e., $p_{comp} \times p_{conc}$) occurred by chance along should be < 0.05.

<u>Quantitation.</u> If presumption of a localized Aroclor addition be confirmed by multiple indicators, and p < 0.05, the magnitude of the addition may be calculated from that of the compositional deviation from the local mean. (See illustration on previous chart).

<u>Results.</u> Illustrative sample-by-sample results for first 6 upper estuary stations given in next chart. Summary data in following charts.

PANEL 12A

Characteristics of Local PCB Addenda in 1988-89 Lower Hudson River Sediment Samples Showing Significant Departures from Regional Ranges of PCB Concentrations and/or Compositions

Approx. RM[a]	Site No.[b]	Sample No.[c]	ppm Total PCB	Identified Addenda[d]	% of Sample PCB[e]	ppm Added PCB[e]	Probabilities of Null Hypotheses p (conc.)	p (comp.)	p (overall)
153	HR-1	2365	1.86	1242/48+	>50	1.15	0.0324	0.0000	0.0000
		2366	2.16	1242/48	65	1.45	0.0100	0.0000	0.0000
		5665	1.21	1254	10	0.12	~1	0.0000	0.0000
		•	•	1260	10	0.12	•	0.0000	0.0000
		•	•	1270	25	0.30	•	0.0000	0.0000
		5666	1.36	1242/48+	60	0.82	0.1485	0.0000	0.0000
		HR1S	2.10	1242/48	>22	1.39	0.0129	0.1	0.001
152	HR-2	267	0.51	1254	5	0.03	~1	0.0256	0.025
		268	2.64	1242/48+	>65	1.93	0.0010	0.0000	0.0000
143	HR-5	212	1.47	1242/48+	>35	0.73	0.1204	0.0085	0.0010
		214	1.58	1242/48	50	0.84	0.0887	0.0000	0.0000
		215	0.66	1260	3	0.02	~1	0.0016	0.011
		259	0.80	1260	4	0.03	~1	0.0030	0.003
		260	1.89	1242/48	60	1.15	0.0324	0.31	0.01
		262	3.82	1242/48+	>20	3.08	0.0000	0.1	0.0000
138	HR-6	HR6S	0.24	1254	15	0.04	~1	0.0000	0.0000
125	HR-8	169	0.75	1260	28	0.21	~1	0.0000	0.0000
		•	•	1270	30	0.23	•	0.0000	0.0000
		170	0.36	1242/48	28	0.10	~1	0.0268	0.026
		171	0.29	1254	6	0.02	~1	0.0075	0.007
		•	•	1270	5	0.01	•	0.0000	0.0000
		172	2.14	1242/48+	>40	1.35	0.0156	0.0013	0.0000
		174	0.71	1242/48	25	0.18	~1	0.005	0.005
		175	0.11	1242/48	20	0.02	~1	0.045	0.05
		176	0.37	1260	5	0.02	~1	0.001	0.001
		177	1.54	1242/48+	>30	0.75	0.1158	0.006	0.0007
117	HR-10	HR10S	0.29	1268	1	0.00	~1	0.0096	0.01

PANEL 12B

Approx. RM[a]	Site No.[b]	Sample No.[c]	ppm Total PCB	Identified Addenda[d]	% of Sample PCB[e]	ppm Added PCB[e]	Probabilities of Null Hypotheses p (conc.)	p (comp.)	p (overall)
90	HR-15	155	1.41	1254	4	0.06	~1	0.0322	0.03
		156	3.27	1242/48+	>35	2.37	0.0000	0.0021	0.0000
		160	0.14	1254	5	0.01	~1	0.0192	0.02
		161	0.13	1254	35	0.04	~1	0.0000	0.04
		"	"	1260	10	0.01	"	0.0000	0.0000
		168	0.70	1242/48	25	0.18	~1	0.05	0.05
81	HR-17	318	0.87	1242/48	38	0.33	~1	0.003	0.003
		320	0.59	1242/48	25	0.15	~1	0.06	0.06
		322	6.51	1242/48+	>35	5.58	0.0000	0.001	0.0000
76	HR-18	HR18S	1.48	1260	8	0.12	~1	0.0000	0.0000
		"	"	1268	1	0.01	"	0.0384	0.04
75	HR-19	311	4.72	1242/48+	>0	3.77	0.0000	~1	0.0000
		312	3.29	1242/48+	>0	2.34	0.0000	~1	0.0000
58	HR-21	HR21S	0.79	1254	5	0.04	~1	0.0139	0.01
		"	"	1270	3	0.03	"	0.003	0.003
52	HR-23	HR23S	1.84	1254	7	0.13	0.0943	0.0015	0.0015
48	HR-24	258	2.93	1242/48+	>0	1.90	0.0012	~1	0.001
		399	0.65	1262	70	0.46	~1	0.0000	0.0000
42	HR-26	HR26S	0.46	1254	8	0.04	~1	0.0004	0.0004
		HR26S	0.46	1270	4	0.02	~1	0.0006	0.0006
41	HR-27	HR27S	0.42	1254	4	0.02	~1	0.0384	0.04
38	HR-28	393	1.94	1254	5	0.10	0.0802	0.0150	0.01
		394	1.17	1254	20	0.23	~1	0.0000	0.0000
		"	"	1260	13	0.14	"	0.0000	0.0000
		"	"	1268	2	0.02	"	0.0000	0.0000
36	HR-29	HR29S	2.44	1242/48+	>0	1.08	0.0417	~1	0.04
25	HR-33	HR33S	0.49	1268	1	0.00	~1	0.0417	0.04
13	HR-39	HR39S	1.96	1260	3	0.06	0.174	0.0132	0.01
		"	"	1268	1	0.02	"	0.0052	0.005

PANEL 12C

Approx. RM[a]	Site No.[b]	Sample No.[c]	ppm Total PCB	Identified Addenda[d]	% of Sample PCB[e]	ppm Added PCB[e]	Probabilities of Null Hypotheses p (conc.)	p (comp.)	p (overall)
0	HR-38	285	0.66	1268	1	0.01	~1	0.0462	0.046
		286	1.42	1254	4	0.06	0.3	0.0570	0.05
		"	"	1268	1	0.01	"	0.0145	0.01
		288	0.50	1254	5	0.03	~1	0.0056	0.05
		"	"	1260	20	0.10	"	0.0000	0.0000
		"	"	1270	55	0.28	"	0.0000	0.0000
		289	2.55	1248+	>20	1.17	0.0306	0.0000	0.0000
		290	0.15	1254	7	0.01	~1	0.0012	0.001
		291	0.66	1254	6	0.04	~1	0.0088	0.01
		"	"	1260	13	0.09	"	0.0000	0.0000
		"	"	1268	4	0.03	"	0.0000	0.0000
		"	"	1270	12	0.08	"	0.0000	0.0000
		292	0.42	1254	16	0.07	~1	0.0000	0.0000
		"	"	1260	5	0.02	"	0.0006	0.0006

Footnotes to Table

a. RM: River miles along center of river, measured from 0 at Battery, S. end Manhattan Island, New York City, to 153 at Federal Dam at Troy, NY (northern end of estuary).

b. Sites for sediment and biota sampling by Harza Engineering Co. in 1988-90 surveys.

c. Samples designated "HR(No.)S" derived from pooling 8-10 individual samples, collected 100 m. apart, along both sides of river, in 1988. Those with three digit numbers represent individual samples of 1989 collection. Those with four digit numbers were collected in 1990.

d. Aroclors responsible for compositional differences from regional background identified by visual observation of congener distribution pattern and statistical analysis of homolog data. Aroclors 1242 and 1248 determined to be usually indistinguishable after partial dechlorination, biodegradation and evaporation/elution in river, and hence are reported as "1242/48".

e. Number listed as "% of sample PCB" indicates value calculated from deviation in compositional indices, conservatively assuming 1242/48 to be 1242. In cases where only the increment in "ppm added PCB" was substantially elevated, indicating excess local deposition of lower PCBs having composition like that of regional average, addendum is indicated as "1242/48 +, % of sample indicated as > (No.), and "ppm added PCB" indicates total local departure from regional mean level.

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PANEL 13

IDENTIFICATIONS OF LOCALIZED AROCLOR DEPOSITIONS IN 106 TIDAL HUDSON RIVER SURFICIAL SEDIMENT SAMPLES FROM 38 STATIONS

Aroclor	Detection Limit	No. Samples in which detected	No. Stations at which found
1270	< 0.5%	7	3
1268	< 0.5%	7	5
1262	1-2%	1	1
1260	1-2%	12	8
1254	2-3%	18	11
1242/48	20%	24	10

PANEL 14

PERCENTAGES OF TOTAL TIDAL HUDSON RIVER SURFICIAL SEDIMENT PCBs CONTRIBUTED BY LOCALIZED ("PATCHY") AROCLOR DEPOSITS

	% of total sediment PCB deposition		
Contributor	RM153-0	RM76-0(a)	RM153-81
Identified local 1242/48	26.5	16.1(a)	36.9
Identified local higher Aroclors	2.8	3.6	2.0
Total identified local Aroclors	29.3	19.7(a)	38.8
Unidentifed local 1242/48	?(b)	?(b)	?(b)
Locally resuspended deposits	?	?	?
Dispersed PCB from upstream	?(c)	?(c)	?(c)
Total	100.0	100.0	100.0

a. Samples from most stations in this section of river pooled before analysis. This generally prevented detection of added 1242/48.
b. Probably 20-40% of identified local 1242/48 deposition.
c. Probably insignificant below Albany (RM 145) judging from observed exponential decline in RM 195-153 range.

PANEL 15

CONCLUSIONS

1. PCBs were largely used and spilled as dense, non-aqueous phase liquids (DNAPL) containing only 1 (or 2) Aroclors and having very low solubilities and dissolution rates in water. Releases of such undispersed DNAPL (or NAPL) into rivers or estuaries are known to result in discrete patches of 1- or 2-Aroclor sediment PCB contamination within a few km. Eventually, sediment movements will disperse and homogenize such patches. Local releases of dispersed PCBs in sewage or run-off will also lead to regionally homogenized PCB deposition.

2. The intrastation variabilities in both PCB level and composition indicate a very "patchy" pattern of Aroclor deposition on tidal Hudson sediments (Panels 6,7).

3. Statistical analysis of these intrastation variabilities indicates that as late as 1989 about half the PCBs in the upper tidal Hudson were still present as patches of

PANEL 16

4. The compositions of both the regionally homogenized and non-homogenized (i.e., Aroclor patch) tidal Hudson PCBs (mostly Aroclor 1242/48; some 1254, 1260, 1262, 1268, 1270) are consistent with those of 1958-77 Monsanto shipments into adjacent communities (mostly Aroclor 1242/48-based Pydraul and Therminal hydraulic and heat exchanger fluids; some higher Aroclors) (Panel 4).

5. Although dissolved and colloid-bound PCBs from upstream sources are known to have been passing through the tidal Hudson since the mid-1970's, the exponential fall-off in upper Hudson sediment PCB levels (Panel 5), as well as considerations of adsorption equilibria, indicate that their contributions to tidal Hudson sediment PCB contamination are probably unimportant.

6. In summary, we conclude from the absence of any significant downstream decline in sediment PCB levels (Panels 5,6); from the heterogeneity of the sediment PCB compositions (Panels, 6,7,12,13), and the compositional concordance with Monsanto sales data (Panels 4, 14) that the elevations in tidal Hudson sediment PCBs arose primarily from local releases rather than a "dominant upstream source." This conclusion is in agreement with that of the original (February 23, 1977) USEPA survey report.