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SUBJECT: Completion of Chemical Analyses of Sediments from New Bedford Harbor for Polychlorinated Dibenzodioxin and Dibenzofurans

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The Environmental Research Laboratory at Duluth, MN has completed chemical analyses of sediments from New Bedford Harbor (NBH) for polychlorinated dibenzodioxins and dibenzofurans (Table 1). Sediments from NBH stations 5, 12 and 14 (Figure 1) were those collected in January, 1986 and maintained under chain-of-custody at 4°C. Results of previous chemical analyses for PCBs, PAHs and metals by the Environmental Research Laboratory at Narragansett, RI are summarized in the attached Tables 2, 3 and 5. Sediment from NBH station 15 was collected in January, 1987. This station is located in the freshwater portion of the Acushnet River. Samples from each location were homogenized and split into duplicates for chemical analyses by high resolution GC/MS. Procedures for analysis including QA/QC are available from ERL, Duluth. The following lists our observations relative to these analyses:

Observations:

- Sediments from NBH stations 5, 12 and 14 contained 10, 220 and 2600 micrograms per gram PCB (dry weight) (Table 5).
- Only sediments from station 14 contained any measurable (4 picograms per gram) 2,3,7,8-TCDD (Table 1).
- Concentrations of other dibenzodioxin congeners were greater than that for 2,3,7,8-TCDD and congener concentrations across stations differed little relative to that for PCBs. (These other congeners are known to be considerably less toxic than 2,3,7,8-TCDD.)
- Concentrations of chlorinated dibenzofurans, known contaminants in certain PCB mixtures, are generally greater than concentrations of chlorinated dibenzodioxins. (The toxicity of 2,3,7,8-TCDF is known to be less than 2,3,7,8-TCDD.)
- The magnitude of increase of concentrations of furans up-bay is congener specific ranging from a factor of about 2 to 15 between NBH 5 and 14. Absence of a strong covariance with PCB concentrations is surprising.

- Of all of the detected dioxins and furans, 2,3,7,8-TCDF is possibly most environmentally important considering its concentrations and relative toxicity.
- We speculate that because concentrations of 2,3,7,8-TCDF differ little between stations whereas the toxicity of these sediments to the amphipod Ampelisca abdita differ markedly, this substance probably does not contribute to the observed effects.

Attachments
DJH:cjb
cc: LeRoy Folmar
Charles Bering

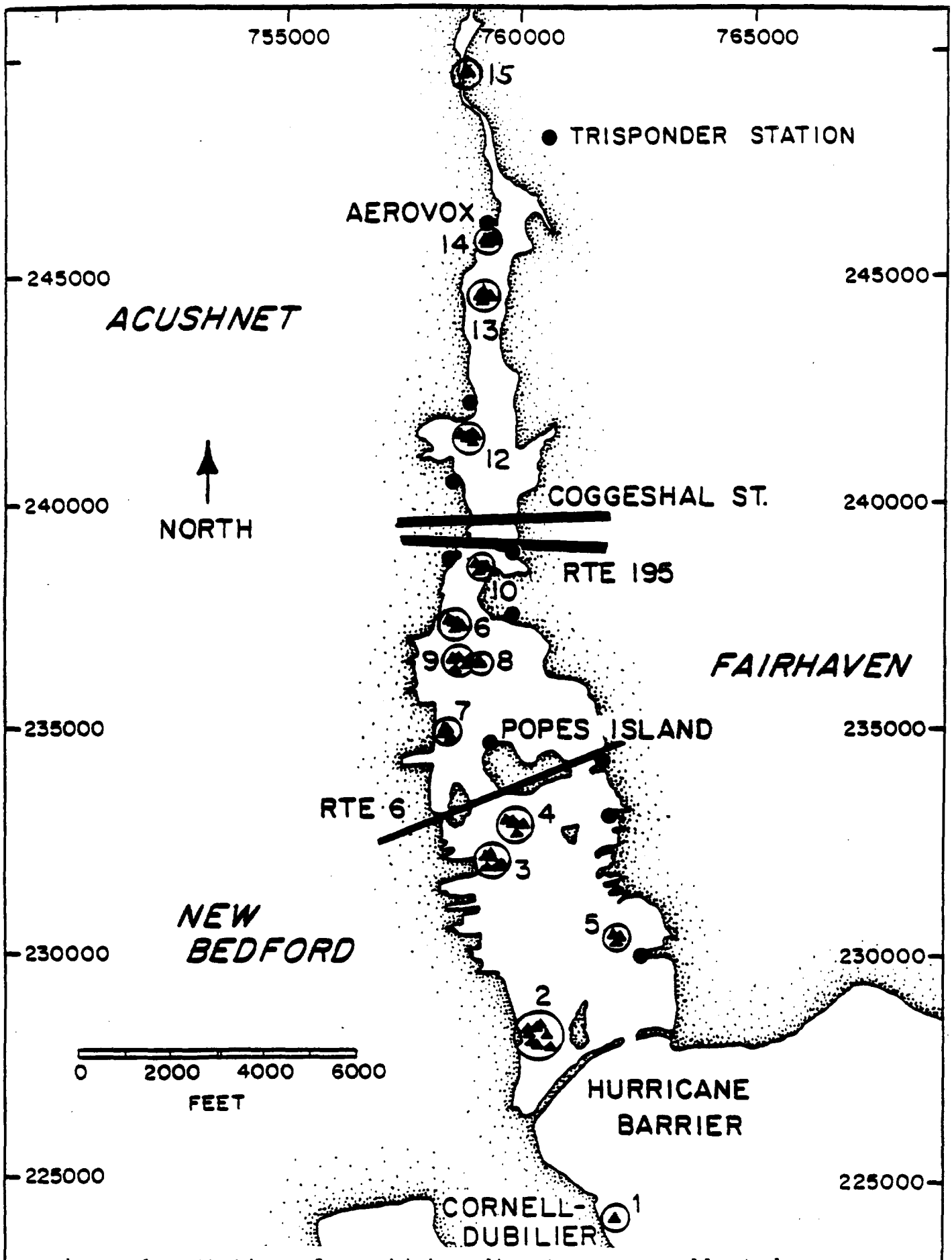

Figure 1: Stations from which sediments were collected on January 21 and 22, 1986. Each triangle represents one of the 9 to 13 ponar dredge samples collected at each station and pooled into a drum for storage. The samples from station 15 were collected on January 6, 1987, using a shovel.

Table 1

Polychlorinated dibenzodioxin and dibenzofuran concentrations (pg/g dry wt) in New Bedford Harbor sediments. The relative environmental significance (RES) relates the toxicological importance of the compound to that of 2,3,7,8-tetrachlorodibenzodioxin.

	STATION				
CONGENER	NBH-5	NBH-12	NBH-14	NBH-15	RES
Dibenzodioxin					
2378	n. d. n. d.	n. d. n. d.	4 4	n. d. n. d.	1.0
12378	n. d. n. d.	21 n. d.	21 28	n. d. n. d.	.5
123478	n. d. n. d.	n. d. n. d.	n. d. n. d.	n. d. n. d.	.1
123678	22 25	65 72	137 81	26 38	
123789	17 20	52 55	70 70	n. d. n. d.	
1234678	534 1570	n. d. 905	1130 1010	324 278	.01
12346789	4030 4010	7370 6530	6100 5510	1490 1390	.001
Dibenzofuran					
2378	691 789	1380 1440	1220 1130	10 10	.4
2367	289 299	1250 980	916 892	7 5	
3467	n. d. 37	272 289	270 281	n. d. 2	
12378	348 358	430 389	516 484	n. d. n. d.	.1
23478	71 69	313 279	597 565	n. d. n. d.	
23467	37 37	n. d. 151	147 176	n. d. n. d.	
123478	n. d. 32	316 310	1510 1340	n. d. 17	.04
123467	29 32	289 227	470 428	60 64	
123678	n. d. 22	196 179	818 730	n. d. n. d.	
123789	n. d. n. d.	n. d. n. d.	n. d. n. d.	n. d. n. d.	
234678	n. d. 7	45 38	119 116	n. d. n. d.	
1234678	152 397	853 592	1240 1240	112 131	.004
1234789	n. d. n. d.	182 151	305 281	26 n. d.	
12346789	218 228	671 595	1230 1070	138 209	

* - Numbers refer to the positions of chlorines on the compound.

n. d. - Not detected. The detection limits depend on the compound and sample size.

Table 2: Concentrations of total PAHs (Sum of parent compounds and homologs measured, in mg/kg dry weight, and PAH molecular weight centroids (calculated mean of the molecular weight of the parent PAHs multiplied by the concentration of those PAHs). Values are from triplicate samples of the sediments from New Bedford Harbor used in toxicity tests.

STATION	PAH CONCENTRATION (MG/KG)		PAH CENTROID (M.W.)	
	SAMPLES	MEANS	SAMPLES	MEANS
SREF	3.5	3.7	241.7	240.8
SREF	4.3		240.0	
SREF	3.2		240.6	
NBH5 *	13	13	239.8	239.8
NBH6	41	38	240.5	240.2
NBH6	36		242.1	
NBH6	36		238.1	
NBH7 **	43	40	237.3	236.7
NBH7	37		236.1	
NBH8	37	35	241.5	242.4
NBH8	35		242.8	
NBH8	34		242.9	
NBH12	120	111	236.1	238.7
NBH12	64		239.5	
NBH12	148		240.5	
NBH14	134	125	235.3	236.5
NBH14	124		236.1	
NBH14	117		238.1	

* Two samples lost in analysis.
** One sample lost in analysis.

TABLE 3 : Concentration (ug/g dry weight) of polychlorinated biphenyls (Aroclor 1254) and selected metals in sediments from New Bedford Harbor. Values are means of triplicate samples from a composite of 9 to 13 Ponar dredge sediment samples from each station in New Bedford Harbor which was used in the fish studies. Concentrations of total organic carbon (in percent) have also been included.

STATION	AROCLOR 1254	Cd	Cu	Cr	Fe	Mn	Ni	Pb	Zn	TOC
REF*	0.051	0.148	53.7	47.0	17100	367	19.8	46.2	133	2.10
NBH-5	7.30	4.18	415	185	14500	112	29.7	147	349	4.12
NBH-6	19.3	10.2	1509	699	19027	137	47.3	303	675	6.50
NBH-7	13.3	5.76	891	410	21800	161	40.0	270	549	6.03
NBH-8	30.9	5.37	1620	829	22600	172	38.2	328	464	7.48
NBH-12	231	79.2	2580	1600	22700	170	237	658	2480	9.97
NBH-14	1100	40.5	1110	670	17600	165	139	840	2270	11.3

* The reference sediment is from Central Long Island Sound.

Table 5. Mean concentration (ug/g dry weight) of polychlorinated biphenyls (PCBs) in sediments from New Bedford Harbor. Analysis was performed by GC/MS. Concentrations are reported by chlorine number congeners, and as total PCBs. Values are from triplicate samples (see Table 4) from one composite from 9 to 13 Ponar dredge samples from each station in New Bedford Harbor that have been tested for their toxicity.

Sample ID	Cl - 1	Cl - 2	Cl - 3	Cl - 4	Cl - 5	Cl - 6	Cl - 7	Cl - 8	Cl - 9	Cl - 10	Σ ug/g
Avg Ref	nd*	nd*	nd*	nd*	0.01	0.01	0.01	0.01	nd*	0.01	0.03
Avg 5 B	nd*	0.22	1.2	3.6	3.4	1.7	0.16	nd*	nd*	nd*	10
Avg 6 B	nd*	0.49	3.8	11	11	5.2	0.61	nd*	nd*	nd*	32
Avg 7 B	nd*	0.20	1.7	5.8	6.3	2.6	0.17	nd*	nd*	nd*	17
Avg 8 B	nd*	0.82	7.5	19	19	8.5	1.2	0.02	nd*	nd*	56
Avg 12 B	nd*	5.7	40	93	61	20	2.4	nd*	nd*	nd*	220
Avg 14 B	8.8	410	840	900	380	110	12	0.98	0.26	nd*	2600

***nd = non detectable (As low as 0.02 ug/g, depending on sample dry weight and congener response)**