RETURN TO 1998 ROD AR INDEX

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OTHER: 46659

ACOE Bellmer Wetlands

Plaintiffs' RFA's XII.E.K.1 COE-NED/AQTC, York, CAA

1. Sediment samples were collected by personnel of the U.S. Army Corps of Engineers as described by Condike 1986 "Sediment Chemistry for New Bedford Harbor", NED Technical Report 62 p.

2. The samples were analyzed for the HSL list of volatile and semivolatile organics, PCBs and pesticides.

3. The results of the analyses for metals and PCBs were partially reported in the SES report to COE dated September 1987 (revised April 1988) (BN 7901064 - 7901331).

3.a PCB content of 20 selected samples was reported in Table 3-5 of the SES report.

3.b The PCB results for 3 samples were omitted from Table 3.5.

3.c Table 3.5 and the associated text omit all mention of sediment samples containing no measurable amount of PCBs.

3.c.1 The April 1988 SES report states, at BN 7901115 that, "PCB concentrations in the surface sediments of the wetland ranged from 0.15 ppm to over 1,900.00 ppm."

3.c.2 The text material (BN 7901115) conveys the impression that all samples contained PCBs.

3.d The SES report presents a misleading picture of the PCB distribution in the wetlands sediments.

3.d.1 RFA XII.E.(K.1) 32 is false.

3.d.2 Figure 3-3 of the SES report is false and misleading.

SDMS DocID 46659

4. All PCB analyses utilized DBC as a surrogate.

4.a Recoveries of the surrogate ranged as high as 272%.

4.a.1 High recoveries of the surrogate are indicative of the presence of interfering substances in the samples.

4.a.2 Results of analyses may be biased high because of the presence of interfering substances.

4.b The results of all of the PCB analyses, wherein surrogate recoveries were outside of the accepted range, are suspect.

1365L

ACOE Bellmer Wetlands

Plaintiffs' RFA's XII.E.K.1 #5 & 6; #51-57; #14-19 — IEP/ENSECO: Sediment

1. IEP obtained samples of sediment and biota from wetland areas designated as 1, 2, 3, 4, 5, and 9.

   1.a The sampling procedure for samples taken from areas 4, 5 and 9 left a depth of sampling option to the sampler, depending on the samplers' recognition of discriminating features.

   1.b When samplers have options for discriminating between samples, the sample choices will reflect the bias of the individual sampler.

      1.b.1 The bias introduced by the sampler means that the samples will not be reproducible by another sampler.

      1.b.2 The results of analyses of a biased sample set may not be representative of the wetlands area.

2. Only six sites were selected for sediment samples within each wetlands area.

   2.a There were not enough samples to adequately characterize the individual IEP wetland areas.

   2.b When the differing sample depth from location to location is considered, the six sites are far too few to provide an adequate 3-dimensional picture of the wetlands areas.

3. ENSECO chromatographic raw data indicate that some of the standards are contaminated.

   3.a This is an indication of poor quality control. (BN 7910617-619)

4. The three samples from Area 9 high marsh yield dramatically different chromatograms.

   4.a 9 HM-1 has serious sulfur contamination as shown at BN 7910592.

      4.a.1 The quantitation of samples showing sulfur interference causes the result to be an estimation at best.

4.b 9 HM-2 resembles the chromatogram of A-1254 with the addition of some lighter components.

4.b.1 These samples would be much more accurately quantitated using A1242 and A1254 than A1248 and A1254 as was done.

4.c 9 HM-3 resembles the chromatogram of A1254 but with the addition of some mid-range components.

5. The three samples from the Area 9 low marsh also yield different chromatograms.

5.a 9 LM-1 has a strong A1242 component.

5.a.1 These samples would be much more accurately quantitated using A1242 and A1254 than A1248 and A1254 as was done.

5.b 9 LM-2 has a serious sulfur interference.

5.b.1 The quantitation of samples showing sulfur interference causes the result to be an estimation at best.

5.c 9 LM-3 resembles a balanced mixture of A1242 and A1254.

5.c.1 These samples would be much more accurately quantitated using A1242 and A1254 than A1248 and A1254 as was done.

6. The use of A1248 and A1254 as standards does not allow for accurate quantitation of the mixture of A1242 and A1254 in any of the samples.

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ACOE Bellmer Wetlands

Plaintiffs' RFA's XII.E.K.1 IEP/ENSECO: Tissues

1. In the mussel data from Areas 4 and 5, the analog chromatograms show interferences and loss of resolution for PCBs.

2. The blank for mussels shows significant contamination (BN 7910849-50 and 7910815).

   2.a This indicates carryover from previous samples or contamination of laboratory glassware.

3. Mummichog data from area 5 shows significant interference and loss of resolution for PCBs.

4. Excessive levels of A1254 in the tissues has been postulated as the reason for very poor recovery of spiked A1254 from the tissues and for poor agreement between spiked duplicates. (BN7901490)

   4.a Levels of total PCBs in tissue samples from area 2 should not have been high enough to cause a problem of this magnitude.

   4.b The mussels from area 4 did contain substantial amounts of interfering substances which would pose a problem for recovery studies.

      4.b.1 The interferences also pose that problem in the course of attempting any routine quantitation.

5. ENSECO raw data indicate that the A1248 standard is contaminated.

   5.a Contamination of a standard is an indication of very poor quality control.

6. The A1260 standards at BN 7910624 and 7910625 are contaminated with an early eluting material.

7. The A1254 standard runs (BN 7910652) show impurities at about 19.1 minutes.

8. The A1248 standard runs (BN 7910653) show impurities at 19.1 and 26.5 minutes.

9. The peak discriminating function of the integrator is set quite coarse as demonstrated by the 3 chromatograms at BN 7910643 and peak at RT 11.25 minutes.

10. The coarse setting means that the integrator will not identify peaks unless they are clearly separate and have some minimum intensity.

10.a Impurities appearing as shoulders on the PCB peaks will thus be quantitated as PCBs.

11. The coarse discriminator function setting will cause the results to lack qualitative and quantitative reliability.

11.a The Enseco results utility is limited to the demonstration of presence or absence of some mixture of PCB's.

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ACOE BELLMER WETLANDS

Plaintiffs' RFA's XII.E.K.1 SES/RAI: Tissues

1. Sanford Ecological Services, Inc. (SES) performed a bioaccumulation study for three supposed food chains in wetlands associated with the Acushnet River upper estuary.

   1.a Samples were collected by SES and analyzed by Resource Analysts, Inc. (RAI) for metals and PCB's.

2. A1254 was used to spike samples of tissue in order to obtain a measure of recovery of PCB's from the tissue.

3. Recovery studies in mussel, sea lettuce, and duck were attempted and resulted in recoveries varying between - 470% and + 2400%. (BN7910461).

4. In spite of recovery data demonstrating poor precision and precision studies demonstrating poor precision (BN7910461), results are reported to 6 significant figures (BN7901184) from a single sample.

   4.a This action demonstrates a fundamental lack of understanding of the utility and significance of analytical data.

   4.b This action demonstrates the lack or disregard of a company quality assurance program and ignorance of the reasons for collecting quality control information.

   4.c There can be no more significant figures in a result than there are in the least precise measurement that is a part of the determination of the result.

      4.c.1 For example, if recovery studies show a variation of +/- 100% then the result can only have one significant figure.

      4.c.2. The number of significant figures in a result R can be less than 1 and this is expressed as a range such as $10^2 < R < 10^3$ or $10 < r < 10^3$.

      4.c.3. The recovery studies cited above as varying from -470% to +2400% indicate that any associated result has less than 1 significant figure.

5. The analyses for PCBs were done using a single point calibration.

5.a With this type of calibration, only samples having concentrations within approximately ± 10 percent of the standard can be considered to have acceptable accuracy.

6. In the case of A1242, depending on the sample, different groups of peaks were selected from the standard for use in calculation of PCB A1242 in the samples.

6.a Using different groups of peaks means that there is no proven relationship between concentrations of A1242 reported for the various samples.

6.b Examples include the use of peaks from A1242 with retention times as shown below:

Bates No.	Sample No.	peaks RT. (min)
7910488	10,853-16	20.104; 22.219; 23.188; 24.546
7910489	10,853-17	20.090; 22.205; 23.175; 24.529; 25.060
7910494	10,853-20	19.272; 20.085; 22.048
7910496	10,853-21	18,095; 19.276; 22.058 23.177
7910499	10,853-23	20.084; 22.200; 23.169 24.526; 25.053

7. The standards for A1254 and A1242 were only run once and that was in the approximate middle of a sequence of approximately 60 runs. (Based on information provided in BN7910456 - BN7910555.)

7.a This practice presumes perfect instrument stability. This cannot be demonstrated and, in fact, some degree of instability is virtually certain.

7.b This practice presumes perfect reproducibility of the detector response.

7.b.1 This is impossible.

8. No internal standards have been used to demonstrate reproducibility of retention times or to allow calculation of relative retention times. Thus, peak identity cannot be assigned with confidence.

9. No internal standards have been used to demonstrate reproducibility of instrument response or to allow calculation of a relative response factor.

9.a PCB concentrations cannot be calculated with any known degree of accuracy.

10. The data cannot be considered to be more than a qualitative indication of the presence of PCB s in mussels, sea lettuce and duck.

10.a Relative proportions of A1242 and A1254 are particularly incorrect and misleading

11. In general, the chromatograms from the mussel, duck and sea lettuce samples were obtained from extracts that were so concentrated that the peaks were off-scale.

11.a Use of overly concentrated extracts prevented pattern recognition from being an effective identifier of PCBs.

12. GC/MS analysis of gull fat extract (BN7910070 and BN7910126) demonstrated the presence of very large quantities of fatty acids and other hydrolyzed lipid components.

13. The results of capillary column GC analysis performed by RAI should be excluded from the NBH data base.

14. All of the raw data from the packed column GC analysis for PCBs is unreadable.

14.a The sheets are either totally illegible or contain critical portions which are illegible.

14.a.1 Critical portions include the sample number, the chromatogram, the retention times, and the peak areas.

14.b Packed column GC was used for the biota samples.

15. It is not possible to determine the quality of the GC packed column analyses without legible raw chromatographic data.

15.a Some of the extracts were obviously chromatographed with too concentrated a solution.

15.b Being unable to read sample number information, one cannot determine if samples, originally too concentrated, were diluted for further analysis.

15.c Because of legibility problems, one often cannot even see how many peaks were in a chromatogram.

15.d Because of legibility problems, one cannot compare samples to standard retention times.

15.e Without adequate legibility, one cannot verify Aroclor patterns.

15.f Without adequate legibility, one cannot verify reproducibility of retention times.

15.g Illegibility often prevents obtaining peak area digitized data, even if one could see the associated peak retention time.

16. All of the packed column PCB measurements should be excluded from the NBH data base.

17. None of the packed column PCB measurements should be admitted in evidence because the results cannot be verified.

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Averett Composites

Plaintiff's RFA XII.E.(L)

1. The U.S. Army Corps of Engineers (referred to herein as COE) performed a study for the characterization and elutriate testing of sediments in NBH. In March 1989, COE issued a report of that study entitled "New Bedford Harbor... Superfund Project, Acushnet River Estuary Engineering Feasibility Study of Dredging and Dredged Disposal alternatives. Report 3. Characterization and Elutriate Testing of Acushnet River Estuary Sediment." (hereinafter referred to as COE Report 3).

2. Table A2 of COE Report 3 purports to present the results of each of 3 replicate analyses for PCB congeners, Aroclors and total PCB's for the upper estuary composite sediment sample.

3. Table 2 of the COE Report 3 purports to present the average of the 3 replicate analyses for PCB congeners, Aroclors, and total PCB's for the upper estuary composite sediment sample.

4. The concentrations of the congeners as presented in Table 2 are not the averages of the congener concentrations determined by the replicate analyses as represented in Table 2A.

   4.a Congener C77 is represented in Table 2 as being 147 ppm dry weight while Table 2A represents each of the 3 replicates as having contained <1 ppm of C77.

   4.b Similarly, the average of the replicates in Table 2A does not equal the entry in Table 2 for congeners C82, C87, C105, C143, C155 and C167.

   4.c The values in Table 2 are incorrect.

5. The value for total PCB concentration in the composite sediment sample is reported to be 2170 ppm on a dry weight basis.

   5.a Total PCB analysis is claimed to be accomplished versus a mixed Aroclor standard of A1242, A1254 and A1260.

   5.b A summation of the Aroclors found above the detection limit (A1242 and A1254) is claimed to yield a total PCB concentration of 1550 ppm.

   5.c Any measurement of total Aroclors based on a measurement of a substantial quantity of A1260 is in error at least to the extent that is purported to be A1260.

6. Paragraph 24 of the COE Report 3 claims to present percentages of various PCB homologs found in the composite sediment from the upper estuary.

   6.a Because Table 2 is not an accurate representation of the results of the congener specific analysis, paragraph 24 cannot be an accurate representation of the distribution of the congeners.

7. The composite sediment sample is purported to be homogeneous.

   7.a If the composite sample is homogeneous then the subsamples of the composite used for the elutriate should have a similar PCB congener concentration distribution, within the limits of the reproducibility of the analytical methodology.

   7.b The congener distributions from the analyses presented in Table 2 should be equivalent to those found in the analysis of the whole elutriate as presented in Tables 6 and 9.

      7.b.1 The dilution or potential alteration of the congener distribution in the total elutriate caused by the site water used in the elutriate testing will not cause the total or substantial elimination of any congener.

      7.b.2 Congeners C50, C82, C87, C105, C138, C143, C153, and C155 were not found to be present in measurable quantities in the whole elutriate as characterized in Table 6 of the COE Report No. 3.

         7.b.2a All of the above congeners are reported to be present in the composite sediment sample as presented in Table 2 of COE Report No. 3.

      7.b.3 Congeners C50, C70, C77, C82, C105, C153, C155, and C167 were not found to be present in measurable quantities in the whole elutriate as characterized in Table 9 of COE Report No. 3.

         7.b.3a All of the above congeners are reported to be present in the composite sediment sample as presented in Table 2 of COE Report No. 3.

N.B. Sewer Grit Study

Plaintiff's RFA s XII.E.(P)

1. Table II-2 of XII E. R-0379 lists only concentrations of A1242.

   1.a The report indicates that no A1254 was present in the sewer grit.

   1.b No sampling methodology or details of any kind are provided in the report.

      1.b.1 Absent such materials, one cannot determine whether the samples were even remotely representative of the materials in the sewer system.

      1.b.2 No effort was made to acquire samples truly representative of the sampling location or of the overall system.

   1.c No information of any kind is provided regarding the PCB analyses.

      1.c.1 The report does not state the general technique used for the analyses (GC vs. GC/MS).

   1.d The study did not develop enough information to determine the total PCB's at any given location in the system.

   1.e The study did not develop enough information to characterize the PCB content of the system.

   1.f The study did not develop enough information to characterize the PCB distribution throughout the system.

2. Conclusions based on the sampling and analytical data will be erroneous.

   2.a Not enough information was developed to draw correct conclusions involving PCB's in the NB sewer system.

ACOE/NUS-FIT

Plaintiffs' RFA XII.E.2 (11) Laucks: Sediment

1. Laucks Testing Laboratories reportedly analyzed samples #AD825 to AD832; AD834 to AD839 and AD923.

   1.a The results of these analyses are reported in Plaintiffs' RFA XII.E.2.11 Table 1.

   1.b The supporting raw data for the analyses purportedly is given at BN761001 - BN762879.

   1.c The results in Table 1 are reported to 7 significant figures, while the method is only capable of delivering two or three significant figures.

2. NUS performed the data validation for the Laucks Testing Laboratory data set.

   2.a According to NUS, BN76-2832 to BN76-2853, "...matrix interference probably accounts for the difficulties..."

      2.a.1 The results indicate that Laucks was unable to obtain good chromatographic results or acceptable recoveries of surrogate and matrix spikes.

      2.a.2 Because of matrix interference, Laucks was unable to recover DBC (dibutyl chlorendate) and thus unable to calculate retention time shifts.

      2.a.3 Because relative retention times cannot be accurately demonstrated, the identity of the eluates cannot be confirmed.

3. GC raw data show an unstable baseline with several negative dips (BN76-2621 for example) and discontinuities which the integrator reads as peaks.

4. GC blanks (BN76-2663) show gross contamination and negative dips in the baseline.

5. Aroclor standards (BN76-2448; BN76-2454; BN76-2456; BN76-2458 as examples) exhibit extreme contamination in all but the A1232 solution.

   5.a The computer identifies this Aroclor contaminant as endrin aldehyde even though the RT is 0.5 minutes from that of endrin aldehyde.

6. The standard mixtures A&B show extreme contamination.

   6.a The contamination is manifested as wide unresolved peaks which cause problems in the definition of overlying peaks (BN76-2502).

   6.b This problem grows worse with succeeding injections, indicating contamination of mixtures A&B.

7. Repeated injections of evaluation sample B eventually disrupt the chromatography, again indicating contamination in the instrument or in the laboratory (BN76-2268).

8. Some of the samples, BN76-1283 & BN76-1365 for AD827, show gross contamination.

   8.a Sulfur is a large contribution to the contamination in AD827.

9. Sample AD828 shows another type of contamination (BN76-1454 and BN76-1460).

   9.a The contamination in AD828 is broad and unresolved.

   9.b Such contamination can cause significant apparant retention time shifts leading to misassignment of peak identifications.

   9.c Such contamination is evidence of a totally inadequate cleanup.

10. Only one peak from A1242 has been used to quantitate this Aroclor from the packed column chromatography and similarly for the capillary column work.

   10.a Single peak quantitation means that the results of the analyses will be biased high or low depending on the extent and type of weathering or degradation of the PCB's in the sample.

   10.b The introduction of bias means that the concentrations of A1242 in the sediment samples are not necessarily represented by the results reported for these samples.

11. No A1254 has been reported to be present in any of the samples.

   11.a A1242 is clearly present in some or all of the samples.

11.b BN76-1554 shows the packed column chromatogram of sample AD830.

11.c The packed column chromatogram of sample AD830 clearly shows the presence of A1254.

11.d Other samples show similar evidence of the presence of A1254.

11.e The Laucks analysts lacked the ability to recognize Aroclor patterns.

12. Because of the problems with the data set produced by Laucks Laboratories, these data should be completely rejected and excluded from the NBH data base.

13. The problems enumerated above illustrate some of the difficulties with the EPA CLP QA/QC protocols and validation procedures.

13.a None of the problems discussed were highlighted during data validation.

13.b The data validation procedure accepted the erroneous quantitation and identification.

13.c The data validation procedure ignored the contamination of the standards and the blanks.

1365L

REVET/ACOE

Plaintiffs' RFA's XII.E.8 — Analyses of Hot Spot Sediment for PCB's

1. None of the Revet chromatograms are available.

   1.a The acceptability of this data, from a chromatographic standpoint, cannot be judged.

2. The surrogate compound, dibutylchlorendate (DBC) was spiked into the samples in order to measure recovery.

   2.a In the majority of analyses the spiked DBC was reported to be "diluted out."

   2.b "Diluted out" means that the sample was diluted to such an extent that the DBC could not be quantitated.

3. On page 169 of the deposition of Edward L. Taylor of Revet, Mr. Taylor cautions that impurities in the samples can cause the sample to require dilution.

   3.a Samples in which DBC was "diluted out" but gave a "ND" (nondetect) for PCB's or a low level (<50 ppm) include #1726, 1728, 1729, 1730,D, 1657, 1659 & 1659D plus 25 others.

      3.a.1 This list included samples such as 1765 (R4656) at a reported 50,000 dilution.

   3.b Sample 1765 was run at a dilution of 5000 and mistakenly reported as 50,000 dilution.

      3.b.1 Miscalculation with the wrong dilution factor has the effect of overstating the PCB content by a factor of 10.

   3.c Samples which require extensive dilution in order to obtain an interpretable chromatogram and yet which contain little or no PCB's, are samples that are highly contaminated with non PCB materials.

4. Surrogate recovery could not be determined because of interferences in samples #1664, 1672, 1674, 1678, 1684, 1692, 1706, 1710, 1720, 1734, 1746, 1746D, 1752, 1754 & 1766.

4.a Interference with the surrogate is evidence of insufficient sample clean-up.

4.b Insufficient sample clean-up leads to multiple interferences and to development of improperly high results.

5. In the absence of the raw chromatographic data we have no measure of chromatographic quality other than the indicated presence of interferents and severe contamination.

5.a In the absence of raw data, there is no true measure of the reproducibility as might be shown by duplicates.

5.b In the absence of raw data, there can be no confirmation of peak areas.

5.c In the absence of raw data, there is no way to determine the true extent of interferences.

5.d In the absence of raw data, there is no evidence of instrument stability as might be shown by baseline stability and reproducibility of retention times.

5.e In the absence of raw chromatographic data, there is no way to assess the quality of the standards.

6. There is no indication of a confirmatory analysis other than the word "confirmed" written on the right hand side of the data book entries as shown in BN16-1051 to 16-1095.

6.a There is no information about how confirmation may have been attempted.

7. The obvious presence of extensive contamination and interferences, the sparse recovery information, and the lack of any way to otherwise measure data quality are sufficient reasons to reject the results of the analyses performed by Revet.

8. There is no evidence of the use of a preset quality control program for the Revet laboratory.

9. There is no methodology other than the general recall of Mr. Taylor (Deposition Transcript p. 107-109).

9.a The laboratory has no specific PCB methodology.

10. Samples 1765 & 1766 were analyzed by Revet but not reported as part of the hot spot data in RFA XII.E.8 Table 1.

10.a The data were excluded from the RFA because they demonstrated carelessness in calculation and extreme contamination of samples.

11. The COE analyses of samples #3307-3315 [BN16-1215A - 16-121BG] are included as part of the RFA No. XII.E.28.

11.a This work was performed with a single point calibration.

11.b Single point calibrations make no allowance for nonlinearity and are usually not valid beyond ± 10% of the calibration value.

11.b.1 The EPA CLP program does not accept any values above the highest calibration point.

11.c Contamination of the blank, as shown in BN16-1215 A&D, was substantial and was not corrected for in the report of results for these samples.

11.d Resolution and chromatographic quality as shown in BN16-1215W are very poor.

11.d.1 Sample should have been further diluted and rerun.

11.e During the analyses, the integrator peak discrimination was set so coarse that most shoulders were ignored.

11.e.1 This technique gives a very high bias to the results because impurities that are not fully resolved are included as PCB's.

11.f The methodology used no internal standard and no surrogate.

11.g There are different chromatographic conditions for samples #3307-3310 (BN16-1215K-16-1215AF) and samples #3311-3315 (BN16-1215A2 - 16-1215BA).

11.g.1 The chromatography of the first set takes approximately 10% longer than the second set.

11.g.2 The elution time of peaks in second set get progressively shorter as the analyses proceed.

11.h Lack of internal standards coupled with changing chromatographic conditions means that there is no reliable way to identify or quantitate peaks in the chromatogram.

11.i The method chosen for the calculation of concentration contributions from various peaks does not recognize differing response factors.

11.i.1 Ignoring response factors means early eluting peaks from lower homologs, which generally have lower response factors, are afforded the same relative response as higher homologs.

11.i.2 The resultant bias will have a sign and magnitude depending on the choice of average RF and the distribution of the PCB's in the sample.

11.j The problems found with this data set are all such that the reported result will be (could be in the case of the preceeding RFA) higher than the actual PCB content.

11.k The data in this set should not be included in the NBH database.

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Battelle/GCA Hot Spot (1985)

Plaintiffs' RFA XII.E.9

1. Plaintiffs' RFA XII.E.9 Table 1 purports to present the results of analyses of sediment samples for PCB's as conducted by GCA Corporation.

2. Results presented for samples AC328 and AC329 (locations NB-CR-001B and NB-CR-001C) are incorrect.

   2.a A data transcription error of 3 orders of magnitude was made.

   2.b The actual results (BN 17-1311 and 17-1317) are a factor 1,000 lower than that reported in Table 1 of the RFA.

3. Results reported by the GCA for A1016 are biased high for samples AC324-AC326 and AC334-AC335.

   3.a There is a large interference from sulfur as exemplified by chromatograms at BN 17-1341 and 17-1343.

   3.b Because of the calibration technique utilizing a flat (or zero) baseline, the peak area is artificially inflated by the presence of the contaminant.

   3.c Standard runs shown at BN 17-1926 indicate that the peak at RT = 3.45 minutes is incompletely resolved from peak at RT = 3.69 minutes but that integrator attempts a separation.

      3.c.1 In chromatogram at 17-1343 resolution is lost and no separation was made.

         3.c.1.a Loss of resolution results in results being biased high.

      3.c.2 In the standard run, the chromatograph has come much closer to achieving baseline resolution for peak clusters.

         3.c.2.a The effect of this is to give a high bias to the results of analysis of samples.

4. Results reported by GCA for A1016 are highly questionable for samples AC332, AC336, AC338 to AC344.

   4.a There is a large sulfur interference in these samples.

   4.b The quantitation is based on a peak that is poorly resolved and often unresolved from other peaks in the chromatogram.

   4.c The effect of the poor resolution is to bias the results high.

5. The A1254 standard run on June 8, 1985 (BN 17-1810) when compared to samples run on June 9, 1985 shows that there has been extensive degradation of the A1254.

   5.a Samples run on June 9, 1985 show nearly total absence of the A1254 peak with RT = 19.5 minutes and nearly total less of the peak with RT = 22.4 minutes.

   5.b The obvious difference in the chromatograms of standards and samples mean that the calculation of A1254 in the samples will be biased very high.

6. None of the PCB results of the Battelle/GCA study should be included in the NBH data base.

1598L

BATTELLE/AQUATEC: WATER

(Plaintiffs RFAs XII.E. 10-11, 13, 16, 26, 27, 29, 32)

1. Water samples from New Bedford Harbor or Buzzards Bay were analyzed by Battelle New England Marine Research Laboratory (Battelle) and Aquatec Inc. (Aquatec).

2. The solvent blanks utilized for the filtrate water samples discussed in the plaintiffs' RFA's contain PCB's.

   2a. The PCB contamination in the blanks is as much as as 20 ppb (example: BN 44-2437).

   2b. The PCB concentration in the concentrated sample extracts, as injected, in certain instances is lower than the PCB concentration in the solvent blank (example: BN 44-2437 and 44-2438).

   2c. Many of the peaks attributed to PCB's in the sample are identical to those found in the solvent blank (example: BN 44-2437 and 44-2438).

   2d. Many of the PCBs attributed to the samples may originate in the solvent used in the preparation of the sample.

3. Many of the samples contain extremely small peaks that are purported to be caused by PCB congeners.

   3a. Many of the peaks purported to be due to PCB's are difficult, if not impossible, to discern by visual examination (examples: BN 44-2532, RT=34.840 minutes; 44-2638, RT=21.226 minutes, RT=8.958 minutes).

4. Many of the samples utilize very large multipliers to account for overall dilution from preinjection volume (PIV) (example: BN 44-2444).

   4a. The use of large multipliers compounds the errors from measurement of very small peak areas.

5. As a group, homologs containing 7-9 chlorines are most subject to error (example: BN 44-2701).

6. As a group, homologs containing 7-9 chlorines are most subject to interference.

7. When total PCB concentration is low, all congener quantitative data are highly suspect. (What is "low" depends on the relationship, in any given case, between the intensity of the purported congener peak and any background "noise" or interferences.)

7a. At very low concentrations, the congener qualitative data are suspect. (What is "very low" depends on the relationship, in any given case, between the intensity of the purported congener peak and any background "noise" or interferences.)

8. Generally speaking, solubility considerations preclude the presence of appreciable quantities of dissolved homologs containing 7-9 chlorines in water samples.

8a. Samples of filtrate showing large quantities of higher PCB homologs are indicative of the presence of colloids or very fine sediment.

9. Samples analyzed by both Battelle and Aquatec (e.g., sample nos. BG23, BG24, BG26 and BG28) (Table 1, RFA XII.E.10) and (Table 1, RFA XII.E.27) give results differing approximately by a factor of 2.

9a. This renders results of analysis done by Battelle alone highly suspect, since Battelle admitted having substantial difficulty with the analyses (Steinhauer Deposition).

9.a.1 Aquatec was brought into the program for this reason.

10. Aquatec's analysis of blanks (sample nos. BG49 - BG56) indicated the presence of large quantities of contamination (relative to the amount of PCB's) in some of the samples.

10.a. Sample No. BG 53, a blank, contained 0.2 ppb of PCB's.

10.b. Most samples contained less than .2 ppb (Table 1, RFA XII.E.27).

11. The types of problems discussed above in 2, 4, 8 and 10 all tend to introduce a high bias into results.

12. The types of problems discussed above in 2, 3, 7 and 10 all tend to facilitate false positive identification.

1542L

BATTELLE/AQUATEC: FILTERS

(Plaintiffs RFAs XII.E. 12, 14, 15, 17, 18, 28)

1. Filters containing particulate matter from water samples collected by Battelle New England Marine Sciences (Battelle) were analyzed by Battelle and Aquatec, Inc. (Aquatec).

2. Plaintiffs' RFAs allege that the results of Aquatec's analysis of samples cited in RFAs XII.E. 12, 14, 15, 17 and 18 are reported in Table 1 of Plaintiffs' RFA XII.E.28.

3. The results reported in RFA XII.E.28 Table 1 have no relation to the Battelle/Aquatec projects.

4. The NUS Data validation study found at BN 45-4639A to 45-4713 indicated that 25 of the 266 samples in the Aquatec study should be rejected because the internal standard (IS) area was not within ±30% of the most recent previous calibration standard IS (BN 45-4641).

   4.a. The results of these 25 analyses should not be included in the NBH database.

5. The chromatogram in BN 45-3313 is an example of an extract containing non-PCB materials that can cause serious interference in the PCB analyses.

   5.a. Some or all of these materials, as well as others, are seen in the chromatograms of all of the filter extracts.

   5.b. These peaks are evidence that there are non-PCB materials in all of the samples.

   5.c. Non-PCB materials may cause a strong signal with the electron capture detector.

   5.d. Non-PCB materials may interfere in the analysis of PCBs using GC/ECD.

      5.d.1 The peak at RT 11.488 min in sample 64719 (BN 45-3314) is an example of interference.

      5.d.2 This particular interference happens often in the chromatograms of the extracts of the filters comprising ETR 9102.

      5.d.3 The 2 peaks with which the peak at RT 11.488 minutes interferes, (11.368 and 11.621 minutes) are purported to represent over 7% of the total PCB in sample 64719.

5.d.4 Other interferences of a similar type are frequent; for example, in sample 64723 the peak at RT 24.188 min. interferes with the quantitation of RT 24.033 min.

6. The chromatogram of sample 64964 (BN45-2010) clearly presents peaks due to impurities.

6.a. The 13 largest peaks are due wholly or partly to impurities from the filter blank.

6.b. These peaks are found in the chromatograms of all of the sample extracts.

6.c. The lesser peaks attributed to PCB's in this sample, may or may not be due to PCB's.

6.c.1 The peaks are, in general, too small and too broad to be assigned to any specific chemical.

5.d.5 The effect of these interferences is to decrease both the quantitative and qualitative reliability of the analytical results.

7. Certain Filter blanks contain extensive PCB contamination, as shown by example in BN45-3340.

7.a. Even though the result was rejected for poor recovery of the IS, there is, in addition, extensive PCB contamination.

7.b. Contamination of filter paper with PCB's is not unusual.

7.c. The potential effect of such contamination is to introduce a large bias toward high results.

8. Contamination is, at times, so large that results from those particular analyses should be discarded.

8.a. Sample 64670 at BN 45-3356 is an example of an analysis that should be invalidated because of an ineffective cleanup, which resulted in an extract full of interfering materials.

8.b. Sample 64704 (chromatogram at BN 45-3476) presents an example of interference that affects a different area of the chromatogram, as is sample 64939 (chromatogram at BN 45-2469).

9. Process blanks such as sample numbers 64795 and 64817 show contamination; potentially indicating that glassware and apparatus used in the analyses are becoming contaminated.

9.a. Laboratory contamination introduces a bias toward high results.

10. Comparing the raw data and the results for samples 64964 and 64739 shows the samples to be very similar.

10.a. Exactly the same peaks have been identified and quantitated for dichloro-, trichloro-, and monocholoro- biphenyl.

10.b. The three peaks for tetrachlorobiphenyl in the filter blank, 64964, are also identified and quantitated in the sample 64739.

10.c. Seven of the eleven peaks for pentachlorobiphenyl in the sample are also in the filter blank.

10.d. When filter blanks are or can be this contaminated it is not possible to demonstrate that there are truly PCB's present in a sample within approximately 2 to 3 times the highest level found in the filter blank.

10.d.1. Compare 64964 with 64963, for example.

10.e. This invalidates the reported results for samples 64703 to 64744.

10.f. Other invalid results include 64748, 64759-61, 64770, 64772, 64776, 64782, 64785, 64787-90, 64792-3, 64803, 64815-6, 64822, 64824-32, 64944-5, 64956-68, 64978-9, 64984, and 65001-2.

10.g. Invalid results should not be included in the NBH data base.

10.h. Sample results reported to be between 700 ug/l and 1000 ug/l should be considered to be potentially biased high by 40 to 100%.

10.i. In cases where the sample extract has been concentrated, the effect of the impurities is intensified in direct proportion to the degree of concentration.

10.i.1. The heightened effect of impurities includes that contributed by the matrix as well as the filter. See for example BN 45-2066.

11. To convert from PCB concentration in the pre-injection volume (PIV) in ug/l to PCB concentration in the particulate sample in ppm, the concentration in the PIV must be divided by a factor equal to:

$$\frac{1000 \text{ ml/l}}{\text{PIV (in ml)} \times \text{sample wt (in grams)}}.$$

11.a. For example, 20,000 ug/l in a .05 ml PIV is equal to 1 ppm for a sample size of one gram.

12. Given the overall interference/impurity problem, the results of analyses such as that for 64881 at 45-2118 are very suspect because of the large multiplier involved.

13. For the reasons stated above, fully 75% of this data set is invalid or suspect.

13.a. Suspect values likely are biased high by a factor of 2 to 5.

1541L

BATTELLE/AQUATEC: SEDIMENT

(Plaintiff's RFA's XII.E. 19-22, 23-25, 30-31)

1. Extracts of sediment samples collected by Battelle New England Marine Laboratory were analyzed by Aquatec Inc. (Aquatec).

2. ETR 9507 sediment sample extract results purportedly are presented in Table 1 of RFA XII.E.22.

   2.a. Sample 66912 raw data are given at BN 35-1121.

      2.a.1. Sample 66912 contains many non-PCB impurities.

      2.a.2. PCB's are not the primary chemicals in sample 66912.

      2.a.3. The distribution of peaks purported to be due to PCB "congeners" in sample 66912 chromatograms is atypical.

      2.a.4. Results from the analysis of the extract of sample 66912 should not be included in the NBH database.

3. ETR 9052 sediment sample extract results purportedly are presented in Table 1 of RFA XII.E.22

   3.a. The raw chromatographic data for samples 64210 and 64211 are presented at BN 42-1271 and 42-1272

      3.a.1. The chromatograms for samples 64210 and 64211 bear an extraordinary resemblence to that of the calibration standards.

      3.a.2. The peak shapes are identical.

      3.a.3. There are no consequential impurities.

      3.a.4. There are few, if any, congener peaks missing.

      3.a.5. The chromatograms are essentially identical to that which would be obtained from a mixture of the PCB Cal B2 and PCB Cal B1.

      3.a.6. Sediment samples 64210 and 64211 are spiked sediments.

      3.a.7. The results from samples 64210 and 64211 should not be included in the NBH database.

3.b. The raw chromatographic data for sample 64214 indicate that the extract contains a high level of non-PCB interference.

3.b.1. The quantitative analysis of this sample is very suspect because of the amount of co-eluting materials.

3.b.2. The results from sample 64214 should not be included in the NBH database.

3.b.3. Samples 64224 and 64226 exhibit similar interference and co-elution to that exhibited by sample 64214.

3.c. The chromatograms of many of the samples indicate that the extracts needed to be diluted before the quantitating run.

3.c.1. These samples include 64230, 64226, 65225 and 64222.

3.d. There is conflicting information regarding the final dilution of sample 64212.

3.d.1. The dilution is claimed to be 1:2 in BN 42-1153 and 42-1408.

3.d.2. The dilution is purported to be 1:20 in BN 42-1401.

3.d.3. The appearance of the chromatogram indicates the dilution must probably 1:2.

3.d.4. Correct PCB content 15.6 ppm.

4. ETR 9049 sediment sample extract results purportedly are presented in Table 1 of RFA XII.E.22.

4.a. Many of these samples, as evidenced by the raw chromatographic data, contained varying levels of potentially interfering materials.

4.b. The potential interferences are not believed to be major factors in the quantitation but do have the potential to bias the results.

4.b.1. Some samples such as 64135, 64157 and 64148 gave baseline problems usually indicative of high boiling impurities.

4.c. Some of the samples such as 64158 contain high levels of potentially interfering compounds.

4.d. Some of the samples were run at too great dilution to be accurately quantitated or for accurate congener assignment (e.g., BN 39-1457, sample 64154).

5. ETR 9050/51 clay fraction sediment sample extracts results purportedly are presented in Table 1 of RFA XII.E.24.

5.a. Raw chromatographic and sample preparation data are found at BN 41-1001 to 41-1812.

5.b. The raw data sheets for sample 64199 (BN 41-1492, 41-1076 and 41-1077) indicate that this extract was concentrated rather than diluted.

5.b.1. The reported result is incorrect.

5.b.2. The sample extract as chromatographed was too concentrated for qualitative or quantitative accuracy.

5.b.3. Chromatography of overly concentrated samples may sharply curtail qualitative and quantitative accuracy.

5.c. Several of the sample extracts in this set contain appreciable levels of non-PCB materials.

5.c.1. Some non-PCB materials have poor chromatographic characteristics under the conditions used; others elute cleanly.

5.c.2. Some of the non PCB materials coelute with PCB congeners.

5.c.3. Coelution introduces a high bias in quantitation.

5.c.4. Some examples of this are samples 64203, 64204, 64202R, 64207 and 64189.

5.d. NUS data validation reported that results from analysis of 64195 were unusable (BN 41-1777).

5.e. Sample 64190 is purported to have contained only 3.23% solids (BN 41-1156).

5.e.1. If the sample contained only 3.23% solids, then it must have contained 97.8% of materials that were lost upon drying.

5.e.2. The dry clay particle portion of the sample will retain all of the PCB's that were contained in the other 96.8% of the sample as well as those originally on the clay.

5.e.3. The result reported for sample 64190 is biased very high.

5.e.4. Samples 64199, 64200, 64196 show high bias.

5.e.5. Because of the low % solids in the clay fraction the results of all of the samples in ETR 9050/51 will be biased high to some extent.

1540L

AQUATEC, INC. RATIOMETRIC DISTRIBUTIONS

1. Using current, state-of-the-art, analytical methodology, not all PCB congeners that occur in a commercial mixture (Aroclor) or in an environmental sample can be separated into single peaks with the use of only one GC capillary column.

   1.a. As a consequence, co-elution of congeners occurs. When one or more of the co-eluting congeners in the peak aggregate have different chlorine numbers, GC/MS can be used to derive ratiometric distributions for encumbered peaks.

2. Aquatec, Inc. used this approach when analyzing PCBs in NBH sediment samples.

   2.a. The ratiometric distributions were developed based on GC/MS analysis of two purportedly representative sediment extracts.

   2.b. The ratiometric distributions used by Aquatec for the quantifiation of encumbered peaks in NBH sediments are as follows:

   Percent Distribution of Chlorination Levels in Major GC Peaks where Co-elution of Two Chlorination Levels May Occur

IUPAC #	Levels	Class SE Sediment Extracts
15/17	2/3	81.41
33, 20/53	3/4	77.35
37/59, 42	3/4	63.78
66, 80/95, 93, 102	4/5	57.87
60, 56/92, 84	4/5	63.72
82/151	5/6	52.92
124/135, 144	5/6	48.09
127/168	5/6	69.51

   2.c. The use of ratiometric distribution by Aquatec, Inc. improves the accuracy and reliability of NBH sediment analysis by levels of chlorination when the sediments being analyzed have distributions similar to the two purportedly representative samples selected for GC/MS determination of the distribution ratio.

3. The anaerobic reductive dechlorination which is occuring in NBH sediments has altered significantly the ratiometric distributions of numerous co-eluting congeners.

3.a. The changes observed for unencumbered peaks as the result of advanced dechlorination expressed as percent removal (R) or percent formed (F) are as follows:

Changes in Distribution of Chlorination Levels Resulting from Reductive Dechlorination

IUPAC #	Levels	Percent Removed or Formed
15/17	2/3	48.6R/33.7F
33, 20/53	3/4	95.9R/36.7F
37/59, 42	3/4	90.6R/21.2F
66, 80/95, 93, 102	4/5	83.8R/32.0R
60, 56/92, 84	4/5	99.6R/17.1R
82/151	5/6	97.3R/49.7F
124/135, 144	5/6	ND/21.9R
127/168	5/6	ND/ND

ND = Not Detected

3.b. Failure to consider these ratio changes resulting from dechlorination will result in the production of data which are erroneous.

3.c. Three sets of ratiometric distribution, representing slight, moderate and advanced dechlorinations would be required for the generation of accurate and reliable data for sediments exhibiting dechlorination alterations.

6159i

Battelle Mussel Watch

Plaintiffs' RFA's XII.E.33 Site 9

1. The raw gas chromatographic data for the samples from Site 9 are purported to be presented in 71-1088 to 71-1176 and 71-1348 to 71-1392.

   1.a No information regarding the 1986 tissue samples is contained within this package other than a results sheet for AAA132.

   1.b Only the calculated results of 1986 sediment samples are contained in the named documents. No raw data are provided.

   1.c No raw data are provided for the 1987 tissue samples AAC240 and AAC241.

   1.d No raw data are available for the 1989 (Phase IV) samples.

   1.e These documents contain information not related to site 9.

2. The quality of chromatographic data cannot be judged without both the analog chromatogram and a <u>complete</u> printout.

3. The RFA attachments contain raw chromatographic data for 3 dilutions of the extracts of tissue sample AAC239.

   3.a No quantitation documentation is presented for the last two dilutions.

4. **The analytical results reported in Table 1, Column C do not accurately reflect the results obtained in the analysis of samples from site 9 of the Battelle Mussell Watch Study.**

   4.a RFA XII.E.33(3) should be denied.

   4.b RFA XII.E.33(5) should be denied.

   4.c RFA XII.E.33(7) should be denied.

   4.d RFA XII.E.33(13) should be denied.

   4.e RFA XII.E.33(15) should be denied.

5. The raw chromatographic data for samples AAI054, AAI055 and AAI056 are contained in documents 71-1094 to 71-1113.

5.a These data indicate that the sample extracts, as injected, are too concentrated.

5.b These chromatograms cannot be interpreted by an analyst because too many of the peaks are off scale.

5.c There is no evidence that these samples were reanalyzed using more dilute solutions.

5.d Chromatographing a more dilute solution will not produce baseline resolution of the individual peaks within the various clusters of peaks.

5.e There is no evidence that the same sample was run with a greater attenuation of the output signal.

5.e.1 Greater attenuation of the signal will not improve the chromatography.

5.f The samples have not been sufficiently prepared or preseparated for an analysis of this type.

5.f.1 Each of the chromatograms contains over 250 peaks.

5.f.2 Given the condition of the sample extracts as run, it will not be possible to achieve high quality chromatograms.

5.f.3 Sharp peaks are only one component of a good g.c. analysis.

5.g The purported PCB congener identities and quantities are of insufficient quality for inclusion in the NBH data base.

6. The raw chromatographic data for samples AAB750 to AAB751 are contained in documents 71-1148 to 71-1165.

6.a The raw data for samples AAI054 to AAI056 should look like those in 71-1148 to 71-1152 or at worst like those in 71-1153 to 71-1165 if there is to be an opportunity for accurate identification and quantitation.

6.b Raw chromatographic data packages like that presented in 71-1148 to 71-1165, although necessary, are not sufficient to guarantee accurate identification and quantitation.

7. The calibration data are presented in 71-1186 to 71-1190.

7.a These data show that the response factor may vary by as much as 25% between two standards analyses.

7.b The accuracy of the values reported for the congeners in the samples of mussel tissue and sediment can be no better than values reported for the standards.

7.c The accuracy of the values reported for the congeners in the samples of mussel tissue and sediment will be less than for values reported for the standards.

7.d Values reported in Table 1 are given with three significant figures; example 1470 ppb.

7.d.1 The correct way to report the values in Table 1 should be of the form 1500 $\pm$ 500 ppb.

8. Poor recovery of the recovery standard [71-1192] results as much or more from the inability of measuring OCN (octachloronaphthalene) amidst the 250+ other compounds as from potential loss during sample preparation.

9. Blank spike recovery for PCB congeners ranged from approximately 120% to 170%.

9.a High PCB spike recoveries indicate that quantitation will be biased high.

9.b High PCB spike recoveries coupled with a correction for low OCN recovery (71-1121) implies potential for extremely high bias in reported results.

10. There is no inter-year consistency on the array of PCB homologs or the pattern from their concentration levels.

10.a Phase 1 reported Cl-7, Cl-8, Cl-9 in 4 of six samples and Cl-8 & Cl-9 in the remaining two samples.

10.b Phase 4 reported no Cl-7, Cl-8 or Cl-9 in any samples.

11. In the absence of raw data for tissues from site 9 for 1986 and 1989 (and part of 1987), the results of these analyses should be rejected for inclusion in the NBH data base.

11.a Denial of inclusion in the NBH data base is supported by the stated problems with other samples.

1545L

BATTELLE MUSSEL WATCH

Plaintiffs' RFA's XII.E.34 SITE 10

1. The raw gas chromatographic data are purported to be presented in 72-1153 to 72-1235 and 72-1416 to 72-1457.

   1.a No raw data have been provided for sample AAB 371.

   1.b No raw data have been provided for the 1986 tissue samples.

   1.c No raw data have been provided for the 1989 samples.

   1.d These documents contain much information unrelated to Site 10.

2. The quality of chromatographic data cannot be judged without both the analog chromatograms and a complete printout.

3. The raw chromatographic data for samples AAI057 to AAI059 are contained in documents 72-1155 to 72-1173.

   3.a These data indicate that the sample extracts, as injected, were too concentrated.

   3.b These chromatograms cannot be interpreted by an analyst because too many of the peaks are officials? off scale?

   3.c There is no evidence that these samples were reanalyzed using more dilute solutions.

   3.d Chromatographing a more dilute solution will not produce baseline of the individual peaks within the various clusters of peaks.

   3.e There is no evidence that the sample was rerun with greater attenuation of the output signal.

      3.e.1 Greater attenuation, however, would not improve the chromatography.

   3.f The samples have not been sufficiently prepared or preseparated for an analysis of this type.

      3.f.1 Each of the chromatograms contains over 200 peaks.

3.f.2 Given the condition of the sample extracts, as run, it will not be possible to achieve high quality chromatograms.

3.f.3 Sharp peaks are only one component of a good g.c. analysis.

3.g The purported PCB congener identities and quantities are of insufficient quality for inclusion in the NBH data base.

4. The raw chromatographic data for sample AAC250 are contained in 72-1175 to 72-1184.

4.a These data indicate that the sample extracts, as injected, were too concentrated.

4.b The chromatogram indicates the presence of over 200 peaks.

4.c The chromatographic column is not adequately resolving the components of the sample.

4.d The purported PCB congener identities and quantities are of insufficient quality for inclusion in the NBH data base.

5. The raw chromatographic data for samples AAC248 & AAC249 are contained in 72-1186 to 72-1195.

5.a The results of the analysis of sample AAC249 are not contained in Table 1 of RFA XII.E.34.

5.b The chromatogram for sample AAC249 indicates that the extract, as injected, was too concentrated.

5.b.1 The results for sample AAC249 were correctly excluded from Table 1.

6. The raw chromatographic data for samples AAB755 to AAB757 and AAB244 - AAB245 are contained in 72-1196 to 72-1215 and 72-1181 to 72-1185.

6.a The chromatograms of these samples indicate that the extracts, as injected, were too concentrated.

6.b The chromatograms of samples AAB755 to AAB757 and AAB244 show too many peaks off scale to allow application of pattern recognition techniques.

7. Some of the calibration data are presented in 72-1242 to 72-1253.

7.a These data show that the response factors of individual PCB congeners may vary as much as 360% within the initial calibration run.

7.b The accuracy of the values reported for the congeners in the samples of mussel tissue and sediment can be no better than values reported for the standards.

7.c The accuracy of the values reported for the congeners in the samples of mussel tissue and sediment will be less than for values reported for the standards.

7.d Values reported in Table 1 are given with 3 significant figures; example 1820 ppb.

7.d.1 The correct way to report the values in Table 1 should be <u>of the form</u> 2000 ± 3600 ppb.

8. Poor recovery of the recovery standard [72-1260] results as much or more from the inability of the analyst to measure OCN amidst the 200+ other compound, as from potential loss during sample preparation.

9. Blank spike recovery for PCB congeners ranged from approximately 91 to 170%.

9.a High PCB spike recoveries indicate that quantitation will be biased high.

9.b High PCB spike recovery coupled with a correction for low recovery of the recovery standard implies potential for extremely high bias in reported results.

10. There is no intra- or inter-year consistency of the array of PCB homologs reported for the samples. [70-3584A.244]

11. There is no intra- or inter-year consistency of the array of PCB congeners reported in the samples. [70-3584A.274]

12. In the absence of raw data for tissues from site 9 for 1986 and 1989 (and part of 1987), the results of these analyses should be rejected for inclusion in the NBH data base.

12.a. Denial of inclusion in the NBH data base is supported by the stated problems with other samples.

13. The results reported in Table 1 for samples AAJ790-AAJ792 show an order of magnitude difference between samples.

14. The results reported in Table 1 for sample AAJ792 do not agree with any other value.

14.a. The value is incorrectly reported in Table 1.

1543L

Battelle Mussel Watch

Plaintiffs RFAs XII.E.35 Site 11

1. The raw chromatographic data for the samples from Site 11 are purported to be contained in 73-1113 to 73-1172.

   1.a No information regarding the 1986 samples is contained within these documents.

   1.b No information regarding the 1987 sediment sample AAB752 is contained within these documents.

   1.c No information regarding the 1989 samples is contained within these documents.

   1.d These documents contain much information not related to Site 11.

2. The quality of chromatographic data cannot be judged without both the analog chromatogram and a complete printout.

3. The raw chromatographic data for samples AAI051 to AAI053 are contained in documents 73-1113 to 73-1134.

   3.a These chromatograms are of poor quality.

   3.b These chromatograms all show a common problem.

   3.c The common problem illustrated by these chromatograms is indicative of a poor sample cleanup and/or improper adjustment of the detector.

   3.d The problem is manifested in a very poor baseline in the chromatograms.

   3.e The analyses of these samples should have been repeated after correcting the problem.

   3.f The data in 73-1113 to 73-1134 and any analysis based thereon are unreliable.

4. The raw chromatographic data for samples AAC236 to AAC238 is given in 73-1135 to 73-1145, and 73-1155 to 73-1164.

   4.a These data are illustrative of several serious problems.

4.a.1 In several cases, measurements are based on extremely small shoulders associated with relatively major peaks.

4.a.1.a This practice causes substantial inaccuracies in quantitation.

4.a.1.b This practice causes severe loss of precision.

4.a.2 The resolution is inadequate for the measurement being attempted.

4.a.3 The cleanup of the samples is inadequate.

4.a.4 The label of the chromatogram beginning on 73-1160 has been changed.

4.a.4.a There is not enough information to determine the true identity of this sample.

4.b These data will not yield accurate and reproducible results.

4.c Results obtained with these data should not be included in the NBH database.

5. The raw chromatographic data for samples AAB748 and AAB749 are purported to be contained in 73-1165 to 73-1172.

5.a The data sheets are largely illegible.

6. Some of the calibration data are presented in 73-1211 to 73-1223 and 73-1235 to 73-1251.

6.a These data show that the calibrations were meant for samples by date rather than by site, therefore all comments regarding calibration data apply to Sites 9-11 equally.

7. The inter-year results on a congener basis are not consistent [70-3584A.274 and 70-3584A.304].

8. The intra-year results on a congener basis are not consistent [70-3584A.274 and 70-3584A.304].

9. In the absence of raw data for tissues from Site 9 for 1986 and 1989, the results of these analyses should be rejected for inclusion in the NBH data base.

9.a Denial of inclusion in the NBH data base is supported by the stated problems with other samples.

1544L

NUS/GZA (Grid)

Plaintiff's RFA XII.E.38 5450PEI.PED

1. PEI/PEDCO analyzed samples AF170 to AF175 and AE801 to AE824

   1.a. The results of these analyses were reported in Plaintiff's RFA XII.E.38.

   1.b. The raw data from these analyses are given at BN 51-1001 to 51-2705

   1.c. The results in Table 1 are reported up to five (5) significant figures but the method is only capable of delivering two (2) or three (3) significant figures.

2. NUS performed the data validation on the PEI/PEDCO data set (BN 51-1941 to 51-1960).

   2.a. According to NUS "The %RSD for DDT is above the established criteria for the standards associated with all samples. Since the patterns for PCB's are similar to 4,4'-DDT the quantitative results for PCB's are marked as estimated for all samples except for those marked as tentative for other reasons".

   2.b. NUS indicated for several samples AE803, AE808, AE810, AE811, and AE813 the retention times for Aroclor 1242 and Aroclor 1254 did not fall within retention time windows.

      2.b.1. The Aroclor results for samples AE803, AE808, AE810, AE811, and AE813 were marked as tentative.

   2.c. NUS indicated for samples AE801, AE806, AE809, AE814 and AE816 the retention time for Aroclor 1254 did not fall within retention time windows.

      2.c.1. The Aroclor 1254 results for samples AE801, AE806, AE809, AE814 and AE816 were marked as tentative.

3. GC raw data show a large solvent tail for most sample analyses.

   3.a. An example of this large solvent tail is sample AE814 (BN 51-1421).

3.b. The large solvent tail make it difficult to identify and quantitate the compounds that elute early in the GC analysis run such as Aroclor 1242.

3.b.1. Multiple peak analytes such as Aroclor 1242 are difficult to identify by peak patterns in this situation.

3.c. This large solvent tail can cause retention times to shift such that analytes elute outside their retention time windows.

4. The laboratory alleged that Aroclors 1242 and 1254 had been confirmed by GC/MS for samples AE814, AE816, and AE817.

4.a. There is no evidence that Aroclor standards 1242 or 1254 had been analyzed by GC/MS.

4.b. There is no evidence that mass spectra were produced for potential PCB's in the sample extracts.

4.b.1. Evidence shows that for sample AE816, for example, (BN 51-1444 to 51-1452) extracted ion current profiles for each chlorination level were produced.

4.b.2. Evidence shows that PCB potential existed for the samples.

4.c. The GC/MS data confirms the potential existence of PCB's in the samples.

4.c.1. The confirmation is not sufficient since no mass spectra were produced.

4.d. The procedure for confirmation of multi-component pesticides and PCB's (BN 49-1431) were not followed.

5. There are PCB's in the method blank (BN 51-3039)

6. Because of the serious defect in the chromatography and contamination in the blanks, none of the results of the analysis of samples AF170-AF175 and AE801 to AE824 should be included in the data base.

0062y

NUS/GZA (Grid)
GCA Laboratory Analyses

Plaintiff's RFA X.II.E. 39

1. PCBs (1248 and/or 1254) were reported as present in nearly all samples, although confirmations are questionable.

   1a. No GC/MS confirmation of PCB identifications was carried out; the stated reason was the low levels found by GC/ECD.

   1b. The identifications of Aroclor 1254 were not confirmed in the following samples: AE520, AE523, AE526, AE530, AE547.

      1b.1 PCB identifications for samples AE523, 526, 530, 547 were not confirmed because the concentrations were below the CRDL (Contract Required Detection Limit).

2. Identification of quantitation criteria are not apparent and subject to misinterpretation.

   2a. For some pesticides, peak heights were used instead of areas. (BN 52-1346).

3. GC raw data was questionable in several areas.

   3a. BN 52-1226 and 52-1229 show chromatograms of AE531 at two different dilutions.

      3a.1 The large mound at 22:00 minutes should not be there as a result of dilution and indicates probably contamination.

   3b. BN 52-1232, a 1:50 dilution of AE531 run on same column type, but different GC, gives a completely different profile than either the 1:10 or 1:100 dilution of AE531.

      3b.1 At least one of these dilutions, analyses, or both, must be in error.

   3c. The footnote on BN 52-1237 does not completely explain why a retention time of 3:32 minutes does not match up with the outputs on BN 52-1238 and 52-1239.

   3d. Area counts for 1248 and 1254 are based on a combination of GC peaks. There is no indication of which peaks are used. The quantitation data cannot be confirmed.

4. Pattern recognition of PCBs is not conclusive.

   4a. The reported "confirmation" analysis for sample AE5341 (BN 1238) is not a good match by pattern recognition with the standard A1248 (BN 52-2954).

   4b. The confirmation of the PCB identify for sample AE520 is not obvious.

5. Method blanks should demonstrate that there are not interferences from the analytical method.

   5a. MBII (Method blank II) for this analysis set showed several potential interfering peaks, especially on the HP5840 GC system (BN 51-3041).

6. All sample analyses should be dated so as to retrace the analytical sequence.

   6a. The Pesticide Evaluation Standards Summary did not always show dates, e.g. BN 52-1333.

7. Quantification of A1248 is questionable.

   7a. BN 52-1068, paragraph 8, indicates that the PCB patterns resembled A1248 <u>or</u> A1242.

      7a.1 All were quantified as A1248.

8. Data submission packages should be sufficient for a complete data validation study to be carried out.

   8a. BN 52-1065, the documentation of this submittal, makes no reference to the analytical method used.

   8b. There is no documentation of how total areas for PCBs are calculated.

   8c. There is no documentation of which peaks were included and/or excluded or if substraction/background interferences were taken into account.

   8d. No justification is given for how reported values were derived.

   8e. It must be assumed, from the submittal package, that all values are estimated and that the reported values could have been higher than the actual.

9. The PCBs were quantitated using baseline-to-baseline assumptions that can cause high bias.

   9a. The presence or sulfur in most of the samples renders this quantitation approach extremely vulnerable to high bias.

10. The quantitations were done on a single peak for each Aroclor.

   10a. Single peak quantitations will not be accurate on weathered environmental samples such as these.

11. None of the results of the analyses of this GCA set of CLP samples should be included in the NBH data base.

6264i

NUS/GZA Grid Sampling
Case 5450 Analyses by York Laboratories
Plaintiffs' RFA XII.E.40

1. York Laboratories Division reportedly analyzed samples AE501-AE518, AE545, and AE546.

   1.a. Table 1 of Plaintiffs' RFA XII.E.40 purports to list results of these analyses.

   1.b. The supporting raw data for these analyses purportedly is given at BN 53-1001 to 53-1514.

      1.b.1. The supporting raw data for sample AE511 are available but no concentrations are reported (BN 53-1266 to 53-1275).

   1.c. The results in Table 1 are reported to four (4) and five (5) significant figures, but the method is only capable of delivering two (2) or three (3) significant figures.

2. NUS performed the data validation for the York Laboratories Division data set (BN 53-1266 to 53-1275).

   2.a. According to NUS, "spectral performance for this fraction was satisfactory although matrix interference was documented as affecting the DBC elution time and recovery."

      2.a.1. Evaluation standards summary reports (BN 53-1356 to 53-1363) show that that the problem of DBC shift was a chronic problem with the 3% OV1 column used as a confirmation column.

      2.a.2. Because the relative retention times could not be accurately demonstrated, the identity of eluates cannot be confirmed.

      2.a.3. Since there was a problem with the 3% OV1 column, a different column should have been selected.

      2.a.4. When the identity of analytes cannot be confirmed, both qualitative and quantitative data reported are suspect.

3. Two extraction blanks were prepared on 1/14/86 and 1/15/86.

3.a. Both blanks were analyzed on the primary column on 1/27/86.

3.a.1. Both blanks were relatively clean with a fairly flat baseline (BN 53-1473 and 53-1482).

3.b. Both blanks were analyzed on the confirmation column more than once.

3.b.1. Both blanks were analyzed on the confirmation column on 1/30/86 (BN 53-1476 and 53-1484).

3.b.1.a. Both blanks were analyzed before any samples were analyzed on 1/30/86.

3.b.1.b. Both blanks had minor peaks in them which could interfere with PCB identification and quantitation.

3.b.2. Both blanks were analyzed on 1/27/86 (BN 53-1474 and 53-1483).

3.b.2.a. Both blanks were analyzed after some samples had been analyzed.

3.b.2.b. Both blanks had many peaks, some of which were broad and unresolved, indicating gross contamination of the GC instrument.

3.b.3. The extraction blank of 1/14/86 was analyzed on 1/28/86 (BN 53-1475).

3.b.3.a. The blank was analyzed after several samples were analyzed.

3.b.3.b. The raw data shows many interfering peaks some which are broad and unresolved.

3.b.3.c. The raw data shows peaks which would interfere in PCB indentification.

3.b.3.d. These peaks indicate that there was gross contamination of the CC instrument.

4. Gross contamination of the GC system can be seen in samples such as sample AE517 (BN 53-1312), where many broad unresolved peaks are seen.

4.a. Cross contamination can be seen in the primary column.

4.a.1. For example, the 'EVALB" standard when run before samples (BN 53-1450) has resolved peaks and a stable baseline.

4.a.2. After samples have been run, the "EVALB" standard (BN 53-1450) has broad unresolved peaks along the baseline which interfere with the integration of standards.

4.b. Cross contamination can be seen in the confirmation column.

4.b.1. For example the "EVALS" standard when run before samples (BN 53-1383) has resolved peaks and a stable baseline.

4.b.2. After samples have been run, the "EVALB" standard (BN 53-1454) has broad unresolved peaks along the baseline which interfere with the integration of the standards.

5. The number of peaks used to identify and quantify the Aroclors is unclear.

5.a. On the chromatograms (BN 53-1226 and 53-1227) of sample AE505, for example, Aroclor identifications are written underneath the area where they would elute.

5.b. Nowhere in the sample report (BN 53-1224 to 53-1230) is there any indication which specific peaks were used for identification and quantitation.

5.c. A peak eluting at approximately 14 minutes in the confirmation run may have been incorrectly used to identify Aroclor 1254.

5.c.1. The peak eluting at approxomately 14 minutes in the sample is also seen in the extraction blank (BN 53-1475).

5.d. The Pesticide/PCB report (BN 53-1368 to 53-1369) indicates that only one peak has been used for identification, quantification and confirmation of Aroclors.

5.d.1. This means that the results of the analyses will be biased high or low depending on the extent and type of weathering or degradation.

6. Results from the analyses of samples AE501-AE518, AE545 and AE546 for PCBs are in error.

6.a. Results from the analyses of samples AE501 - AE518, AE545 and AE546 for PCB's should not be incorporated into the NBH data base.

1660L

NUS/GZA Grid Sampling
Case 5503 Analyses by S-Cubed

Plaintiff's RFA XII.E.41

1. S-Cubed analyzed samples AF110 - AF119 and AF201 - AF215.

   1.a. The results of these analyses were reported in Plaintiff's RFA XII.E.41 Table 1.

   1.b. The raw data from these analyses are given at BN 54-1001 to BN 54-1634.

   1.c. The results in Table 1 are reported from four (4) to five (5) significant figures but the method is only capable of delivering two (2) or three (3) significant figures.

2. NUS performed the data validation for the S-Cubed data set (BN 54-1460 to 55-1472).

   2.a. According to NUS "The %RSD for most linearity checks were above 10% with DDT having the poorest linearity check"

      2.a.1. NUS indicates that the poor DDT calibration check can indicate possible quantitation problems for positive Aroclor findings.

      2.a.2. Because of the calibration problems with DDT, NUS flagged all data for the Aroclors to be estimated.

   2.b. Samples AF116 and AF117 were field duplicates.

      2.b.1. The percent difference for the results for Aroclor 1248 was 69%.

      2.b.2. The percent difference for the results for Aroclor 1254 was 48%.

      2.b.3. According to NUS "Due to the high percent difference between field duplicates for Aroclors 1248 and 1254, associated quantitative results for this case should be considered estimated.

3. Most surrogate recoveries were above the advisory limits (BN 54-1473 to 54-1474).

3.a. The laboratory stated in its narrative (BN 54-1198) that the high recoveries were due to matrix effects.

3.a.1. The percent recovery summary sheets (BN 54-1473 to 54-1474) indicate that the surrogate recovery for the extraction blank were at or above the advisory limits.

3.b. NUS states in the data validation report (BN 54-1460 - 55-1472) that there is a possible "high bias systematic error in the DBC recovery procedure"

3.c. NUS further states that there is insufficient information to assign high DBC recoveries to matrix or high laboratory bias.

3.d. Because there is no evidence to indicate matrix problems or high laboratory bias, the recoveries are unreliable.

3.e. High surrogate recoveries imply that all results may be biased high.

4. All of the results from the analysis of samples AF110 - AF119 and AF201 - AF215 should be considered to be estimates.

0062y

NUS/GZA Grid Sampling
Case 5503 Analyses by ETC

Plaintiff's RFA XII.E.42

1. Environmental Testing and Certification (ETC) analyzed samples AE825 - AE838 and AF216 - AF226.

   1.a. The results of these analyses were reported in Plaintiff's RFA XII.E.42 Table 1.

   1.b. The raw data from these analyses are given at BN 55-1001 to 55-1981.

   1.c. The results in Table 1 are reported from three (3) to five (5) significant figures but the method is only capable of delivering two (2) or three (3) significant figures.

2. NUS performed the data validation for the ETC data set (BN 55-1442 to 55-1454).

   2.a. NUSA approximated all results due to "numerous shortcomings" (BN 55-1444) in the data set.

      2.a.1. Numerous problems with calibration checks existed.

      2.a.2. Most surrogate recoveries were above the advisory limits.

      2.a.3. No matrix spike or matrix spike duplicate recoveries were calculated for one sample.

      2.a.4. System performance showed major breakdown of DDT and Endrin.

3. GC raw data show that there is a large unresolved peak eluting from 05 to 5 minutes in the primary column.

   3.a. Samples AE832 (BN 55-1274) and AE836 (BN 55-1474) illustrate the problem of a large unresolved peak eluting from 0.5 to 5 minutes in the primary column.

      3.a.1. The size of the large peak suppresses the profile of the later eluting peaks.

   3.b. Any analytes which elute within the 0.5 to 5 minute time span cannot be determined.

3.c. The existence of this large unresolved peak eluting from 0.5 to 5 minutes demonstrates that the clean up procedures for these samples was inadequate.

4. GC raw data for the confirmation column show that there is a large unresolved peak eluting from 17 to 22 minutes.

4.a. Sample AE832 (BN 55-1277) illustrates the problem of a large unresolved peak eluting from 17 to 22 minutes in the confirmation column.

4.b. This large unresolved peak can mask the identity of peaks which elute within the 17 to 22 minute time span.

4.c. The existence of this large unresolved peak eluting from 17 to 22 minutes illustrates inadeqauate cleanup of the extracts.

5. The samples in this set had reported concentration ranges for Aroclor 1254 which ranged from 130 ug/kg to 14000 ug/kg.

5.a. GC instrument calibration for the Aroclors are based on single point calibrations.

5.b. All samples were analyzed using the final extract volume.

5.b.1. No samples were analyzed at any further dilution.

5.c. Samples which have high reported concentrations of Aroclors are unreliable since they greatly exceed the established ranges.

6. Linearity, calibration and breakdown checks were performed for the primary and confirmation columns.

6.a. All linearity checks for DDT exceeded the 10 percent relative standard deviation criteria (BN 55-1443).

6.b. Most calibration checks had greater than 20 percent DDT/Endrin breakdown (BN 55-1466 to 55-1468, BN 55-1624 to 55-1626 and BN 55-1777 to 55-1779).

6.b.1. The method states that if DDT and/or Endrin breakdown exceeds 20 percent, then corrective action must be taken and sample analysis must be repeated (BN 49-1419).

6.b.2. There is no evidence that corrective action was taken or if sample analysis was repeated.

6.c. The GC chromatogram for one of the "EVALB" standard shows a rising baseline (BN 55-1493).

6.c.1. This rising baseline indicates contamination of the GC instrument.

6.c.2. There is no evidence that any instrument contamination problems were addressed.

7. Some samples had evidence of sulfur interference.

7.a. For example the GC chromatogram for sample AF223 (BN 55-1414) indicates that there is a sulfur interference in the sample.

7.b. The sulfur peak masks the identity of PCB.

7.c. The method states that if compounds of interest are prevented from being determined by the presence of interferences, further cleanup is required. If sulfur is evident, go to sulfur cleanup (BN 49-1423).

7.d. There is no evidence that sulfer cleanup was performed.

8. Most surrogate recoveries were above the advisory limits (BN 55-1456 to 55-1458).

8.a. The lab stated in its narrative (BN 55-1195) "There were interfering peaks due to the Aroclor profile for DBC"

8.b. All three extraction blanks had recoveries above the advisory limits.

8.b.1. High recoveries in the extraction blanks which exceed the advisory limit means that some problem may have existed in the preparation of the samples.

8.b.1.a. The laboratory did not indicate any sample preparation problems in their narrative (BN 55-1195).

8.b.2. The laboratory analyzed the samples on the 40th day after extraction.

8.b.2.a. Losses of solvent due to evaporation during storage may have occurred, further concentrating the extracts.

8.b.2.b. The extract concentration would account for high surrogate recoveries.

8.b.2.c. This extract concentration would bias all results high.

9. The laboratory indicated that, for some samples which contained Aroclors, the relative retention times for the potential Aroclors were outside their retention time windows.

9.a. The laboratory stated that emphasis was placed on pattern recognition (BN 55-1195).

9.b. Samples were analyzed once for each column and with no dilution of the extracts.

9.c. The presence of high levels of sulfur in some samples suppressed additional peaks in the sample analysis runs.

9.c.1. The peak suppression by the sulfur presence makes pattern recognition determinations difficult if not impossible.

9.d. The large unresolved peak eluting in some samples is an indicator of potential column overload.

9.d.1. The large unresolved peak can suppress the presence of other peaks making determinations by pattern recognition difficult.

9.d.2. The column overload would cause retention time shifts in the samples.

9.d.3. Dilutions of the extracts would solve the column overload problem.

9.e. Since column overload caused retention times to shift, identification of Aroclors by retention time is unreliable.

9.f. Since large contaminant peaks in the GC runs suppressed many additional peaks in the GC chromatogram, determination of Aroclors by pattern recognition is unreliable.

10. The raw date from the analyses of samples AE825 - AE838 and AF216 - AF226 indicate the analyses were poorly and carelessly conducted.

10.a. The results of these analyses are invalid.

10.b. None of the results of these analyses should be included in the NBH data base.

0062y

NUS/GZA Grid Sampling
Case 5575 Analyses by ERCO

Plaintiff's RFA XII.E.43

1. Energy Resources Company, Inc. (ERCO) analyzed samples AF264 to AF283MSD and an ERCO Blank.

   1.a. The results of these analyses were reported in Plaintiff's RFA XII.E.43 Table 1.

   1.b. The raw data from these analyses are given at BN 56-1001 to 56-1465.

   1.c. The results in Table 1 are reported from four (4) to five (5) significant figures but the method is only capable of delivering two (2) or three (3) significant figures.

2. NUS performed the date validation for the ERCO data set (BN 56-1378 to 56-1389).

   2.a. According to NUS "Most of the differences that occurred in this package dealt with 4,4'-DDT. Because of the fact that many of the Aroclor peaks and 4,4'-DDT peaks have similar retention times, it is felt that the shortcomings in the items above are applicable to the quantification of Aroclors and all of the values in this set should be approximated."

3. GC raw data show that there are many unresolved peaks.

   3.a. An example of the many unresolved peaks is sample AF264 (BN 56-1183 to 56-1184).

   3.b. Integration reports indicate that all integrations were made from baseline to baseline.

   3.c. There is no indication on the chromatograms where the baselines are defined.

   3.d. Therefore the integrations for these samples are unreliable.

4. The organic analysis data sheets are given at BN 56-1137 through 56-1182

   4.a. For the "ERCO Blank" (BN 56-1178) no Aroclors were detected.

4.a.1. The quantitation limits for Aroclors 1242, 1248, and 1254 were determined to be the same.

4.b. For samples AF266, AF268, AF269, AF277, AF275, AF278, AF279, AF280, and AF281, all reported concentrations of Aroclors were below the quantitation limits.

4.c. For samples AF267, AF271, and AF274, part of the total reported concentrations represents Aroclors at concentrations below their quantitation limits.

5. There is no evidence to determine how many peaks were used for confirmation of Aroclors.

5.a. There is no evidence to determine if potential Aroclor peaks were within specified retention time windows.

5.b. For some confirmation analyses, sample AF282 (BN 56-1226) for example, some peaks are off-scale.

5.b.1. Off-scale peaks are an indication of possible column overload which could potentially shift peaks outside their retention time windows.

5.b.2. Off-scale peaks make it difficult to determine the presence of Aroclors by pattern recognition.

6. GC raw data for the "ERCO Blank" have a number of peaks (BN 56-1344 to BN 56-1345).

6.a. Some of these peaks are full scale across the GC trace.

6.b. Many of these peaks are unresolved.

6.c. The Quantitation Forms (BN 56-1314 to 56-1321) indicate that no samples were "background corrected" or corrected for "blank responses".

6.d. The non-correction for blank responses could bias the results high.

7. Quantitation of the Aroclors were not made against the standard run during the initial calibration.

7.a. The laboratory calibration form (BN 56-1332) lists GC standard runs which do not correspond to those indicated on the Pesticide Evaluation Standards Summary (BN 56-1352)

7.b. Two (2) point calibration curves were used for Aroclors 1248 and 1254.

7.b.1. These calibration curves were run after the samples had been analyzed.

7.b.2. These runs are not documented on the Pesticide Evaluation Standards Summary.

7.c. Relative response factors for the two calibration points were averaged and used to determine Aroclor concentrations.

7.d. Samples were not analyzed after analyzing the standards.

7.e. The specified (BN 49-1420) sequence for the quantitation of the samples was not followed.

8. None of the results for samples AF264 to AF283 should be incorporated into the NBH data base.

0062y

NUS/GZA Grid Sampling
Case 5528 Analyses by Aquatec

Plaintiff's RFA XII.E.45

1. Aquatec Inc. - Environmental Services analyzed samples AF234 - AF258.

   1.a. The results of these analyses were reported in Plaintiff's RFA XII.E.45 Table 1.

   1.b. The raw data from these analyses are given at BN 59-1001 to 59-2319.

   1.c. The results in Table 1 are reported to five (5) to significant figures but the method is only capable of delivering two (2) or three (3) significant figures.

2. NUS performed the data validation for the Aquatec Inc. - Environmental Services data set (BN 59-1933 to 59-1944).

   2.a. According to NUS "The calibration factors from the initial calibration information could not be reproduced using the information available".

   2.b. NUS did not take any action as a result of not being able to reproduce calibration factors.

   2.c. Inability to reproduce the calibration factors cast doubt upon the reliability of the data.

3. The laboratory analyzed extracts on a gas chromatography/mass spectrometry (GC/MS) system for PCB confirmations.

   3.a. A 100 ng/ul chlorinated standard was analyzed by GC/MS.

      3.a.1. The 100 ng/ul standard contained a mixture of Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260 (BN 59-1184).

   3.b. Individual Aroclors were not analyzed separately.

   3.c. The GC/MS results for some of the samples were interpreted as indicating the presence of PCBs.

3.c.1. The identification of PCBs as Aroclors 1242 or 1254 was not confirmed as a result of the GC/MS analysis.

3.d. The procedure for GC/MS confirmation as specified in the method was not followed (BN 49-1431).

4. One peak was indicated as being for confirmations of Aroclors 1242 and 1254 BN 59-1948 through 59-1962).

4.a. The peak used for retention time confirmation for Aroclor 1242 was outside the retention time window for all samples except sample AF1242.

5. GC raw data show that many of the early eluting peaks are off-scale.

5.a. An example of many early eluting peaks being off-scale is sample AF245 (BN 59-2141).

5.b. These off-scale peaks indicate potential column overload thus shifting retention times of compounds outside their retention time windows.

5.c. These off-scale peaks make it difficult for determination of Aroclors by peak recognition.

6. The samples all showed severe sulfur contamination (BN 59-2045 and 59-2050).

6.a. The cleanup was inadequate

6.b. The treatment applied to this problem was to assume a baseline to baseline resolution of the GC peaks.

6.b.1. For example, see BN 59-2039

6.b.2. The baseline correction results in a very high bias for A1242 in most samples.

6.b.3. The total PCB's are also therefore biased high.

7. Many of the chromatograms contained negative dips in the baseline.

7.a. The treatment of this problem was to assume a baseline that went below zero.

7.b. This treatment of the baseline will bias the results high.

7.c. Negative dips in the baseline occur most frequently in the A1254 region of the spectrum

8. None of the results of samples AF234 - AF258 should be included in the NBH data base.

0062y

NUS/GZA Grid Sampling
Case 5549 Analyses by York Laboratories
Plaintiffs' RFA XII.E.46

1. York Laboratories Division reportedly analyzed samples AF284 - AF313.

   1.a. Table 1 of Plaintiffs' RFA XII.E.46 purports to list results of these analyses.

   1.b. The supporting raw data for these analyses purportedly is given at BN 61-1101 to 61-2116.

   1.c. The results in XII.E.46 are reported to five (5) significant figures, but the method is only capable of delivering two (2) or three (3) significant figures.

   1.d. Over-reporting,of significant figures is scientifically unsound and implies a precision and accuracy that is unreliable.

2. NUS performed the data validation for the York Laboratories Division data set (BN 60-2105 to 60-2116).

   2.a. According to NUS, "since these sediments were positive for PCB's 1242 and 1248 and all exceptions to the analytical protocol occurred for DDT measurements, I recommended that the values for the PCB's be approximated".

      2.a.1. The summary table of the data validation report indicates that A1248 and A1254 were found and approximated.

      2.a.2. DDT was above the specified relative percent difference for all calibration checks.

      2.a.3. DDT has a peak which will coelute with many of the PCB mixtures.

      2.a.4. Since DDT calibration was above the specified percent relative standard deviation, concentrations are estimated and not generally accurate.

      2.a.5. Reporting "estimated" concentrations to 5 significant figures is unsound and misleading.

3. GC raw data show that there is gross contamination of blanks.

3.a. The extraction blank of 2/13/86 shows gross contamination (BN 60-1980 to 60-1982).

3.b. The extraction blank of 2/11/86 shows many small peaks along the baseline along with negative dips in the baseline (BN 60-1967 to 60-1968).

3.c. When blanks are contaminated, sample concentrations are usually over-estimated.

4. Samples contribute to gross contamination of the gas chromatography (GC) system.

4.a. Standard "EVALB" analyzed before any samples shows distinct peaks and a stable baseline (BN 60-1778).

4.b. Standard "EVALB" analyzed between sets of samples shows an unstable baseline with some negative dips (BN 60-1869 and 60-1871).

4.c. This gross contamination caused DBC to shift outside the retention time window for the confirmation column.

4.c.1. The laboratory was aware of the problem and contacted the EPA Regional Office for help to resolve it (BN 60-2103).

4.c.2. The EPA Regional Office response to the DBC problem was to dilute out the DBC.

4.c.3. Diluting out DBC creates uncertainty of identification of analytes.

4.c.4. DBC percent differences were not reported for many runs (BN 60-1729, 60-1731, 60-1733) with no explanation given.

5. Interpretation of Aroclor 1254 is inconsistent.

5.a. For example, chromatograms of sample AF289 (BN 60-1354) and AF291 (BN 60-1396) resemble the corresponding extraction blank of 2/11/86 (BN 60-1967). Several peaks in the two samples have been identified as Aroclor 1254 in the samples but not in the blank.

5. b. For example, in sample AF297 (BN 60-516) the peaks identifying Aroclor 1254 are not discernable.

6. The numbers of peaks used to identify and quantify Aroclor 1254 is not known.

6.a. For example, on the primary column for sample AF293 (BN 60-1411), the chromatogram is labeled in the general area where Aroclors 1248 and 1242 elute.

6.b. Nowhere in the sample data (BN 60-1408 to 60-1443) is there any indication which peaks were specifically used for identification and quantification.

7. On occasion the GC peaks are off-scale.

7.a. For example, for sample AF288 both GC runs (BN 60-1319 and 60-1320) are even off-scale at a 1:5 dilution.

7.a.1. This sample should have been diluted and further analyzed.

7.a.2 When the peaks are off-scale, it is difficult to confirm whether the sample pattern is similar to any Aroclor or Aroclor mixture.

7.a.3 When the Aroclor pattern match is incorrectly identified, errors in quantification can occur.

8. PCB confirmations are inconsistent.

8.a. The PCB confirmation procedure by GC/MS was not followed (BN 49-1431).

8.a.1. The potential Aroclors were not analyzed by GC/MS.

8.a.2. The corresponding extraction blanks were not analyzed for PCB confirmation by GC/MS.

8.a.3. The PCB's were not confirmed by analysis of Aroclor standards.

8.a.3.a. The three prominent PCB peaks were not compared with their corresponding peaks in an Aroclor standard.

8.b. The identifications of PCB's are inconsistent.

8.b.1. For example, for sample AF294 (BN 60-1444 to 60-1478), in the GC/MS confirmation run a

peak at scan 2105 was identified to be a possible PCB.

8.b.1.a. Scan 2105 was rejected as being a "tetrachlorobiphenyl isomer" (BN 60-1467).

8.b.1.b. Scan 2105 was accepted as Aroclor 1248 (BN 60-1475).

8.b.1.c. Scan 2105 was also accepted as Aroclor 1254 (BN 60-1476).

8.b.1.d. The same reference standard spectrum was used for all three identifications.

8.b.1.e. Aroclors 1248 and 1254 were always targeted to elute at the same retention time (BN 60-1451 for example).

8.c. When Aroclor identifications are inconsistent, errors in quantification can occur.

9. The results of the analyses of AF 284-AF 313 for PCB's are in error.

9.1. The results of the analyses of AF 284-AF 313 for PCBs are in error.

0055y

NUS/GZA Grid Sampling
Case 5549 Analyses by ERCO

Plaintiff's RFA XII.E.47

1. Energy Resources Company, Inc. (ERCO) analyzed samples AF314 to AF315, AF393 to AF400 and AE851 to AE865.

   1.a. The results of these analyses were reported in Plaintiff's RFA XII.E.43 Table 1.

   1.b. The raw date from these analyses are given at BN 61-1001 to 61-1501.

   1.c. The results in Table 1 are reported up to six (6) significant figures but the method is only capable of delivering two (2) or three (3) significant figures.

2. NUS performed the data validation for the ERCO data set (BN 61-1326 to 61-1335).

   2.a. According to NUS the retention time and retention time windows were not reported on the Pesticide/PCB Identification form (BN 61-1326 to 61-1335)

   2.b. NUS accepted the data, despite this omission.

3. GC raw data show that there are many unresolved peaks.

   3.a. An example of the many unresolved peaks in sample AF397 (BN 61-1225 to 61-1226).

   3.b. Integration reports indicate that all integrations were made from baseline to baseline.

   3.c. There is no indication on the chromatograms where the baselines are defined.

   3.d. Therefore the integrations for these samples are unreliable.

4. The organic analysis data sheets are given at BN 61-1158 to 61-1219.

   4.a. For the "ERCO Blank 1" (BN 61-1209) no Aroclors were detected.

4.a.1. The quantitation limits for Aroclors 1242, 1248, and 1254 are determined to be the same.

4.b. For samples AF393, AF394, AF395, AF396, AE851, AE852, AE855, AE860, AE863 and AE864, all reported concentrations of Aroclors were below the determined quantitation limits.

4.c. For samples AF314, AF315, AE856 and AE857, part of the reported total Aroclors present at concentrations below the quantitation limit.

5. GC raw data for the extraction blanks (BN 61-1336 to 61-1339) show some distinct peaks from 1 to 13 minutes.

5.a. Some of these peaks are resolved and others are unresolved.

5.b. These peaks indicate the presence of contamination.

5.c. The Quantitation forms (BN 61-1374 to 61-1387) indicate that no samples were "background corrected" or corrected for "blank responses".

5.d. The non-correction for blank responses will bias the results high.

6. Quantitation of the Aroclors were not made against the standards run during the initial calibration.

6.a. The laboratory calibration form (BN 61-1387) lists GC standard runs which do not correspond to those indicated n the Pesticide Evaluation Standards Summary (BN 61-1317)

6.b. A two (2) point calibration curve was used for Aroclor 1248 and a three (3) point calibration curve for Aroclor 1254.

6.b.1. These calibration curves were run after the samples had been analyzed.

6.b.2. These runs are not documented n the Pesticide Evaluation Standards Summary.

6.c. The relative response factors for the (two or three) calibration points were averaged and used to determine Aroclor concentrations.

6.d. Samples were analyzed after analyzing the standards.

6.e. The specified (BN 49-1420) sequence for the quantitation of the samples was not followed.

7. Results from the analysis of sample AF314 - AF315; AF393 - AF396; AE851 - AE852; AE855 - AE857; AE860; AE863; and AE864 should not be included in the NBH date base.

7.a. All other results from this set of samples should be viewed with suspicion.

0062y

NUS/GZA Grid Sampling
Case 5549 Analyses by Cambridge Analytical Associates
Plaintiffs' RFA XII.E.48

1. Cambridge Analytical Associates (CAA) reportedly analyzed samples AE866-AE872 and samples AF176-AF179.

   1.a. Table 1 of Plaintiffs' RFA XII.E.48 purports to list results of these analyses.

   1.b. The supporting raw data for the analyses purportedly is given at BN 62-1001 to 62-1888.

   1.c. The results in Table 1 are reported up to five (5) significant figures, but the method is only capable of delivering two (2) or three (3) significant figures.

2. NUS performed the data validation for the Cambridge Analytical Associates data set.

   2.a. According to NUS, "this CLP lab has a basic problem in that their Pesticide/PCB reagent blank has a chromatographic interference with DBC."

      2.a.1. Because of matrix interference, DBC was not recovered and the laboratory was unable to calculate the retention time shifts.

      2.a.2. Because relative retention times cannot be accurately demonstrated, the identity of eluates cannot be confirmed.

   2.b. NUS had flagged all PCB concentrations as estimates due to the non-linearity of DDT (BN 62-1539).

3. GC raw data for standards of Aroclor 1248 and 1254 (BN 62-1879 and 62-1886) show unresolved peaks. However, integration reports for these GC runs indicate that areas were determined from baseline to baseline.

   3.a. Sample AE866 (BN62-1852), for example, had unresolved peaks but peak areas were reported as if the peak of interest began and ended at the baseline (baseline to baseline).

   3.b. This demonstrates that the GC column (3% OV1) is insufficient for identification and quantification.

3.c. Use of baseline-to-baseline integration when peaks are unresolved usually results in over-estimation of analyte concentration.

4. The laboratory had a problem with the DBC surrogate.

4.a. DBC retention time shifts were reported for the confirmatory column (BN 62-1717).

4.b. No DBC shifts were reported for the primary 3% OV1 column (BN 62-1719).

4.c. DBC shifts were greater that the 2% tolerance set forth in the method for the 3% OV1 column.

5. The laboratory had a problem with blank contamination.

5.a. Raw data for the blank (BN 62-1663) indicates a contaminant peak at 4 minutes and several contamination peaks from 9 minutes to 13 minutes.

5.a.1. Integration reports for Aroclors 1248 and 1254 (BN62-1878 and BN62-1879) indicate that peaks for Aroclors 1248 and 1254 have some common retention times with contaminant peaks.

5.a.2. For example, the blank and Aroclor 1248 have a peak which elutes at 4 minutes.

5.a.3. Sample AF176 (BN 62-1859) has peaks for Aroclor 1254 which coelute near the contaminant peaks from 9 minutes to 13 minutes.

5.b. The quantitation form (BN 62-1534) indicates that no corrections were made for blank responses.

5.b.1. Failure to correct for blank responses leads to results for quantitation of Aroclors 1248 amd 1254 that are biased high.

6. Spreadsheets (BN 62-1535 to 62-1536) indicate that five (5) peaks were used for quantitation of Aroclors.

6.a. Notation on one spreadsheet (BN 62-1535) indicates "Areas are corrected areas (i.e. 1254 area is subtracted from total area to obtain area of 1248)"

6.b. Sample AE866 (BN 62-1852) for example has one area which corresponds with the integration report for Aroclor 1248.

6.b.1. Adjusted areas for samples cannot be traced from the blank (BN 62-1663) or from chromatograms of Aroclor 1248 (BN 62-1878) or Aroclor 1254 (BN 62-1879).

6.b.2. The response factor for Aroclor 1248 had been incorrectly calculated from the standard. Samples AE866 and AE869 are calculated incorrectly (biased low) for Aroclor 1248 by 40%.

6.c. There is not evidence of how many peaks were used to confirm the identity of Aroclors.

7. The problems and inaccuracies found in the Cambridge Analytical Associates analyses of samples AE866-AE872 and AF176-AF179 are sufficient to disqualify the results for inclusion in the NBH data base.

1657L

NUS/GZA Grid Sampling
Case 5575 Analyses by ERCO

Plaintiff's RFA XII.E.49

1. Energy Resources Company, Inc. (ERCO) analyzed samples AF180 - AF187.

   1.a. The results of these analyses were reported in Plaintiff's RFA XII.E.49 Table 1.

   1.b. The raw data from these analyses are given at BN 68-1001 to 63-1634.

   1.c. The results in Table 1 are reported from three (3) to four (4) to significant figures but the method is only capable of delivering two (2) or three (3) significant figures.

2. NUS performed the data validation for the ERCO data set (BN 63-1690 to 63-1472).

   2.a. According to NUS, "The percent breakdown for DDT was above the established criteria or the evaluation standards associated with samples AF182 - AF187.

   2.b. The continuing calibration check calculation numbers were chosen to fit the percent difference calculations such that the lowest percent difference was obtained.

   2.c. PCB's were not quantified in the manner described on the Pesticides/PCB summary sheets (BN 63-1511 to 63-1514).

      2.c.1. Pesticide/PCB summary sheet BN 63-1511 indicates that the GC column 2250/2401 was a confirmatory column for the Aroclors.

      2.c.2. Pesticide/PCB summary sheet BN 63-1513 indicates that the GC column 3% SP2100 was used as the primary column.

      2.c.3. Pesticide/PCB Identification sheet BN 63-1514 indicates that the 2250/2401 column was used as the primary column for the Aroclors; this contradicts the information in points 2.c.1. and 2.c.2., above.

3. Due to the calibration and quantitation problems with these samples NUS rejected all results for samples AF180-AF187.

4. GC raw data show many peaks that are unresolved.

   4.a. Sample AF180 is an example of a chromatogram having unresolved peaks (BN 63-1356)

   4.b. The integration report for sample AF180 (BN 63-1356) shows that all peaks were integrated from baseline to baseline.

      4.b.1. There is no indication of where the baseline is defined on the chromatograph.

      4.b.2. Because the baseline cannot be defined, the integrations are unreliable.

5. GC raw data show that for many chromatograms the early eluting peaks are off scale.

   5.a. Chromatograms for samples AF184 (BN 63-1364) and AF180 (BN 63-1356 to 63-1357) are examples of chromatograms where the early eluting peaks are off-scale.

   5.b. With chromatographic peaks off-scale it is difficult to identify Aroclors by pattern recognition.

6. Many of the reported Aroclor concentrations are below the defined quantitation limits.

   6.a. The "ERCO MB" blank report states that none of the Aroclors 1242, 1248 or 1254 were found (BN 63-1160).

      6.a.1. The "ERCO MB" blank report indicates that the quantitation limits for Aroclors 1242, 1248 and 1254 are the same.

   6.b. No Aroclor 1242 was found in samples AF180-AF187 (BN 63-1128 to 63-1160).

   6.c. All reported concentrations for Aroclor 1254 are below the quantitation limit for Aroclor 1242 (BN 63-1128 to 63-1160).

6.c.1. Since the quantitation limit for Aroclor 1242 and 1254 are the same then all reported concentrations for Aroclor 1254 are below their quantitation limit.

6.d. Since all reported concentrations for Aroclor 1254 are below their quantitation limit then the reported concentrations are unreliable.

7. None of the results for samples AF180 - AF187 should be included in the NBH data base.

0062y

NUS/GZA Grid Sampling
Case 5054 Analyses by PEI
Plaintiffs' RFA XII.E.50

1. PEI Associates reportedly analyzed samples AF538-AF543 and AF801-AF819.

   1.a. Table 1 of Plaintiffs' RFA XII.E.50 results of these analyses.

   1.b. The supporting raw data for these analyses purportedly is given at BN 64-1001 to 64-3224.

   1.c. The results in Table 1 are reported to four (4) and five (5) significant figures, but the method is only capable of delivering two (2) or three (3) significant figures.

2. NUS performed the data validation for this data set (BN 64-2416 to 64-2475).

   2.a. According to NUS, "retention time windows cannot be verified with the information provided."

      2.a.1. Because retention time windows cannot be verified, the identity of the "eluates" cannot be confirmed.

   2.b. When analyte identity cannot be confirmed, the quantification is suspect.

3. Problems were encountered in differentiating among Aroclor 1242, Aroclor 1254 and Heptachlor; some peaks were multiple-counted.

   3.a. The laboratory noted that "Heptachlor and PCB 1254 both have peaks which co-elute with the peaks of A1242. The quantitation of either of them when they occur in the same sample is approximate because of the interferences" (BN 64-1151).

      3.a.1. The procedures used over-estimated the quantity of PCBs/Pesticides present.

   3.b. The same peaks were used for identification and quantitation of both Heptachlor and Aroclors.

      3.b.1. For example, the peak at 2.73 minutes (BN 64-1257) in sample AF539 was identified and quantified both as Heptachlor and as A1242.

3.b.2. As another example, in sample AF543 (BN 64-1423) the peak eluting at 4.98 minutes was included in the calculations of both Aroclors 1242 and 1254.

3.c. These procedures would bias the estimates of PCB concentration high.

4. Gel Permeation Chromatography (GPC) used for sample extract clean-up was not sufficient to remove interferences.

4.a. Despite the GPC cleanup, some samples still had large interferences of sulfur such as sample AF802 (BN 64-1542).

4.b. Despite the GPC cleanup, some samples contained other interfering peaks which were not identified.

4.c. The failure to remove interfering substances generally results in over-estimation of the quantity of PCBS.

5. Chromatographic resolution was poor and the baseline was not acceptably flat. As a result, some integrations for peaks in chromatograms were in error.

5.a. For example, sample AF540 (BN 64-1291) has many unresolved peaks.

5.b. A baseline was drawn from a valley early in the chromatogram to one much later in the chromatogram.

5.c. From the valleys of the unresolved peaks, lines were drawn to the baseline with the entire enclosed area being taken as the area of the peak.

5.d. The enclosed area arbitrarily biases high the concentrations of Aroclor 1242 and 1254 as illustrated in sample AF540 (BN 64-1291).

6. Results from the analyses of samples AF538-AF543 and AF801-AF819 for PCB's are in error.

6.a. Results from the analyses of samples AF538-AF543 and AF801-AF819 for PCB's should not be included in the NBH data base.

0057y

ERLN Predicting Bioaccumulation

Plaintiff's RFA X11.E.R-0377

1. There is no description of the extraction procedure. (BN0860019 - BN0860037)

2. GC traces are difficult to verify

   2.a. Most GC traces are not labeled with retention times, File Q5S02V059S.01a (BN0860302) for example.

   2.b. Some GC traces have illegible sample data information (such as BN0860199 for example).

   2.c. Many GC traces, BN0860302 for example, have many peaks which are off-scale.

      2.c.1. GC peaks off-scale include the internal standard peak.

      2.c.2. It is impossible to verify either absolute or relative peak heights for off-scale peaks.

      2.c.3. It is usually impossible to verify the existence of unresolved peaks for off-scale peaks when the chromatogram is not properly scaled.

3. GC traces are not included for all samples.

   3.a. GC traces were not provided for samples identified as the "NBH-2 Sediment 42 Day" and identified as "5622 through 5627".

      3.a.1. Quantitation reports for samples identified as the "NBH-2 Sediment 42 Day" and identified as "5622 through 5627" are given at BN0860072-BN0860083.

   3.b. On the sample concentration report for "NBH-2 Macoma Day 42" (BN0860133) the document indicates that the raw data was not included because the raw data was not worthwhile.

      3.b.2. There are no GC chromatograms for sample set "NBH-2 Macoma Day 42".

4. Concentration calculations for cogeners are not demonstrated.

4.a. The results of cogener qualitative and quantitative analysis on BN0860069 appear in X11.E.R-0377 Appendix A.

4.b. The final cogener results (BN0860069) for file Q4502V0595.02a do not correspond to those on the quantitation report (BN0860079).

4.c. The response factors (RF) on sample quantitation reports differ on consecutive samples.

4.c.1. For example, File Q4502V0595.01a and File Q4502V0605a are consecutive files (BN0860079).

4.c.2. The RF for analyte "CB209" is 1.367716e-01 for File Q4502V059.5.01a while the RF for analyte "CB209" is 8.339322e-02 (BN860079).

4.c.3. A calibration response factor should be the same for consecutively analyzed samples.

4.d. There is no information on the equations describing calibration curves.

4.e. The validity of calibration curves cannot be verified.

5. Concentration calculations for Aroclor 1254 are unavailable.

5.a. It has not been demonstrated that the seven specific peaks can be used to quantify Aroclor 1254.

5.a.1. The specific peaks used to identify and quantify Aroclor 1254 have not been identified.

5.b. There is no evidence which details the calibration results for Aroclor 1254.

5.c. The validity of calibration curves has not been demonstrated.

5.d. Absent data verifying calibration the results for Aroclor 1254 must be considered to be unreliable.

1707L

ERLN/SAIC Sampling

Plaintiffs' RFA XII.E.(S)

1. Samples were aliquoted into three (3) series': "A" for Analytical, "B" for Barrel, and "C" for Composite (Deposition of Dr. Richard Pruell Exhibit 12 p. 24)

2. Samples 1A through 5A along with a standard reference soil were extracted on 1/24/86 (Deposition of Dr. Richard Pruell Exhibit 12 p. 8).

   2a. Samples 1A through 5A were spiked with a solution of Phenanthrene-d10 and Octachloronaphthalene [OCN] (BN 15-3462).

3. Samples 10A, 12C, 13A, and 14A were extracted along with a standard reference soil on 1/28/86 (Deposition of Dr. Richard Pruell Exhibit 12 p. 12).

   3a. Samples 10A, 12C, 13A, and 14A were spiked with a solution of Phenanthrene-d10 and OCN (BN 15-3462).

4. Samples 6A through 9A were extracted along with a standard reference soil on 1/28/86 (Deposition of Dr. Richard Pruell Exhibit 12 p. 12).

   4a. Samples 6A through 9A were spiked with a solution of Phenanthrene-d10 and OCN (BN 15-3462).

5. Three (3) aliquots of samples 5B through 8B, 12B, and 14B were extracted on 2/25/86. (Deposition of Dr. Richard Pruell Exhibit 12 p. 7).

   5.a. The aliquots of samples 5B through 9B, 12B, were spiked with a solution of Phenanthrene-d10 and OCN (BN 15-3462).

   5.b. The reference standard soils for samples 5B through 9B, 12B, and 14B were extracted on 2/28/86.

      5.b.1. The reference standard soils were extracted three days after the extraction of the corresponding samples.

      5.b.2. Quality control samples should be extracted along with their corresponding samples in order to trace problems such as inadequate extraction or sample cross contamination.

5.b.2.a. This procedure was not followed for the aliquots of samples 5B through 8B, 12B, and 14B.

5.b.3. The laboratory, thus, cannot, identify and correct problems with extraction efficiency or cross-contamination for samples 5B through 8B, 12B, and 14B.

6. All samples were analyzed by gas chromatography - mass spectrometry (GC/MS) between 3/25/86 and 10/8/86 (Deposition of Dr. Richard Pruell Exhibit 11). Data for these samples are located in the Deposition of Dr. Richard Pruell Exhibit 21.

6.a. Sample extracts 5B through 8B were analyzed by GC/MS on 3/25/86, 3/26/86, and 3/27/86.

6.b. Two (2) extracts of sample 12B and two (2) extracts of sample 14B were analyzed by GC/MS on 6/3/86. A third extract of sample 12B was analyzed by GC/MS on 6/25/86.

6.b.1. The extracts of samples 12B and 14B were analyzed four (4) months after extraction.

6.b.2. EPA protocols specify analysis of extracts no more than forty (40) days after extraction.

6.b.3. Loss of solvent in these extracts will bias the results high.

6.c. Extracts 1A through 10A, 12C, 13A, and 14A were analyzed by GC/MS on 8/18/86 and 8/19/86; the reference extracts were analyzed by GC/MS on 8/20/86.

6.c.1. The results for samples 1A through 10A appear on Table 1 of XII.E.R-0382 and referenced in the deposition of Dr. Richard Pruell Exhibit 7.

6.c.2. Extracts 1A through 10A, 12C, 13A, and 14A were analyzed seven (7) months after extraction.

6.c.3. EPA protocols specify analysis of extracts no more than forty (40) days after extraction.

6.c.4. Loss of solvent in these extracts will bias the results high.

6.d. Extracts 12C, 13A, and 14A were re-analyzed by GC/MS on 10/8/86.

6.d.1. The results for samples 12C, 13A and 14A analyzed on 10/8/86 appear in Table 1 of XII.E.R-0382 and Table 1 of the report referenced in the deposition of Dr. Richard Pruell Exhibit 7.

6.d.2. Extracts 12C, 13A, and 14A were analyzed nine (9) months after extraction.

6.d.3. EPA protocols specify analysis of extracts no more than forty (40) days after extraction.

6.d.4. Loss of solvent in these extracts will bias the results high.

7. The plaintiff's RFA (XILE.S 21d) states that the "GC was operated in the electron impact mode at 70 electron volts and 300 microamps".

7.a. The referenced Attachment (XII.E.R-0382) states that the "instrument" was operated in the conditions outlined above.

7.b. The "electron impact mode", seventy (70) electron volts and three-hundred (300) microamps are mass spectrometer parameters.

7.b.1. Seventy (70) electron volts is a standard mass spectrometer parameter.

7.b.2. Three-hundred (300) microamps is a mass spectrometer parameter which can be varied.

7.b.2.a. There is no evidence to support the fact that this parameter was set at 300 microamps.

7.b.2.b. There is no evidence to support the fact that the 300 microamp parameter was kept constant for all analyses.

8. Evidence (Dr. Pruell Deposition Exhibit 11) shows that spectra of decafluorotriphenylphosphine (DFTPP) was

only sometimes produced and not always produced as is implied in the Plaintiff's RFA XII.E.S 21e, Attachment XII.E.R-0382 and in Dr. Pruell Deposition Exhibit 7.

8.a. For example, evidence (Dr. Pruell Deposition Exhibit 11) shows that when samples were analyzed on 8/18/86, DFTPP was not analyzed.

8.b. When samples were analyzed on 8/19/86, DFTPP was analyzed but no evidence was produced (Dr. Pruell Deposition Exhibit 21) that confirmed that DFTPP met the specifications detailed by Eichelberger et al (1975).

8.c. DFTPP was analyzed on 5/7/86 and the spectrum was produced (Dr. Pruell Deposition Exhibit 21). However no mass spectrometry data analyzed on 5/7/86 was used in Attachment XII.E.R-0382 and in Dr. Pruell Deposition Exhibit 7.

8.d. No evidence is available to determine if various source potentials were adjusted to produce a spectrum of DFTPP which met the specifications detailed by Eichelberger et al (1975) when the samples listed in Table 1 were analyzed.

8.e. No evidence is available to indicate the mass spectrometer had been properly calibrated to produce standard spectra when the samples listed in Table 1 of Attachment XII.E.R-0382 and in Table 1 of Dr. Pruell Deposition Exhibit 7 were analyzed.

9. A standard solution was injected at the beginning of the day as is indicated in the Plaintiff's RFA XII.E.S.(24).

9.a. The standard solution injected at the beginning of the day contained the internal injection standard (Deposition of Dr. Richard Pruell, Exhibit 21).

9.b. The standard solution injected at the beginning of the day contained compounds representing each level of chlorination (Deposition of Dr. Richard Pruell Exhibit 21).

9.c. Evidence in the Deposition of Dr. Richard Pruell, Exhibit 11, indicates that no other PCB standard, other than the one containing the compounds indicated above, was injected at the beginning of the day.

9.d. The standard solution injected at the beginning of the day did not contain Aroclor 1254 as was indicated in Attachment Doc. No. XII.E.R-0382 and as was indicated in the Deposition of Dr. Richard Pruell, Exhibit 7.

9.e. All Aroclors were analyzed on 6/25/86 and 6/26/86 (Deposition of Dr. Richard Pruell Exhibit 11).

9.e.1. The results of Aroclor 1254 and the standard injected at the beginning of the day do not correlate.

9.e.1.a. Aroclor 1254 contained mostly tetrachloro- and hexachloro-substituted PCB's.

9.e.1.b. Aroclor 1254 contained no octachloro- or decachloro-substituted PCB's.

10. A standard solution, was only sometimes injected at the end of the day, (Deposition of Dr. Richard Pruell Exhibit 11).

10.a. The standard solution, when injected at the end of the day, contained the internal injection standard (Deposition of Dr. Richard Pruell Exhibit 21).

10.b. The standard solution, when injected at the end of the day, contained compounds representing each level of chlorination (Deposition of Dr. Richard Pruell Exhibit 21).

10.c. The standard solution, when injected at the end of the day, did not contain Aroclor 1254 as was indicated in Attachment Doc. No. XII.E.R-0382 and as was indicated in the Deposition of Dr. Richard Pruell Exhibit 7.

10.d. Evidence in the Deposition of Dr. Richard Pruell Exhibit 11 indicates that no PCB standard, other than the one containing the compounds indicated above, was injected at the end of the day.

11. There is no evidence to indicate when an internal injection standard was added to each extract.

11.a. There is no evidence in the Laboratory Standard Logbook (BN 15-3435 to 15-3599) that an internal standard injection solution was prepared or that

an internal injection standard solution was acquired from an outside source.

11.b. There is no evidence in the Project notebook (Deposition of Dr. Richard Pruell Exhibit 9) that the internal injection standard was added to the samples.

11.b.1. The project notebook only indicates when samples changed custody for analysis (Deposition of Dr. Richard Pruell Exhibit 9 pp.89-90 for example) and not when samples were spiked with internal injection standard.

11.b.2. The samples were analyzed more than once over several months. For example, sample 14A was analyzed on 8/19/86 and 10/8/86.

11.b.2.a. he internal injection standard would have only been added once.

11.b.2.b. This is inconsistent with adding them "just prior to analysis".

12. No evidence is available to substantiate that spectra were checked when unusual peak patterns were observed, as is indicated in the Plaintiff's RFA XII.E.S 26.

13. Reconstructed Ion Chromatograms (RICs) indicate that the samples had not been adequately cleaned up prior to the concentration step.

13.a. RICs for samples 1A, 2A, and 3A (Deposition of Dr. Pruell Exhibit 21) consist of a large unresolved peak supporting many better resolved peaks over the entire chromatographic run.

13.a.1 No other reconstructed ion chromatograms are available for data reported in Attachment XII.E.R-0382 and in the Deposition of Dr. Pruell Exhibit 7.

13.a.2. Interferences may exist, leading to falsely higher concentrations for samples 1A, 2A, and 3A.

13.b. The RIC for sample 12B analyzed on 5/1/86 consisted of a large unresolved peak with many

better resolved peaks over the entire chromatographic run.

13.b.1. Mass chromatogram of mass 326 for sample 12B analyzed on 5/1/86 (Deposition of Dr. Pruell Exhibit 21) has some prominent peaks and many minor peaks.

13.b.2. Interferences may exist, leading to falsely higher concentrations for sample 12B.

13.b.3. Data for sample 12B analyzed on 5/1/86 was not used in Attachment XII.E.R-0382 and in the Deposition of Dr. Pruell Exhibit 7.

13.c. The RIC for sample 14B (Deposition of Dr. Pruell Exhibit 21) analyzed on 5/1/86 had prominent peaks along with a large unresolved peak with many minor peaks throughout the entire chromatographic run.

13.c.1. Interferences may exist, leading to falsely higher concentrations for sample 14B.

13.c.2. Data for sample 12B analyzed on 5/1/86 was not used in Attachment XII.E.R-0382 and in the Deposition of Dr. Pruell Exhibit 7.

14. Mass spectrometer parameters were changed from calibration to sample analysis for samples 12C, 13A, and 14A analyzed on 10/8/86.

14.a. The results for samples 12C, 13A, and 14A analyzed on 10/8/86 appear on Table 1 of the report referenced XII.E.R-0382 and Table 1 of the report referenced in the deposition of Dr. Richard Pruell Exhibit 7.

14.b. The electron multiplier on the mass spectrometer was changed from 1100 volts to 1300 volts after analysis of the calibration standard (Deposition of Dr. Richard Pruell Exhibit 11).

14.c. A second parameter on the mass spectrometer was changed from 600 to 430 (Deposition of Dr. Richard Pruell Exhibit 11).

14.d. It is not common practice to change mass spectrometer parameters throughout the course of a day once calibration of the mass spectrometer for quantitation is established.

14.e. Different parameters produce different relative response factors for each analyte.

14.f. Since the extent to which the relative response factors have been changed is not known, the results for samples 12c, 13A, and 14A are unreliable.

15. Surrogate recoveries were not monitored for any samples analyzed by GC/MS.

15.a. Surrogate compounds benzo(a)anthracene-d12 and OCN were spiked into every sample.

15.b. Quantitation reports (Deposition of Dr. Richard Pruell Exhibit 21) indicate that surrogate compounds benzo(a)anthracene-d12 and OCN were not monitored.

15.c. Reconstructed ion chromatograms do not show the presence of either surrogate.

15.d. Samples were analyzed several months after extraction.

15.d.1. Monitoring surrogate recoveries by GC/MS would indicate possible changing concentrations of analytes in the extracts.

15.d.2. Since surrogate recoveries were not monitored by GC/MS analysis, the results of analysis by GC/MS are unreliable.

16. Many factors of correct analytical procedure were ignored during the study.

17. Many poor analytical practices were incorporated into the laboratory work.

18. None of the results of the geochemical study should be incorporated into the NBH data base.

0074y

1. In July of 1987, a final report presenting the results of analyses conducted in 1986 on sediments and edible tissues of mussels collected in Buzzards Bay and in other territorial waters of the United States, entitled "Phase I Final Report on National Status and Trends Mussel Watch Program; Collection of Bivalve Molluscs and Surficial Sediments; and Performance of Analysis for Organic Chemicals and Toxic Trace Pollutants," (referred to herein as the Report) was issued to the National Oceanic and Atmospheric Administration (NOAA).

   1.a The work described in the report was conducted by Battelle Ocean Sciences ("BOS"), pursuant to contract No. 50-DGNC-5-00263 to the NOAA.

   1.b The report was prepared by BOS pursuant to contract No. 50-DGNC-5-00263.

2. Attachment 7005000 to 7005239 attached herewith, is a true and accurate copy of the Report.

3. Table 5.8 of the Phase 1 Final Report presents a summary of percent recoveries of pesticides and PCB analytes in spiked blanks and the coefficients of variation (CV's) associated with the determination of percent recoveries (7005122).

   3.a Table 5.8 of the Phase 1 Final Report contains PCB recovery data for tissue and sediment blanks spiked with PCB congeners.

      3.a.1 The recoveries of the various PCB congeners from tissue ranged from 121% to 190%.

      3.a.2 The recoveries of the various PCB congeners from sediment ranged from 110% to 142%.

      3.a.3 These data, showing recoveries greater than 100%, indicate that the methodology has a high bias.

         3.b.3.a All PCB results from analysis of samples are biased high.

      3.a.4 The Phase 1 Final Report states that "these relatively high percent recoveries are acceptable data" (7005123).

3.b.4.a It is acceptable to the plaintiffs for the results to be biased high.

3.a.5 The CV's found for the recovery data range from 24% to 51%.

3.b.5.a The magnitude of the CV is indicative of the best precision that could be expected in the mussel watch data.

4. Table 5.9 of the Phase 1 Final Report presents the mean concentrations of organic compounds, including PCBs, in test sediments and test tissues as determined by Battelle during Phase 1 (7005124).

4.a Table 5.9 of the Phase 1 Final Report contains data that show the CV's for PCB entities to range as high as 92% for sediments and 64% for tissues.

4.a.1 The uncertainty in a measurement increases when progressing from the analysis of blanks to the analysis of test samples.

4.a.2 The uncertainty in a measurement will increase as the complexity of the sample increases.

5. Table 5.10 of the Phase 1 Final Report presents a summary of triplicate analysis of organic compounds in field collected tissue samples (7005725).

5.a Data presented in Table 5.10 of the Phase 1 Final Report show the CV's for the triplicate analysis for various PCB entities ranging as high as 118%.

5.a.1 The apparent complexity of the sample has increased as has the CV.

5.a.2 An example will help clarify the magnitude of the problem now that analysis are being performed on field samples.

5.a.2.a Analysis of ET09 A, B, and C yield a mean of 277 ppb of hexachlorobiphenyl with a CV of 55%.

5.a.2.b The real range of results for hexachlorobiphenyl in ET09 A, B, and C was 100 ppb to 370 ppb.

6. Table 5.11 of the Phase 1 Final Report presents a summary of triplicate analysis of organic compounds in field collected sediment samples.

   6.a Data presented in Table 5.10 of the Phase 1 Final Report show the CVs for the triplicate analysis for field collected sediment samples range as high as 120%.

7. Figure 6.6 of the Phase 1 Final Report shows the comparison of east coast intrasite bivalve PCB variability in unnormalized data and in data normalized to lipid content.

   7.a Figure 6.6 of the Phase 1 Final Report shows that bivalves from sites 9 and 10 are among the highest sites for tissue to tissue variability.

8. The findings presented in the Phase 1 Final Report consistently reveal the high variability in the analytical results and between tissues from Buzzrards Bay sites.

6153i

Battelle Mussel Watch — Phase 2 Final Report

1. In April of 1988, a final report presenting the results of analyses conducted, in 1987, on sediments and edible tissues of mussels collected in Buzzards Bay and at other east coast and west coast sites, entitled "Phase 2 Final Report on National Status and Trends, Mussel Watch Program; Collection of Bivalves and Surficial Sediments from Coastal U.S. Atlantic and Pacific Locations and Analysis for Organic Chemicals and Trace Elements" (referred to herein as Report 2) was issued to the U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA).

   1.a The work described in Report 2 was conducted by Battelle Ocean Sciences (BOS) pursuant to Contract No. 50-DGNC-5-00263 to the NOAA.

   1.b Report 2 was prepared by BOS pursuant to Contract No. 50-DGNC-5-00263.

2. Attachment BN 7005240 to 7005583 attached herewith, is a true and accurate copy of Report 2.

3. Table 6.2 of Report 2 presents concentrations, by congener, of PCBs from east coast interlaboratory calibration analysis of NBS tissues and sediment interim reference materials (IRM's)(7005382).

   3.a The reported levels of the various PCB congeners purported to be contained in the Phase 2 IRM's indicate that this IRM is not suitable to represent sites 9 and 10.

      3.a.1 The reported pesticide and PCB levels in the IRM do not match the purported PCB and pesticide levels from Sites 9 and 10 in Buzzards Bay.

   3.b None of the raw data for the interlaboratory calibration exercises (ICE) were provided to AVX.

      3.b.1 A judgment could not be made on the validity of the ICE without the raw data.

   3.c The coefficient of variation (CV's) of the results for the various congeners measured in the ICE were as high as 92% in tissue and 76% in sediment.

3.c.1 These large CV's occurred in the apparent absence of the types of interferences found in samples from Sites 9 and 10 in Buzzards Bay.

4. Purported recovery of spike internal standard DBOFB in process blanks was presented at 7005384.

4.a The mean percent recovery was 99%.

4.b The CV for the mean percent recovery was 60%.

4.c There is false security in the mean percent recovery because of the very high CV.

4.c.1 Individual percent recovery may be much different than the mean of 99%.

5. Table 6.5 of Report 2 presents a summary of percent recoveries of PCB congeners from spiked blanks (7005386).

5.a Mean recoveries of congeners spiked into blank samples ranged as high as 158%.

5.a.1 14 of the 19 congeners showed recoveries over 130%.

5.a.2 Low CV's for recoveries of individual congeners mean the recoveries were consistently high.

5.b The mean recovery of spiked DBOFB was 54%.

5.b.1 The CV for the mean DBOFB was 53.5%

5.b.2 The recovery of spiked DBOFB was not very predictable for any given sample.

5.c High recoveries for the congeners from blank solutions imply a high bias to PCB results from samples.

6. Table 6.8 of Report 2 presents a summary of concentrations of PCB congeners from batch control analysis of NBS tissue and sediment interim reference materials (IRM's)(70053900).

6.a CV's for measured concentrations of individual PCB congeners ranged as high as 206%.

6.b The variation about the mean, for this congener, is over twice as large as the mean.

7. Table 7.6 of Report 2 compares USFDA action levels in fish and shellfish to Phase 2 mussel watch data (7005485-87).

7.a Table 7.6 of Report 2 indicates that Phase 2 mussel watch results never exceeded 50% of the USFDA action levels for PCBs in fish and shellfish.

8. Figures 7.11 and 7.13 present the PCB composition ratios in east coast bivalves and sediments (7005499-7005501).

8.1 The ratio of the total concentration of Cl-2 through Cl-5 congeners to Cl-6 through Cl-9 congeners is large at Site 10 in Buzzards Bay.

8.b There are much greater concentrations of the lighter PCBs at Site 10 than the heavier PCBs.

6154i

1. In February 1989, a final report presenting the results of analyses, conducted in 1988, on sediments and edible tissues of mussels collected in Buzzards Bay and other U.S. coastal waters, entitled "Phase 3 Final Report, on National Status and Trends, Mussel Watch Program; Collection of Bivalves and Surficial Sediments from Coastal U.S. Atlantic and Pacific Locations and Analysis for Organic Chemicals and Trace Elements." Volume I of II (referred to herein as Report 3) was issued to the U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA).

   1.a The work described in Report 3 was conducted by Battelle Ocean Sciences (BOS) pursuant to Contract No. 5-DGNG-5-00263 to the NOAA.

   1.b Report 3 was prepared by BOS pursuant to Contract No. 5-DGNC-5-00263.

2. Attachment BN 7005584 to 7005837, attached herewith, is a true and accurate copy of Report 3.

3. Table 6.7 of Report 3 presents the mean concentrations of PCBs in tissue interim reference material (IRM) analyzed by Battelle as Phase 3 batch controls. (BN 7005603).

   3.a The coefficients of variation (CV's) of results of the analysis in the IRM, Narragansett Bay mussels, ranged as high as 264% for some of the congeners.

      3.a.1 The CV's of the results of the analyses of the various congeners in the IRM were over 100% for 16/18 of the total congeners measured in the analysis.

   3.b. The CV's of the results of the analysis of the various congeners in the IRM, Dorchester Bay mussel, ranged as high as 332 percent.

      3.b.1 The CV's of the results of the analysis of the various congeners in this IRM were over 50% for 7/18 of the total congeners measured in the analysis.

4. In Report 3, it is stated that "The range of acceptable internal standard recoveries was generally 50 to 150 percent." (BN 7005705).

4.a The acceptable recoveries may vary by a factor of 3 from analysis to analysis.

5. Table 6.23 of Report 3 presents the information on the rate of confirmation of PCB congener data by a second gc column in Phase 3 tissue samples (BN 7005727).

5.a For congener Cl_8(195) the rate of confirmation was 0.

5.b For congeners Cl_9(206) and Cl_{10}(209) the rate of confirmation was 10 percent or less.

5.c For congeners Cl_2(8), Cl_3(18), and Cl_5(105) the rate of confirmation was less than 80%.

5.d The overall rate of confirmation was 88 percent.

5.d.1 For any given congener there is a 12% chance that it has been misidentified.

5.e No consideration should be given to the results of the analysis for Cl_2(8), Cl_3(18), Cl_5(105), Cl_8(195), Cl_9(206), and Cl_{10}(209).

5.e.1 Results of analyses of these congeners should be excluded from the NBH data base.

5.e.2 The results of analysis reporting concentrations of any of these congeners should be adjusted downward as appropriate for correction.

6. Table 6.26 compares the PCB concentrations obtained on samples using an HPLC cleanup versus that obtained with the mussel watch protocol (7005753).

6.a The results obtained with the two methods using IRM tissue showed differences ranging from -28.4 percent to +263 for various PCB congener concentrations.

6.b The results obtained using HPLC cleanup are not directly comparable to those obtained with the mussel watch protocol.

7. Table 6.29 presents a summary of mean percent recoveries of PCB from spiked tissues using the HPLC method. (BN 7005758).

7.a The mean percent recoveries were generally poor and highly variable among the various PCB congeners.

7.a.1 Recoveries from mussel tissues ranged from 0 to 111 percent.

7.a.2 Recoveries from oyster tissues ranged from -18 to 80.3 percent.

8. The HPLC method is not ready for use in the Mussel Watch Program.

6155i

Battelle Mussel Watch Phase 4 Revised Draft Final Report

1. In June 1990, a revised draft of "Phase 4 Final Report on National Status and Trends, Mussel Watch Program; Collection of Bivalves and Surficial Sediments from coastal U.S. Atlantic and Pacific Locations and Analysis for Organic Chemicals and Trace Elements (referred to as Report 4) was released to the defendants.

   1.a The work described in Report 4 was conducted by Battelle Oceanic Sciences (BOS) pursuant to Contract No. 5-DGNC-5-00263.

   1.b Report 4 was prepared by BOS pursuant to Contract No. 5-DGN-5-00263.

2. Attachment BN 7005838 to 7006144, attached herewith, is a true and accurate copy of Report 4.

3. The automated HPLC cleanup was purported to have been validated during Phase 3 and implemented in Phase 4 (BN 7005851).

   3.a The Phase 3 final report (Report 3) did not claim validation of the HPLC cleanup.

   3.b The Phase 4 final report (Report 4) did not demonstrate validation of the HPLC cleanup.

4. Analysis of total PCBs as Aroclors, using packed column gc techniques, were purported to have been performed for Site 10 mussel tissue extracts. (BN 7005893-94)

   4.a Table 7.1 presents the purported results of the analysis of mussels from Site 10 (Buzzards Bay Angelica Rock) and two other mussel watch sites (BN 7005893).

      4.a.1 Table 7.1 reports quantities of A1242, A1254, and A1260.

   4.b The raw data for these analysis has not been provided.

      4.b.1 In the absence of raw data, the defendants have been unable to determine the quality of the Aroclor data for Site 10.

   4.c The text indicates that A1248 and A1254 are the Aroclors present at Site 10.

4.c.1 The purported presence of A1248 at Site 10 is of interest because of the absence of a source of A1248 in NBH (BN 7005893).

4.d The Aroclor method yielded 8.6 ppm (dry wt.) total Aroclors vs. 21 ppm (dry wt.) total congeners for Site 10.

4.d.1 The Aroclor value was noted as being significantly lower than the congener value.

4.d.2 At site HRUB, the Aroclor method yielded 3.6 ppm (dry wt.) total Aroclors vs. .985 ppm (dry wt.) total congeners.

4.d.2.a The results obtained by the two methods were said to "agree well."

4.d.3 The above information indicates that the Aroclor method vs. the congener method purportedly gave results that were 2.4 times lower and 3.6 times higher for Site 10 and Site HRUB respectively.

4.d.4 The treatment of results is not consistent.

4.e The purported results of the analysis of Site 10 tissue samples should not be included in the NBH data base.

5. The results of the mussel watch analysis are being reported on a dry weight basis.

5.a The same results on a wet weight basis would be 10 to 20 times lower.

5.b FDA action levels are normally expressed on a wet weight basis.

6156i

Battelle Mussel Watch

September 14, 1986 memorandum from S. Steinhauer to Dr. Boehn.

1. An in-house memorandum was sent from Dr. Steinhauer to Dr. Boehn on September 14, 1986 [McGrath Exhibit 138C] BN_____.

1.a The September memorandum discussed problems that Battelle was having with the analytical chemistry part of the Phase I Mussell Watch Program.

1.b The following were problems indicated in the September memorandum.

1.b.1 Forty percent of the samples analyzed to that date by GC/ECD do not demonstrate recoveries of the DBOFP internal standard of 50 percent or greater.

1.b.1.a Recovery of less than 50% is unacceptable by EPA standards.

1.b.2 None of the 78 tissue or sediment samples analyzed for PAH have D8-naphthalene recoveries of greater than 50%.

1.c. Dr. Steinhauer was worried that NOAA would not accept the data.

1.d There was no calibration tracking information for the GC/ECD operation.

1.d.1 Data from samples could not be conclusively tied to calibration information.

1.e The methodology was never validated using the complete procedure.

1.e.1 Battelle could not conclusively demonstrate that the method worked.

1.f None of the spiked blank samples were analyzed prior to running the samples.

1.f.1 Insufficient recovery information was available to justify beginning analysis of samples.

1.g GC recovery standards were never added to the solutions.

1.g.1 Recovery of other internal standards was never quantitated.

2. The first part of the Mussel Watch Program did not produce valid results.

2.a Unless they were reanalyzed, the early results from Phase I of the Mussel Watch Program should not be included in the Mussel Watch data base.

6157i

Large Lakes Research Station
Congeneric PCB Methodology

1. The congeric PCB methodology utilizing a two-column system described by Mullin (1990) represents the state-of-the-art for congener-specific PCB analysis.

2. The benchmark literature reference essential for the identification of individual PCB congeners on the SE-54 (or its equivalent DB-5) capillary column is Mullin, et al. (1984).

   2a. The relative retention times (RRTS) and structure for biphenyl and all 209 PCB congeners are listed in the order of election for an SE-54 column.

   2b. Retention times were determined relative to a reference standard, octachloronapthalene. All 209 theoretically possible congeners were available as reference compounds for the RRT determination.

3. Data generated by Large Lakes Research Station (LLRS) for NBH sample were considered preliminary since the samples included no quality control/quality assurance measure such as field blanks, laboratory blanks, or spiked samples to measure extraction efficiency.

4. The results were intended to demonstrate the detail which can be obtained by using the PCB methodology described by Mullin (1990); they do not represent validated data.

5. The quality of the chromatograms for samples BC81 and BC71 is poor. Many negative peaks are present and the vast majority of the peaks are off-scale. Chromatographic quality is improved for samples BC67 and BD19, but negative peaks are still present.

6. No data validation can be performed for these samples since integrator output data including peak retention times and areas were not provided.

7. The true and accurate reference documents supporting these RFAs are:

   Mullin, Michael D., Congeneric PCB methodology Two-Column System, US EPA, LLRS, Grosse Ile, MI 48139, May 24, 1990. (Attachment Doc. Q.III.3).

Mullin, M.D., C.M. Pochini, S. McCrindle, M. Romkos, S.J. Safe, and L.M. Safe. 1984. High-Resolution PCB Analysis: Synthesis and Chromatographic properties of all 209 PCB Congeners. Environ. Sci. Technol., Vol. 18:468-476.

6158i

1633L BATTELLE BIOTA: LOBSTER/FLOUNDER

1. The raw data for the Aquatec analyses of edible muscle tissue from lobsters collected by Battelle in NBH in June 1985 are contained in Attachment Doc. No. III. 0021 (BN Q01966-Q02248).

   1.a The data in these documents accurately present the results obtained by Aquatec.

   1.b in Attachment Doc. No. III. 0021 (BN Q01966-Q02248) is relied upon by EPA in fulfillment of its statutory and regulatory mandate to conduct a remedial investigation and feasibility study at the New Bedford Harbor Superfund site.

   1.c Attachment Doc. No. III. 0021 (BN Q01966-Q02248) is part of the EPA Administrative Record and/or Sites file for the New Bedford Harbor Superfund site.

2. A complete quality control audit of all analytical data gathered by Aquatec Inc. from its analyses of PCB concentrations in lobster and flounder collected in June 1985 was carrried out by NUS Corporation (Plaintiffs' RFA XII. E.R. 15).

3. The Aquatec GC/MS analysis of the PCB's in edible muscle tissue of the two lobsters from area 1 found that the total PCB content of the lobsters represented in Table 10 of the Battelle Lobster/Flounder report as M & L were 520 ppb and 750 ppb.

   3.a The GC/MS result will be more accurate than the GC result because it does not include the amounts of interfering compounds.

   3.b The GC/MS results are reported on pp. 177 and 155 of Attachment Doc. No. III. 0021.

   3.c The GC/MS results for total PCB's in the edible muscle tissues of lobsters are 25% lower than the GC results for the same tissues.

4. In general, the AVX review of the raw data presented in Attachment Doc. No. III. 0021 concurs with that

described in the NUS validation report.

4.a The reported levels of the C1-2, C1-8, and C1-9 homologs are generally biased high.

4.b The cause of the high bias is the presence of interfering contamination.

4.c Aquatec sample No. 67019 is much too dilute for accurate quantitation.

5. The PCB levels in the edible muscle tissue of lobsters are below the FDA action level of 2 ppm.

6. The analytical methodology used by Battelle/Aquatec for analysis of edible muscle tissue from lobsters is equivalent to or better than the FDA methodology.

6.a The FDA method for PCB's in fish and shell fish can be found in documents bearing plaintiffs' Bates numbers V.B. R 0310.

6.b There is particular reference to the methodology for the analysis of lobsters for PCB's in the first two pages of V.B. R 0310.

6.c The determinative step of the FDA methodology requires a matched standard.

6.c.1 The matched standard would consist of that mixture of Aroclors which most closely resembles the PCB distribution found in the samples.

6.c.2 The PCB calculation is conducted using the total peak height or peak area of the mixed Aroclor standard as the reference.

6.c.2.a The total peak area in the standard must be used if some of the peaks do not appear in the samples.

6.d The determinative step of the FDA method for analysis of PCB's in edible muscle tissue from lobsters will tend to give lower quantitative results than the EPA methods because it uses total peak area from the standard and because PCB mixtures in nature are usually altered from their Aroclor origins.

6.e The EPA methodology, method 8080, for Aroclors is similar and equivalent to the FDA methodology in the hands of an experienced chemist.

6.e.1 The EPA methodology employs methylene chloride as an extracting solvent.

6.e.2 Methylene chloride should be a more efficient extracting solvent.

6.e.3 The EPA and FDA cleanup methodologies are similar, but chlorinated pesticides may still interfere in both methods.

6.e.4 The Tissumiser approach to sample preparation and extraction used by EPA laboratories is more efficient than the FDA approach.

6.e.5 Capillary column GC analyses used in EPA type approaches are less subject to interference than the FDA packed column approach to Aroclor measurement.

6.e.6 For equivalent samples, showing some weathering, and in the absence of large quantities of chlorinated pesticides, the EPA method will give higher results.

6.e.6.a The results will be higher because of more efficient extraction.

6.e.6.b The results will be higher because of the determinative step.

7. The raw data for the Aquatec analyses of hepatopancreas tissue from lobsters collected by Battelle in NBH in June 1985 are contained in Attachment Doc. No. III. 0022.

7.a The data in these documents reflect the results obtained by Aquatec.

7.b Attachment Doc. No. III. 0022 is relied upon by EPA in fulfillment of its statutory and regulatory mandate to conduct a remedial investigation and feasibility study at

the New Bedford Harbor Superfund site.

7.c Attachment Doc. No. III. 0022 is part of the EPA Administrative Record and/or Sites file for the New Bedford Harbor Superfund site.

8. Except as discussed below, AVX concurs with the Aquatec evaluation of its GC data.

8.a The identity and quantitation of Cl-8 and Cl-9 congeners is highly questionable.

8.a.1 Cl-8 and Cl-9 congener contributions should not be included in the total PCB concentrations.

8.b Sample 2579A0108 shows substantial interference in the quantitation of Cl-3 and Cl-4 congeners.

8.b.1 The total PCB concentration attributed to Cl-3 and Cl-4 should be reduced by approximate factors of 5 and 2, respectively.

8.b.1.a The contribution of the Cl-2 congeners to the total PCB concentration in this sample should be discounted.

8.b.2 If adjustments are made for Cl-8 and Cl-9 the total PCB concentration would be estimated to be 92,000 ppb.

8.b.3 If adjustments are made for Cl-3 and Cl-4 to total PCB concentration would be estimated to be 63,000 ppb.

8.b.4 The purported contribution of Cl-2 congeners in this sample is also unusually large and has no parallel in any other run in this series.

8.b.4.a Adjusting total PCB concentration for the removal of Cl-2 congener concentrations yields total PCB's of approximately 57 ppm.

8.c Samples 2579A0088, 0089 and 0104 may also have interferences with Cl-2 and Cl-3 congener quantitation.

8.d Samples 2579A0088, 0094, 0096, 0102, and 0104 were run in very dilute solutions and the resulting concentration multiplied by an appropriate but large dilution factor.

8.d.1 This has the effect of greatly magnifying any quantitation errors.

9. The raw data for the Aquatec analysis of edible muscle tissues from flounder collected by Battelle in NBH in June, 1985 are contained in Attachment Doc. No. III. 0023.

9.a The data in these documents reflect the results obtained by Aquatec.

9.b Attachment Doc. No. III. 0023 is relied upon by EPA in fulfillment of its statutory and regulatory mandate to conduct a remedial investigation and feasibility study at the New Bedford Harbor Superfund site.

9.c Attachment Doc. No. III. 0023 is part of the EPA Administrative Record and/or Sites file for the New Bedford Harbor Superfund site.

10. Except as noted below, AVX concurs with the Aquatec interpretation of the GC data.

10.a Sample No. 66994 is the extract of muscle tissue from a flounder collected in Area 4.

10.a.1 The homolog distribution pattern is unlike that found in any of the other flounder muscle extracts in this study.

10.a.1.a Extraordinarily high concentrations of the Cl-1 and Cl-4 homologs have been claimed.

10.a.2 This is the only flounder to have edible tissue with PCB levels that exceeded the FDA action level.

11. Whole body lobster and flounder tissues were prepared for inorganic analysis by digestion of the tissue homogenate with nitric acid.

11.a The tissue and the nitric acid were sealed in a digestion vessel and heated in a microwave oven.

11.b The digested sample was cooled, milli-Q water was added, and the diluted digestate was decanted into a vial.

12. The tissue digestates were analyzed for cadmium (Cd), copper (Cu), and lead (Pb), on a Perkin Elmer 3030 atomic absorption spectrometer (AA).

12.a The AA was equipped with-and operated with a Zeeman effect graphite furnace as described in Attachment Doc. No. III. 0013.

13. The Cd, Cu, and Pb content of the lobster and flounder tissues are accurately reported in Tables 1 and 2 and in Attachment Doc. Nos. III. 0014, 0015, 0016, and 0017.

13.a Attachment Doc. Nos. III. 0014, 0015, 0016, and 0017 are relied upon by EPA in fulfillment of its statutory and regulatory mandate to conduct a remedial investigation and feasibility study at the New Bedford Harbor Superfund site.

13.b Attachment Doc. Nos. III. 0014, 0015, 0016, and 0017 are part of the EPA Administrative Record and/or Sites file for the New Bedford Harbor Superfund site.

13.c Tables 1 and 2 are admissible as evidence.

14. A complete quality control (QC) audit of analytical data gathered by Battelle from its analyses of Cd, Cu, and Pb, content in lobster and flounder, was carried out by NUS Corporation.

1632L BATTELLE BIOTA: CLAMS

1. Mercenaria Mercenaria (clams) were collected during September to December, 1984, and June/July, 1985, from the fishery closure areas shown in Figure 1 of the 1987 Battelle Lobster/Flounder Report (Attachment Doc. Nos. III. 0004, 0005, 0006)

   1a. The clams were collected with a clam dredge (Attachment Document No. III. 0007)

2. Collections of clams were made first in Area 4, and progressed sequentially into Areas 3, 2, and then 1.

   2a. The pattern of collecting from the areas of lowest contamination (Area 4) to those with potentially higher contamination was used in order to minimize the potential for cross contamination of the samples via the sampling gear.

3. Following their collection, all specimens were rinsed with site seawater, double wrapped in acid washed aluminum foil and polyethylene bags and immediately frozen with dry ice.

4. The clam samples collected in 1984 and 1985 were stored and frozen pending analysis.

5. Analyses of PCB concentrations were conducted by Aquatec on the whole body tissues of the clams collected for this study in 1984 and 1985.

6. A quality control audit of analytical data gathered by Aquatec, Inc. from its analyses of PCB concentrations in clams was carried out by NUS Corporation (Attachment Doc. No. III. 0008)

7. In preparation for analysis, each clam was rinsed with distilled water, opened, and the tissue removed and replicates composited according to Battelle SOP No. 5-074-01 (Attachment Doc. No. III. 0009)

8. Composited tissues were homogenized with a Tekmar homogenizer.

8a. Distilled water and potassium hydroxide pellets were added to the homogenate of the tissues and the sample rehomogenized.

8b. The rehomogenized tissue mixture was transferred to a Teflon jar, internal standards were added and the jar was sealed.

8c. The mixture was then heated at 80°C for 4 hours.

9. Upon cooling, each tissue composite digestate was acidified with hydrochloric acid, diluted with distilled water, and extracted repeatedly with methylene chloride.

9a. The combined tissue extracts were washed with water, dried, and concentrated.

9b. The concentrated tissue extracts were then further cleaned with sulfuric acid and/or 7% deactivitated alumina before analyses.

10. Samples were analyzed for PCB's by gas chromatography.

11. Two of the samples were analyzed for PCBs by gas chromatography/mass spectrometry (GC/MS) on a Finnigan 4530 quadrupole equipped with a Finnigan 9610 capillary gas chromatograph (GC), and a Data General Nova computer and Incos data system as a confirmational analysis.

11a. The GC/MS was equipped with a 30 m x. 0.25 mm DB5 fused silica capillary column that was threaded directly into the ion source.

11b. The GC was operated in the splitless mode.

11c. The mass spectrometer (referred to herein as "MS") was operated in the multiple ion detection mode that selectively monitors target mass (m/c) ranges to afford sensitivity similar to that obtained with a GC equipped with an electron capture detector.

12. In the GC/MS Analyses, C11-, C12-, C13-, C14-, C14- and C14-PCB congeners and total PCBs were quantitated for each sample collected in the 1984-1985 collection program, on a wet weight basis, using an internal standard method of quantitation recommended by

EPA-Cincinnati.

12a. The EPA-Cincinnati-recommended method specified the addition of $^{d}12$-chrysene internal standard to be added just prior to GC/MS analysis and quantification to be performed on selected parent ion masses (m/e) characteristic of PCBs and $^{d}12$-chrysene.

12b. The EPA-Cincinnati-recommended method further specified frequent (2 to 3 times per day) calibration of the instrument with EPA-supplied calibration solutions.

13. The result of the analyses of clams for PCB's are accurately presented in Attachment Doc. Nos. III. 0010 and 0011 (BN Q00089-Q00693) (SRS 2476A-ETR 9149)

13a. The information regarding the weights of tissues digested for each of the samples is accurately presented in Attachment Document No. III. 0012 (BN Q01362-Q01626)

13b. The concentration of PCB's in the clam tissues in each composited sample is accurately presented in Table 1.

13c. Attachment Doc. Nos. III. 0010 and 0011 are relied upon by EPA in fulfillment of its statutory and regulatory mandate to conduct a remedial investigation and feasibility study at the New Bedford Harbor Superfund site.

13d. Attachment Doc. Nos. III. 0010 and 0011 are part of the EPA Administrative Record and/or Sites file for the New Bedford Harbor Superfund site.

13e. The analytical results presented in Attachment Doc. Nos. III. 0010 and 0011 were validated by NUS.

14. Only one sample of the 39 composite samples of clams analyzed for PCB's showed a concentration of PCBs greater than 2 ppm.

14a. The average PCB concentration in clams for Area 1 (including that sample which exceeded 2 ppm) is 0.47 ppm.

14b. The average PCB concentration in clams from Area 1 (excluding the two apparent outliers of 2.64 and 0.012 ppm) is 0.30 ppm.

14c. The average PCB concentration in clams from all three areas closed to fishery use is 0.29 ppm.

15. The clam tissue samples analyzed for PCB's by Aquatec contained a large amount of potentially interfering materials.

15a. These potential interferences were most obvious in Aquatec samples 65593 to 65610.

15b. The chromatogram for Aquatec sample No. 65593 best exemplifies how serious this problem can be.

Table 1

Concentrations of PCB's in Whole Body Composites of *Mercenaria Mercenaria* from New Bedford Harbor

Sample Collection Number	Collection Area	Aquatec Number	PCB Tissue (ppm)
2476A0216	2	65573	0.044
2476A0217	2	65574	0.100
2476A0218	2	65575	0.034
2476A0219	3	65576	0.022
2476A0220	3	65577	0.051
2476A0221	3	65578	0.018
2476A0222	4	65579	0.003
2476A0223	1	65580	0.440
2476A0224	1	65581	0.220
2476A0225	1	65582	0.410
2476A0226	4	65583	0.004
2476A0227	1	65584	0.290
2476A0228	1	65585	0.130
2476A0229	1	65586	0.220
2476A0230	1	65587	0.280
2476A0231	2	65588	0.038
2476A0232	2	65589	0.020
2476A0233	2	65590	0.002
2476A0234	3	65591	0.230
2476A0246	3	65593	0.065
2476A0247	3	65594	0.122
2476A0248	3	65595	0.078
2476A0405	4	65596	0.071
2476A0406	3	65597	0.022
2476A0428	4	65598	0.044
2476A0429	4	65599	0.083
2476A0430	4	65600	0.079
2476A0431	1	65601	0.48
2476A0432	1	65602	2.64
2476A0433	1	65603	0.16
2476A0434	3	65604	1.37
2476A0435	3	65605	0.65
2476A0436	4	65606	0.023
2476A0437	1	65607	0.40
2476A0438	1	65608	0.012
2476A0439	2	65609	0.360
2476A0440	2	65610	0.171
2476A0441	2	65611	0.230
2476A0442	2	65612	0.078

TABLE 2.

BATTELLE BIOTA DATA - SELECTED METALS

ORGANISM	SAMPLE STATION #	CADMIUM (PPM)	COPPER (PPM)	LEAD (PPM)
CLAM	0405M3	J0.351	1.276	J1.366
	0405M2	J0.416	1.380	J1.562
	0405M1	J0.412	1.068	J1.739
	0405M	0.495	1.445	1.720
	0405M	0.155	R1.738	1.488
	0405L3	J0.066	1.217	J0.155
	0405L2	J0.114	1.255	J0.054
	0405L1	J0.226	1.203	J0.113
	0405L	0.470	2.239	0.340
	0405L	0.293	R1.896	0.672
	0305M3	J0.175	1.701	J0.410
	0305M2	0.313	R2.056	2.619
	0305M2	J0.502	1.223	J2.570
	0305M2	J0.394	1.555	J1.884
	0305M1	J0.581	2.687	J3.654
	0305M1	J0.289	1.387	J1.185
	0305M1	0.296	R1.786	4.578
	0305L3	0.189	2.036	0.263
	0305L3	0.284	R1.867	0.245
	0305L3	J0.211	2.199	J0.455
	0305L2	0.275	R1.673	0.434
	0305L2	J0.320	2.416	J0.479
	0305L2	0.066	1.921	0.171
	0305L1	J0.560	3.760	J0.568
	0305L1	0.314	R2.075	0.388
	0305L1	0.137	4.767	0.200
	0205M3	J0.301	1.786	J0.445
	0205M3	0.253	R1.881	0.904
	0205M2	J0.264	2.904	J0.838
	0205M2	0.227	R1.442	0.580
	0205M1	J0.387	2.279	J2.530
	0205M1	0.158	R1.524	0.628
	0205M1	0.158	R1.524	0.628
	0205M1	0.113	26.220	0.867
	0205L3	0.231	R1.462	0.510
	0205L3	0.248	2.359	0.568
	0205L3	J0.199	2.040	J0.469
	0205L2	0.305	3.751	1.042
	0205L2	J0.179	1.146	J0.424
	0205L2	0.168	R1.885	0.846
	0205L1	0.473	2.757	1.430
	0205L1	0.306	R2.206	1.119
	0205L1	J0.402	1.360	J0..584
	0105M3	J0.094	3.036	J0.767
	0105M3	0.098	R3.063	0.581
	0105M3	0.098	R3.063	0.581
	0105M2	0.071	J3.391	0.672
	0105M2	0.071	J3.391	0.672
	0105M2	0.164	5.765	2.016
	0105M2	J0.116	4.511	J1.137
	0105M1	0.120	4.619	1.067
	0105M1	0.095	J4.985	1.214
	0105M1	J0.139	4.828	J0.224
	0105M1	0.095	J4.985	1.214
	0105L3	0.177	J5.905	0.270
	0105L3	J0.315	4.433	J0.681
	0105L3	0.477	9.354	3.915
	0105L3	0.177	J5.905	0.270
	0105L2	0.131	J6.586	1.032
	0105L2	0.131	J6.586	1.032
	0105L2	0.188	5.139	1.123
	0105L2	J0.086	76.000	J0.712
	0105L1	0.199	J6.025	1.100
	0105L1	0.199	J6.025	1.100
	0105L1	J0.176	9.762	J0.888
	0105L1	0.500	11.900	1.562

Table 1. Summary of Criteria Used in Reviewing New Bedford Harbor PCB Sampling and Analysis

Area	Criterion for Good Practice	Reference
Sampling Plan	Statistical design based on probability sampling	EPA 1979a, 1980, 1982, 1982a
Sampling Device	Corer, not grab sampler, needed for depth stratification	EPA 1982a, 1983
	New sampler for each sample or thorough cleaning between samples	EPA 1979, 1980, 1980c, 1980a, 1982, ASTM 1977
Sampling Handling	Do not prerinse sample devices with sea water	EPA 1979, 1979a, 1980c, 1982
	Store at 4°C from time of collection	EPA 1979, 1979a 1980c, 1982, 1982a
	Extract within 7 days, analyze within 30-40 days	EPA 1979, 1979a, 1980c, 1982, 1982a, ASTM 1981
	Avoid contact with plastics	EPA 1979, 1980, 1980a, 1980b 1982, 1982a, ASTM 1977
Field QC	Collect and analyze field replicate samples	EPA 1979a, 1979, 1980, 1982
Quantitative Analysis	Requires experienced analyst	EPA 1979, 1980c, 1982
	GC/ECD on 6 ft column by EPA Method 608 or equivalent	Webb 1973, ASTM 1978, EPA 1979, 1980, 1980c, 1989b 1989b, 1982
	Thin layer chromatography not quantitative	EPA 1980b, FDA 1977

Table 1 Summary of Criteria ADL Used in Reviewing New Bedford Harbor PCB Sampling and Analysis

Area	Criterion for Good Practice	Reference
	Quantification as Aroclors if and only if good match of peak patterns	Webb 1973, FDA 1977,
	Peak-by-peak quantification if not good match to Aroclor	Webb 1973, ASTM 1981
	Calibration curve spanning range of samples	ATM 1977, EPA 1979, 1980b, 1980c, 1982
	Daily analysis of calibration standards	EPA 1979, 1980b, 1980c 1982
	Confirmation of identity of presumed PCBs by independent method	Webb 1973, EPA 1979, 1980, 1982, 1980c, ASTM 1981
Laboratory QC	Laboratory replicates, matrix spikes with each batch of samples	EPA 1979, 1980, 1982, 1979a
	Analysis of reference materials	EPA 1979a
	Report only significant figures in data	EPA 1979a

Table 2. References to Support Criteria of Good Practice

ASTM 1977 — Method D 3304, "Analysis of Environmental Materials for Polychlorinated Biphenyls," in Annual Book of ASTM Standards, Part 40, American Society for Testing and Materials, Philadelphia, PA, 1977.

ASTM 1981 — D 3694-78 "Preparation of Sample Containers and For Preservation of Organic Constituents," in Annual Book of ASTM Standards, Part 31, American Society for Testing and Materials, Philadelphia, PA, 1981.

D 3534-80 "Polychlorinated Biphenyls in Water, in Annual Book of ASTM Standards, PArt 31, op. cit., 1981.

EPA 1979 — "Organochlorine Pesticides and PCBs - Method 608, Proposed Rules," Federal Register, Vol. 44, No. 223, Monday, December 3, 1979.

EPA 1979a — "Handbook for Analytical Quality Control in Water and Wastewater Laboratories," (EPA Environmental Monitoring and Support Laboratory, Cincinnati, OH), EPA-600/4-79-019, March 1979.

EPA 1980 — "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, (First Edition)," (EPA Office of Solid Waste, Washington, DC), SW-846, May 1980.

EPA 1980a — "Samplers and Sampling Procedures for Hazardous Waste Streams," (EPA Municipal Environmental Research Laboratory, Cincinnati, OH), EPA-600/2-80-018, January 1980.

EPA 1980b — "Analysis of Pesticide Residues in Human and Environmental Samples," (EPA Health Effects Research Laboratory, Research Triangle Park, NC), EPA-600/8-80-038, June 1980.)

EPA 1980c — "Organochlorine Pesticides and PCBs - Method 617," October 1980.

EPA 1982 — "Test Methods for Evaluating Solid Waste. Physical/Chemical Methods, (Second Edition)" (EPA Office of Solid Waste, Washington, DC), SW-846, July 1982.

Table 2. References to Support Criteria of Good Practice

EPA 1982a	"Handbook for Sampling and Sample Preservation of Water and Wastewater," (EPA Environmental Monitoring and Support Laboratory, Cincinnati, OH), EPA-600/4-82-029.
EPA 1983	EPA-600/X-83-018, March 1983. Characterization of Hazardous Waste Sites. A Methods Manual, Volume II, Available Sample Methods, March 1983.
FDA 1977	"FDA Pesticide Analytical Manual - Vol. 1. Multi-Pesticide Residue Methods for Food and Feeds," NTIS UB/C/118, August 1977.
FDA 1980	"FDA Pesticide Analytical Manual - Vol. 1. Revisions to Appendix and Chapters 2 and 3, NTIS PB80-911801, March, 1982.
Webb 1973	"Quantitative PCB Standards for Electron Capture Gas Chromatography," Webb, R.G. and A.C. McCall, (EPA Southeast Environmental Research Laboratory, Athens, GA), J. Chrom. Sci., 11, 366-373, July 1973.

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New Bedford Harbor Request For Admissions

SAMPLING PROTOCOLS

1. During the years 1978 to 1989, various government agencies and/or contractors for the government agencies including the U.S. Army Corps of Engineers, U.S. Coast Guard, Massachusetts D.E.Q.E., Battelle, GZA Drilling and NUS Corporation, conducted a number of sampling programs that collected and analyzed soils and sediments in New Bedford Harbor, the Acushnet River estuary and adjacent wetlands.

2. The purported intent of these programs was to attempt to characterize the spatial extent of PCB and heavy metals contamination in sediments and wetland soils of the New Bedford Harbor.

3. In order to spatially characterize PCB contamination in a large area such as New Bedford Harbor, much planning must be done prior to the initiation of a sampling program and a number of elements should be considered in a sampling program design.

4. A sampling program capable of accurate spatial characterization will produce data that are free from unintended biases.

5. Bias is a systematic influence which overstates or understates the values for a sampling program data set.

6. If biases are introduced in the sampling program, an inaccurate assessment of the situation may be made.

7. A successful sampling program will produce data that can be integrated with data from past or future sampling programs to produce a meaningful and unified data set.

8. A successful sampling program will obtain sufficient data to fully characterize an alleged contamination problem in horizontal and vertical extent, and, if appropriate, over time.

9. One essential element of a successful sampling program is a detailed and carefully designed written sampling plan.

10. If no formal goals and objectives are established it is unlikely that a sampling program will lead to adequate characterization of the site.

11. Personnel familiar with the site to be sampled should contribute their knowledge to the development of the sampling plan.

12. The sampling plan should be developed by personnel familiar with sampling, data collection, data organization, and data analysis as all of these elements are necessary to properly characterize a site.

13. All personnel involved with the sampling program should be provided with a copy of the sampling plan.

14. All personnel involved with the sampling program should carefully study and understand the methods and objectives of the sampling plan.

15. The project leader should confirm that all personnel involved with the sampling program understand the methods and objectives of the sampling plan.

16. The use of consistent methods and approaches during initial and subsequent sampling programs is critical to the objective of obtaining comparable data.

17. Failure to apply consistent methods and approaches severely limits the usefulness of the data.

18. Consistency can be designed into a sampling plan by incorporating methods and approaches used in previous sampling programs into the new sampling plan.

19. Changes from one sampling program to another should be documented in detail in the new sampling plan.

20. Changes from one sampling program to another must be justified based on facts and scientific judgment and should attempt to correct or mitigate past deficiencies.

21. One element to be considered in the design of a sampling plan is the physical dimension of the project and its extent in area, volume, and, if appropriate, time.

22. The possibility that subunits of the project area may be different from others should be investigated because different sampling approaches and later remedial treatments may be necessary for different subareas.

23. Existing site data should be collected, assembled, and evaluated with respect to appropriate characteristics including the physical environment, geology, site history, weather patterns, water flow patterns, tidal cycles, and groundwater movement.

24. A conceptual model of the site should be developed to differentiate the subunits or physical sample types from each other so that specific sampling plans can be implemented in each area.

25. Specific objectives for the data to be collected must be developed and stated in writing that address issues of purpose of the data, storage of the data, intended immediate and long-range use of the data, analytical uses of the data, data users, and intended data interpretation techniques.

26. Methods of physical sample collection must be evaluated and a sample collection method capable of capturing samples representative of the known physical characteristics of the site must be selected.

27. Analytical methods able to provide accurate and unbiased results must be selected.

28. Acceptable levels of risk and error should be determined before sampling based on written criteria developed for the study objectives.

29. Samples collected will be used to interpret which areas of the site are above the contaminant action threshold levels and thus require remediation as well as which areas are below the contaminant action threshold concentration and as such will not require remediation.

30. Some areas where the material is interpreted from sample data as being above the contaminant action threshold concentration will actually contain material that is below the threshold concentration.

31. This misclassification of material is called a Type I error and will cause these areas to be unnecessarily remediated.

32. Some areas where the material is interpreted from the sample data as being below the contaminant action threshold concentration will actually contain material that is above the threshold concentration.

33. This misclassification of material is called a Type II error and will cause these areas to forego appropriate remediation.

34. Sampling programs should be designed to minimize Type I and Type II errors and these programs should be designed to achieved specified levels of error or probabilities that correct decisions are being made.

35. The size/volume of the physical samples to be taken in the field should be selected and maintained constant throughout the various sampling programs.

36. Comparison of samples that have unequal lengths or volumes may be statistically inappropriate due to the volume/variance relationship.

37. The volume/variance relationship dictates that samples of larger volumes have smaller variances than samples with smaller volumes.

38. For example, the variance of 6 inch sediment cores is higher than the variance of 12 inch sediment cores where these cores are representative of the same statistical population.

39. Different volumes from the same statistical population possess different statistical population parameters and thus may not be directly comparable since variability bias is present.

40. Statistical approaches should be specified to account for instances where incomplete sample volumes are obtained, as different sample volumes can create statistical bias.

41. Statistical approaches should be specified to account for values that are below the limit of detection.

42. Statistical approaches should be specified to account for instances where non-response occurs.

43. Non-response is the condition where an attempt is made to collect a sample but the sample cannot be collected.

44. Non-response may indicate a different statistical population and reevaluation of the subarea classifications should be performed.

45. Statistical methods should be incorporated into the initial design to achieve appropriate randomness in locating the sample locations and to avoid unintended bias during all phases of the sampling program.

46. All alternatives or considerations associated with selected approaches should be listed and written justification for their selection or rejection should be provided.

47. The probability that additional sampling events will be required in the future should be considered to be higher than the probability that no additional sampling will be required.

48. The integration of initial data collection programs with those that may occur in the future should be carefully planned and outlined.

49. Changes in sampling methods, sample volumes, or analytical techniques will severely limit the usefulness and comparability of the data collected as these changes can introduce bias.

PCB SEDIMENT SAMPLING PROGRAMS

50. New Bedford Harbor has been the focus of a number of government sponsored sampling programs.

51. Starting on April 14, 1982 and finishing on April 21, 1982, personnel from the U.S. Coast Guard collected sediment samples at 33 locations in the Acushnet River Estuary.

52. In June of 1985, Battelle/NUS conducted a sediment core sampling program in the upper estuary.

53. Starting in late July of 1985 and finishing in May of 1986, the U.S. Army Corps of Engineers (USACE) conducted a field sampling and laboratory analysis program to characterize PCB contamination in New Bedford Harbor (Condike, 1986).

54. In 1987, USACE conducted a "hot spot" sediment sampling program focused on the area of purported elevated PCB concentrations in sediments in the upper estuary.

55. The harbor area for these studies is that area north of the Coggeshall Street bridge and continuing north to the Wood Street bridge, known as the "upper estuary."

56. Starting in December of 1985 and finishing in February of 1986, GZA Drilling and NUS Corporation (GZAD/NUS) conducted a sediment core sampling program in New Bedford Harbor.

57. The harbor area for the GZAD/NUS study is that area south of the Coggeshall Street bridge and continuing south beyond the hurricane barrier into a portion of Buzzards Bay.

58. PCB concentrations sharply decline with depth in all areas of the upper estuary and indicate that any contamination is primarily surficial.

59. Failure to develop well-designed sampling programs and protocols has severely compromised the usefulness and comparability of the data.

60. A lack of coordination between sampling efforts has severely limited the comparability and usefulness of the data.

61. In the sediment sampling program performed by the U.S. Coast Guard, April 1982, three sediment cores were collected at each location.

62. The top inch from each of the three sediment cores was composited into one sample that purports to represent the top inch of sediment at the sample location.

63. The sediment interval between 5.5 inches and 6.5 inches from each of the three sediment cores was composited into one sample that purports to represent the sediment interval between 5.5 inches and 6.5 inches.

64. The bottom 1 to 2 inches of each of the three sediment core samples were composited into one sample that purports to represent the bottom 2 inches of sediment at each sample location.

65. The bottom sediment interval of the U.S. Coast Guard sediment samples contains two different volumes of material.

66. These volumes are quite small which contributes a variability bias to the sample data and preempts them from being compared with samples of greater length collected in other sampling programs.

67. Much of the sample core length was not analyzed and significant data gaps occur in this sampling program.

68. Data gaps severely limit the ability to spatially characterize PCB contamination in sediments.

69. As reported in Table 2 of the Hot Spot report, pages 16 0069 to 16 0071, all locations in the U.S. Coast Guard sampling program were analyzed for the depth intervals 0-1 inch and 5.5-6.5 inches.

70. As reported in Table 2, most locations contained an additional single analysis at a depth greater than 6.5 inches.

71. The depth at which this deepest analysis occurs varies in a haphazard manner.

72. Haphazard sampling can lead to biased estimates of population parameters and is inappropriate for sediment characterization.

73. Sediment cores taken by the USACE in 1985 (Condike) varied between 1 inch and 24 inches.

74. Different length cores within the same sampling program, as seen in the U.S. Coast Guard and USACE Condike studies, makes comparison of the cores extremely difficult due to the volume/variance relationship and severely limits their use for spatial characterization.

75. Comparison of different length cores between different sampling programs as occurs amongst the U.S. Coast Guard, USACE Condike and USACE Hot Spot studies is also preempted due to the volume/variance relationship and severely limits their use for spatial characterization.

76. The USACE "hot spot" sediment sampling program collected cores that were 1 foot in length.

77. Comparison of the 1 foot cores with samples of varying lengths from the Condike study and the 1 inch samples with data gaps from the U.S. Coast Guard study is preempted by the volume/ variance relationship.

78. The lack of a written sampling plan contributed to the problem of varying core sample lengths and different classification schemes in the various sampling programs.

79. During a portion of the USACE Condike study, cores were visually classified and strata within the core were sampled.

80. No written explanation of the visual classification scheme is provided in the Condike report.

81. Visual classification schemes, especially undocumented ones, are subject to the biases of the individual who is classifying the cores.

82. Brian Condike used a different classification method within the same sampling program, partitioning cores into 12 inch intervals (Tr. I, pages 67 and 68).

83. The use of different partitioning methods within the same sampling program demonstrates a lack of coordination and consistent objectives amongst the members of the sampling team.

84. Lack of a written sampling plan resulted in misunderstanding amongst sampling team members as to how many sample data were required.

85. Brian Condike states in his report that one of the objectives of USACE was to obtain a sufficient number of cores (greater than or equal to 120) to spatially characterize the upper Acushnet estuary.

86. During the study, 168 sediment cores representing a greater number than specified, were taken at 143 locations.

87. The great majority of the cores collected were not analyzed.

88. Sediments from only 39 of these cores, representing 38 locations, were extruded.

89. Of the extruded cores, 33 cores representing 32 locations were analyzed.

90. Daniel Averett contradicts the objectives stated by Brian Condike in the Condike report where he declares in his

testimony (Tr. 1-50) that it was not considered necessary and it was not intended to analyze as great a number of sample cores as was stated in the report.

91. No justification was given for analyzing 33 cores instead of the 120 or more stated in the Condike report or the total of 168 cores that were collected.

92. Lack of a statistical design compromises the usefulness of the government sponsored sampling programs.

93. No statistical design was mentioned for USACE upper estuary sampling effort described in the Condike report.

94. There was no statistical design used for USACE upper estuary study (Averett Dep. 1-42).

95. Lack of a statistical design affords the opportunity for bias to be introduced into a sampling program.

96. Lack of a statistical design indicates that acceptable levels of error and risk have not been addressed.

97. A bias was introduced in the positioning of sample locations for USACE upper estuary sampling program.

98. For USACE upper estuary sampling program, a grid measuring 250 feet by 250 feet was established on the project area.

99. The origin of the grid in the north-south direction was selected by Daniel Averett to be the Coggeshall Street bridge (Tr. 1-46).

100. By not using a random technique to establish the grid origin, a bias was introduced to the sampling program.

101. One of the objectives stated in the Condike report was to spatially characterize the upper Acushnet estuary.

102. One important method of method of spatially characterizing an area is by creating isopleth maps of sampled data.

103. Statistical analysis incorporating isopleths is a major part of the process of minimizing Type I and Type II errors so that correct assessments and correct subsequent decisions can be made.

104. It was not on objective of the 1985 sampling to sample in a fashion that would support the drawing of isopleths of PCB contamination (Otis Dep. 1-17).

105. It is inappropriate to consider the Battelle, USACE Condike, USACB "Hotspot", and U.S. Coast Guard data sets in

conjunction with one another due to the inconsistencies in the volumes of the samples collected and the lack of coordination between sampling programs.

106. Because of the separate nature of these data sets, PCB contamination in harbor sediments cannot be accurately assessed.

107. Attempts to delineate the spatial extent of the PCB contamination in New Bedford Harbor will be error prone due to the lack of coordination amongst the data sets.

108. With the limited amount of data that can be unified into a single data set, little is known between the existing data points and attempts to classify sediments will result in large Type I and Type II errors.

109. What can be said with confidence about the various government-sponsored sediment sampling programs is that they have failed to demonstrate any widespread elevated PCB contamination at depths in excess of 12".

110. PCB concentrations sharply decline with depth in virtually all samples, indicating that PCB contamination is primarily surficial.

WETLANDS SEDIMENT SAMPLING PROGRAMS

111. The government has sponsored three sediment sampling programs in wetland areas in the New Bedford Harbor region.

112. Starting in July of 1985 and finishing in October of 1985, USACE reportedly collected 75 sediment samples from wetland areas for chemical analysis from 72 locations within the Acushnet River upper estuary.

113. On December 12, 1986, Sanford Environmental Services (SES), under contract to USACE, conducted a sediment sampling program within the Pope Beach wetland area.

114. On September 3, 1987, IEP, Inc. (IEP), under contract to the USACE, conducted a sediment sampling program from 3 wetland areas.

115. In October of 1987, Balsam Environmental Consultants, Inc. (Balsam), conducted a defendant sponsored wetlands sediment sampling program in the Acushnet River upper estuary.

116. Of the 75 sediment samples collected in the USACE wetlands sampling program, 42 were sent to USEPA contract laboratories for priority pollutant analysis.

117. The area sampled by the USACE was later designated as two wetland areas.

118. The wetland areas sampled during the USACE sampling program in the upper estuary have been identified as wetland 1 and wetland 3 in the report entitled "Wetland Study Report For The New Bedford Superfund Site, Final Report, June 1988" by IEP, Inc. (IEP), page 4.

119. The locations of wetland 1 and wetland 3 can be seen in Figure 1-2, page 3 of the IEP report.

120. The area sampled by SES is located on Buzzards Bay south of Egypt Street in Fairhaven, Massachusetts.

121. The approximate location of the Pope Beach wetland area in relation to the estuary and the harbor areas can be seen in Figure 1-2, of the report entitled "Acushnet River Estuary, New Bedford Harbor Superfund Project Wetlands Assessment" by Sanford Ecological Services, Inc., September 1987, revised April 1988 (SES), page 1-4.

122. The Pope Beach wetland area also appears in Figure 2-2, page 13, of the IEP report.

123. A total of 7 sediment sample locations were collected from the Pope Beach wetland area.

124. Sediment cores were collected at two depths, 0-6 inches and 0-12 inches in the Pope Beach wetland.

125. Only the 0-6 inch deep core samples were analyzed.

126. The 3 wetland areas sampled as part of the IEP program can be seen in Figure 1- 2, page 3 of the IEP report.

127. One of the wetland areas sampled by IEP is located in the upper estuary and is known as wetland 5.

128. Two of the wetland areas sampled by IEP are located in the middle harbor area and are known as wetlands 4 and 9.

129. Six sediment samples were collected from each of the three wetland areas in the IEP study for a total of 18 samples.

130. The government sponsored sampling programs failed to demonstrate any widespread PCB contamination in the sediments of wetland areas.

131. Occurrences of the highest PCB concentrations from the USACE upper estuary and Balsam wetland sampling programs, are associated with sediment samples collected in close proximity to a major tidal creek within the wetlands.

132. Sediment samples with reportedly relatively high PCB concentrations for wetlands areas were associated with areas containing tidal creeks or drainage ditches which provide pathways for water and sediment from the estuary.

133. Sediment samples from the wetlands collected at locations not in close proximity to tidal creeks or drainage basins were typically reported to contain PCB concentrations of less than 10 ppm.

134. The Balsam wetland study that parallels the USACE study in the upper estuary indicates that the limited contamination found by USACE is overstated.

135. The small number of data collected in the various wetlands sediment sampling programs provides only limited options for spatial characterization of PCB contamination.

136. A lack of clear objectives is characteristic of the wetlands sampling programs.

137. The objectives of the wetland sediment sampling do not attempt to achieve spatial characterization of PCB contamination.

138. The objective of the USACE sampling program, as stated in the Condike report, was to obtain a total of 30 additional samples from the wetland adjacent to the estuary.

139. No justification was given as to why the number 30 was chosen to represent the wetland area.

140. In spatial characterization, a data set containing 30 samples has no special significance.

141. A grid of 23 possible sample locations was established in the Pope Beach wetland area (SES report, page 3-24).

142. The report states that only 7 locations, selected at random, were used for sampling sites.

143. In the testimony (Tr. I-55) of Russell J. Bellmer, seven locations were selected based on budgetary constraints, not on any type of scientific basis.

144. Limited objectives for the sampling program were stated in the IEP report.

145. This is a violation of good sampling design and affords little chance to characterize the spatial extent of alleged PCB contamination.

146. EPA-sponsored wetlands studies conducted to date have not furnished an adequate basis on which to spatially characterize PCB contamination (Bellmer Tr. 1-105).

147. No statistical methods were used to determine sample sufficiency or error levels and spatial characterization was not a consideration.

148. No sampling plans were developed to maintain consistency in volumes or methodology for sampling of the wetland areas.

149. The lack of sampling plans produced data sets that were biased, inconsistent in sediment volumes collected, different types of sample collection devices were used for the sampling, and inconsistent in the classification of types of marsh area samples.

150. Amongst the USACE, SES, and IEP sediment sampling programs, it is known that at least 10 different sample volumes were collected.

151. Unequal volumes of sample material introduce a bias into the sampling data and preempt comparability of data sets.

152. In the USACE wetland sediment sampling program, a common garden spade was used to collect samples to a depth of one foot.

153. It is very difficult to keep representative volumes equal with a garden spade.

154. It is very difficult to prevent mixing of different depth intervals in a sample hole when sampling with a garden spade.

155. Mixing of materials from different depth intervals cross contaminates the sample and introduces additional bias.

156. As sampling gets deeper within a sample hole, the cross contamination problem becomes more severe and even more bias can be introduced.

157. In the SES wetland sediment sampling program, sediment cores were collected at two depth intervals.

158. The upper layer of sediment, 0-15 centimeters (approximately 0-6 inches), was collected using a soil auger.

159. The deeper cores, (0-30 centimeters or approximately 0-12 inches), were collected by hand using plastic core tubes.

160. The two types of cores used in the SES sediment sampling study have different volumes and thus volumetric bias has been introduced.

161. Changing the sampling volume design demonstrates a lack of consistency and planning in the wetland sediment characterization program.

162. Further inconsistencies were introduced during the IEP wetland sediment sampling program.

163. The depths from which the sediment samples were taken in the IEP program were variable (IEP report, page 11).

164. Variable depth sampling is a haphazard technique and introduces bias into the sample data.

165. Two different types of sampling devices were used in the IEP sediment sampling program.

166. Some sediment samples were collected using a trowel while others were collected using a soil bucket auger.

167. Again volumetric bias has been introduced by means of different sampling devices.

168. The large number of differing sediment sample volumes severely limits the comparability of the various sediment data sets for the wetland areas.

169. The existence of different volumes within a wetland sediment sample data set severely limits the comparability within a wetland area.

170. In order to assess spatial characteristics of PCB contamination, it is necessary to obtain accurate spatial coordinates for sediment sample data.

171. The lack of accurate spatial coordinates severely limits the usefulness of the data for spatial characterization and analysis.

172. In the SES sediment sampling program, sample locations were not surveyed (SES report, page 11).

173. All samples locations in the SES sediment sampling program are located approximately (SES report, page 11).

174. The location of the sampling grid origin for the SES sediment sampling program was also not randomized and thus a bias was introduced.

175. The precise sediment sampling locations for the USACE upper estuary wetlands sampling program are not contained in the data report.

176. Russell J. Bellmer states in his testimony (Tr. 1-58) that a random number generator on a computer or hand calculator was used to select the 7 locations used for sediment sample collection out of the possible 23 locations.

177. Mr. Bellmer states in his testimony (Tr. 1-56) that if the sample could not be physically taken where the random number generator selected it, then the location was "moved over slightly".

178. By moving the location of the sample datum in this manner, human judgment was used in the sample location process.

179. Human judgment can introduce significant bias into the sampling program.

180. Generation of an alternative location for the sample by means of the random number generator is a preferred technique.

181. The close proximity of samples A-4 and A-5 in the Pope Beach wetland area biases the data in favor of this region.

1678L

August 21, 1987 Balsam Sediment Sampling and Field Program Clean Harbors Analytical Analysis

1. On August 21, 1987, personnel of Balsam Environmental Consultants, Inc. ("Balsam") collected sediment samples from the Acushnet River upper estuary. Leonard Sarapas, Thomas Woodard and Allen Walker participated in the August 21, 1987 sampling.

2. Prior to the conduct of the August 21, 1987 sampling, a protocol was developed setting forth the objectives for this sampling event and detailing the collection methods, intended sampling locations and vertical horizons, sample handling and transport, quality assurance/quality control procedures and other information. A duplicate of the Balsam protocol for the August 21, 1987 sampling, and certain other sampling events conducted on August 19 and 20, 1987, is attached as Document Nos. 009094-009108 and 009401-009403.

   2a. In addition to sediment sampling, other tasks were undertaken during the August 1987 field program.

   2b. Observation of bedform morphology was one of these tasks.

   2c. Observation of sediment stratigraphy was one of these tasks.

   2d. Drs. Bohlen and Bosworth and Mr. Sarapas observed both bedform morphology and sediment stratigraphy in New Bedford Harbor during the August 1987 field program.

   2e. Drs. Bohlen and Bosworth and Mr. Sarapas observed the Upper Estuary bedform morphology and found it to be relatively smooth and uniform.

   2f. The Upper Estuary bedform morphology is relatively smooth and uniform.

   2g. Drs. Bohlen and Bosworth and Mr. Sarapas observed harbor sediment stratigraphy and found it to be as reported in Dr. Bosworth's field notes (Bates 9409-9412) and Mr. Sarapas' field notes (Bates 8900-8947).

   2h. New Bedford Harbor's sediment stratigraphy is accurately represented in Dr. Bosworth's and Mr. Sarapas' field notes.

3. The August 21, 1987 sampling was designed as a preliminary study to begin to characterize the variability and distribution of PCB Aroclors in New Bedford Harbor.

4. Sediment cores were obtained using a 3-inch diameter Schedule 80 PVC core barrel sampler.

5. The core barrel sampler was sized so as to permit collection of sediments to a depth of up to 24 inches below the sediment/water interface.

6. Two sampling stations were utilized for the August 21, 1987 sampling event, "Quadrant A" and "Quadrant B."

7. The loran coordinates of Quadrant A were 25592.12 and 44026.77.

8. The loran coordinates of Quadrant B were 25595.60 and 44029.03.

9. The approximate locations of Quadrants A and B are accurately depicted in figure 3 of Balsam's protocol for the August, 1987 sampling events, a duplicate of which is attached as Document No. 009403. [Which?]

10. Based upon PCB data reported by Condike (1986), sediment in Quadrant A was assumed to have an average PCB concentration of approximately 50 parts per million.

11. Based upon PCB data reported by Condike (1986), sediment in Quadrant B was assumed to have an average PCB concentration of 500 parts per million.

12. A floating sample frame, 2 meters on a side, was used to define each sampling quadrant.

13. In each case, the floating sample frame was staked to avoid movement.

14. Predetermined random coordinates within the floating frames were sampled.

15. The predetermined random coordinates were obtained through use of a Hewlett-Packard calculator random number generator program.

16. The floating frame was marked at 11 equidistant points on each side.

17. The orientation of the placement of the frame at Quadrant A is accurately depicted in the Balsam field log for the August 21, 1987 sampling at Document No. 008988.

18. The orientation of the placement of the frame at Quadrant B is accurately depicted in the Balsam field log for the August 21, 1987 sampling at Document No. 008993.

19. Individual sample locations were identified with the prefix "NBH", followed by "QDA" or "QDB" (representing Quadrant A or Quadrant B, respectively), followed by "SD" (sediment) and a two to four digit number. The two to four digit number was determined by an X coordinate (west to east) and a Y coordinate (south to north). The X and Y coordinates ran from 1 to 11.

20. Following collection of each sediment sample, recovery of sediment (vertical dimension) was measured and geologic descriptions of sediment material were recorded.

21. Extrusion of cores was conducted on board the sampling vessel following collection.

22. Following extrusion, each sample was segregated into intervals. In most cases, the intervals were 0"- 6", 6"- 12", 12"- 18" and 18" to the bottom of the core.

23. Actual horizons for each subsample are accurately recorded in the Balsam field log for the August 21, 1987 sampling event (erroneously labeled August 20, 1987), a duplicate of which is attached as Document Nos. 008985-009000.

24. Subsamples were identified with the designation described above together with a letter designation (A, B, C, D or E). The depth horizon represented by each of the subsamples from a given grid location is accurately recorded in the Balsam field log.

25. Sample samples were collected from the cores such that sediment contacting the interior wall of the core barrel was excluded.

    25a. This was performed by collecting only the center portion of the sediment cores for samples, and excluding the outer portion of the cores.

26. Each subsample then was homogenized in a pre-cleaned, stainless-steel container, and then transferred to a pre-cleaned glass sample container provided by Clean Harbors Analytical Services ("CHAS").

27. Each such container was labeled with the date, time and field sample designation.

28. All of the sediment samples from the August 21, 1987 sampling were placed on ice and maintained at or near 4° C following collection and during transportation to CHAS.

29. The Balsam August 21, 1987 samples were collected and shipped under a chain-of-custody. Document Nos. 009109-009114 are duplicates of the chain-of-custody documents with which the samples were transported to CHAS.

30. The August 21, 1987 samples were transported to CHAS by Leonard Sarapas of Balsam.

31. Quality assurance/quality control procedures implemented in the course of the August 21, 1987 sampling event included washing of sampling equipment and sampler's gloved hands with a trisodium phosphate and water solution followed by potable water rinse.

32. Quality assurance/quality control samples submitted to CHAS included blind duplicate and equipment or field blank samples.

33. A duplicate of the Balsam field log for the August 21, 1987 sampling event, which accurately records dates, weather, personnel, sampling activities, sample recovery and sampling locations, is attached hereto as Document Nos. 008985 - 009000.

34. Sediment samples taken from New Bedford Harbor by Balsam Environmental Consultants (Balsam) on August 21, 1987 were received, together with chain-of-custody forms (Document Nos. 009109 to 009114) by CHAS on August 21, 1987. The samples were relinquished by Leonard Sarapas of Balsam and received by Marcia Sullivan of CHAS.

34a. A total of 73 samples was received. At the time of sample log-in, the samples were each given

individual consecutive sample numbers by CHAS -- 200303 to 200375, inclusive, as indicated on the chain-of-custody forms. These numbers were used internally by CHAS to identify the sample set and to track the progress of individual samples in the set.

34b. At the time of log-in, a subset (33) of the samples was designated to be "extracted and held," and the remaining samples were designated to receive full analysis for Polychlorinated Biphenyls (PCB's).

34c. Following sample log-in, the samples, which were collected in 500 mL wide-mouth glass jars, were put in refrigerated storage at 4°C by CHAS until time of sample extraction and further analysis.

35. Joe Cassella, Eric Fix, Andrea Manganiello, Ken Marus, and Fran Querzoli conducted work for CHAS on the sample set.

36. Extraction and additional sample preparation was conducted on all 73 samples in the sample set.

37. Qualitative and quantitative determination of PCB content was done on the 40 samples designated by Balsam as not to be "extracted and held."

38. Sediment samples were removed from refrigerated storage and homogenized in their sampling container by stirring with a stainless steel spatula.

38a. An aliquot of homogenized sediment (approximately 12-25 grams, wet weight) was weighed into a tared 100 mL beaker for total solids determination. This aliquot was dried for at least 4 hours (typically overnight) at 105°C to remove all water content, cooled, reweighed, and total solids determined.

38b. A second aliquot of homogenized sediment (typically 12-15 grams, wet weight) was weighed into a clean, tared 400 mL glass beaker for PCB determination. The sediment was mixed with sufficient granular sodium sulfate to obtain a sandy consistency. A surrogate (recovery) standard (50 uL of 20 ppm Dibutylchlorendate (DBC) was added to each sample prior to

extraction. The original sample container, containing unused sediment, was returned to refrigerated storage.

38b.1 100 mL of 1:1 acetone:methylene chloride was added to each sample, and the sample was remixed with a stainless steel spatula to break up any large clumps of sodium sulfate.

38b.2 The samples were sonicated with an ultrasonic probe for 3 minutes, then set aside for 10-15 minutes to allow any suspended material to settle.

38b.3 The supernatant resulting from the sonication was decanted and filtered through a filter paper cone containing sodium sulfate into a 500 mL Erlenmeyer flask.

38b.4 The extraction was repeated two additional times, as outlined above. All extracts of a given sample were combined in the same 500 mL Erlenmeyer flask. The flask was capped, and placed in refrigerated storage pending further sample preparation.

38b.5 Combined extracts were decanted through a second filter paper cone containing sodium sulfate into a Kuderna-Danish (K-D) apparatus for volume reduction. The K-D apparatus was fitted with a 3-ball Snyder column, placed on a water bath, and the solvent volume reduced to approximately 4 mL. The apparatus was cooled, approximately 50 mL of hexane was added, and the solvent mixture was homogenized. Heating was resumed until the apparent solvent volume was approximately 5 mL. Following further cooling, the extract final volume was quantitatively adjusted to 10 mL in hexane.

38b.6 Extracts were then transferred to 20 mL screw-top culture tubes for storage.

38c. Samples to be "extracted and held" received no further sample preparation.

38d. Extracts of samples to be analyzed for PCB's received additional preparation.

38d.1 1 mL of the extract was pipetted to the top of an alumina column, consisting of a disposable Solid Phase Extraction (SFE) column filled with approximately 5 cm of activated alumina. One half mL of acetone was added to the SPE column, and drawn through under vacuum into a 10 mL volumetric flask. Hexane was then added to the column and the eluate was collected up to a final volume of 10 mL for each sample.

38d.2 Aliquots of these alumina-cleaned extracts were transferred to 2 mL autosampler vials for PCB analysis by GC/ECD, and the remaining (cleaned) extract was transferred to a 20 mL screw-top culture tube for storage.

38e. Depending upon the level of interferences and/or PCB's found in individual samples, certain extracts received additional dilutions, or sulfur removal (using tetrabutlyammonium hydrogen sulfate/sodium sulfite reagent) during the course of analysis.

39. The weighing for extraction, weighing for total solids determination, extraction, concentration and clean-up of the samples, and dilution of certain of the samples after initial analysis, is recorded accurately in the CHAS laboratory notebooks, duplicates of which are attached hereto as Document Nos. M000252-M000255, M000256-M000269, M000274-M000278, and M000279-M000285, and in the extraction records, duplicates of which are attached hereto as Document Nos. M000139-M000168.

40. Aroclor analyses were conducted on the samples. PCB's, if any, found in the sediment samples, were quantified by manufactured formulation (e.g., Aroclor 1248 and/or 1254.)

40.a 2 uL of each sample was injected in the splitless mode into a gas chromatograph (GC).

40.b A Hewlett-Packard 5890A GC, equipped with an electron capture detector (ECD) and an autosampler was used for Aroclor analysis. A 30 m x 0.325 mm I.D. DB-5 fused silica capillary column was used to provide sufficient resolution to facilitate accurate Aroclor identification.

40.c Helium, at a head pressure of 20 psi, was used as the carrier gas for the samples being analyzed, and nitrogen was used as the make-up gas to provide sufficient total gas flow to the detector.

40.d The GC injector temperature was held at 225°C and the detector temperature held at 350°C. The GC oven temperature was held at 160°C for the first two minutes of each run, then ramped to 270°C at 5°C/minute, and held at 270°C for the final 6 minutes of each run.

41. Duplicates of GC sequence sheets for runs including the August 21, 1987 samples, which accurately set forth the sequence in which standards, samples and quality control samples were run as well as dilution information for the samples, are attached hereto as Document Nos. M000169 and M000236.

42. Both reference standards and quantitation standards were run with the samples. Duplicates of capillary column GC/ECD chromatograms for the reference standards are attached hereto as Document Nos. M000022-M000026. Duplicates of capillary column GC/ECD chromatograms for quantitation standards are attached as Document Nos. M000030 and M000031. Reference and quantitation standard concentrations are stated accurately in handwritten notations appearing on these chromatograms.

43. Duplicates of capillary column GC/ECD chromatograms for the August 21, 1987 samples that were subjected to analysis are attached hereto as Document Nos. M000033-M 000088. Concentrations of the various samples are accurately stated in handwritten notations appearing on these chromatograms.

44. PCB's, if any, found in the samples were qualitatively identified by comparison of the sample chromatograms to reference Aroclor standards (Aroclor 1242, 1248, 1254, and 1260) analyzed along with the sediment samples.

44.a Aroclors found in this sample set were quantified as Aroclor 1248, Aroclor 1254, or as mixtures of these two Aroclors.

45. PCB's were quantified by the external standard method. GC system linearity was first demonstrated by using a four-point curve, analyzed immediately prior to sample analysis. Individual samples were then calculated using a "one-point" curve, based on a one ppm reference standard of the appropriate Aroclor identified. Reference standards were interspersed with samples being analyzed. Analysis was conducted over as brief, and undisturbed, an interval as possible to facilitate consistent system response.

45.a Duplicates of documents accurately recording the results of instrument linearity evaluations are attached hereto as Document Nos. M000014-M000020.

46. Aroclors were quantitated by peak area. A representative set of 6 peaks was chosen from each Aroclor reference standard for use. Samples containing a given Aroclor were quantitated using the same set of peaks, barring any matrix interferences or interferences from other Aroclors. Peaks affected by interferences were "dropped" from both the sample and reference standard peak area totals. Aroclors in samples containing Aroclor mixtures were quantitated individually, again omitting any peaks affected by matrix interferences and/or Aroclor co-elution.

47. Sample results were calculated on a milligrams/kilogram, sample dry weight basis.

48. Spike and surrogate (DBC) recoveries were monitored to determine the accuracy of PCB determinations.

48.a Surrogate recoveries ranged from 78% to 133% for all the sediment samples analyzed.

48.b For spike analysis, an uncontaminated sediment was chosen, and spiked with Aroclor 1254 at a level of 15 mg/kg (dry weight). Spike recoveries averaged 95% for the samples spiked.

49. In-house duplicate samples analyzed showed some variance in Aroclor concentrations. This variance may have been due to sample stratification, or to other factors relating to sample preparation.

50. Duplicates of documents accurately recording spike recovery and variance in analytical results for duplicate samples are attached hereto as Document No. 000028.

51. Duplicates of PCB calculation data sheets accurately setting out retention times of peaks used and associated peak areas are attached hereto as Document Nos. M000170-M000235 and M000237-M000251.

52. Results of calculations were hand written onto draft data forms, duplicates of which are attached hereto as Document Nos. M000097-M000138.

53. Document Nos. M000006-M000007, duplicates of which are attached hereto, contain a cross-reference table which accurately correlates field subsample designations (e.g., NBH-QDA-SD-211A) with CHAS laboratory identification numbers (e.g., 200303).

54. Document No. M000005, a duplicate of which is attached hereto, accurately reports the results of total solids determinations for the August 21, 1987 samples which were subjected to chemical analysis.

55. Document Nos. M000002-M 000004, duplicates of which are attached hereto, accurately report the results of PCB analysis of August 21, 1987 samples quantified as total Aroclors, Aroclor 1248 and Aroclor 1254.

56. The analytical results reported in Document Nos. M000002-M000004 accurately reflect the total PCB and Aroclor 1254 concentrations within the samples at the time the samples were analyzed, within the constraints of the method employed.

56a. The results of CHAS PCB sediment analyses were reviewed with respect to analytical validity.

56b. The results of the CHAS PCB sediment analyses were found to be valid and acceptable for the use intended.

56c. The results of the CHAS PCB sediment analyses are valid and acceptable for the use intended.

56d. The CHAS PCB sediment analytical data were also found to be acceptable in small-scale environmental variability of PCB concentrations in estuary sediment.

56e. The CHAS PCB sediment analytical data are acceptable to assess small-scale environmental variability of PCB concentrations in estuary sediment.

1617L

October 1987 Balsam Salt Marsh Sampling --
Wilson Laboratories Analysis

1. On October 22 and 23, 1987, personnel of Balsam Environmental Consultants, Inc. ("Balsam") collected soil samples from the salt marsh on the east bank of the Acushnet River upper estuary. Allan Walker and Shawn McGrath participated in the October, 1987 field sampling.

2. The October, 1987 salt marsh soil sampling program was designed to assess the presence of PCBs in salt marsh soils of the Acushnet River upper estuary.

3. Soil samples were collected along six transects running east and west across the salt marsh area. Document No. 007781, a duplicate of which is attached hereto, depicts accurately the location of the six transects, numbered 1 through 3 and 5 through 7.

4. Three stations were sampled along each transect. The location of such sampling stations are depicted accurately in Document No. 007781.

5. A total of 18 stations were sampled. Two samples were collected at each of these stations; one from the 0" - 6" depth horizon, the second from the 6" - 12" depth horizon.

6. Samples were collected manually using a shovel and stainless steel utensils.

   6a. Samples were collected in such a manner to prevent cross-contamination between samples from varying soil depths.

   6b. Samples collected from the 0"-6" soil depth interval were obtained by removing soils from the side wall of the sampling excavation from the 0"-6" horizon using a stainless-steel spoon.

   6c. Samples from the 6"-12" soil depth interval were obtained in the following manner:

      #A. A hole at least 12" in depth was excavated at the sampling station.

      #B. The 6"-12" horizon of the excavation side wall was scraped to remove soils which may not have originally existed in that horizon.

      #C. Soils were collected from the scraped 6"-12" horizon of the excavation side wall with a stainless steel spoon.

6d. Samples collected in the manner described above are acceptable and can produce acceptable quality samples.

6e. The samples collected during the October 1987 are reliable and representative in nature.

7. Samples were placed in a stainless steel bowl and homogenied.

8. Homogenized samples were placed in sample containers provided by Wilson Laboratories ("Wilson")

9. Sample containers were labeled with field sample designations, date and time.

10. Sample locations were identified with the prefix "UEM" (for "upper estuary marsh"), followed by the transect number 1, 2, 3, 5, 6 or 7) followed by the number 1, 2, or 3 (from the most westerly to the most easterly sample location) and the letter "A" (0" - 6" horizon) or "B" (6" - 12" depth horizon).

11. Following and prior to collection of each sample, sampling equipment and sampler's gloved hands were washed with a tri sodium phosphate and water solution followed by a tri sodium phosphate and water solution followed by a potable water rinse.

12. Two blind duplicate soil samples were prepared.

13. The sample assigned field designation UEM-4-15-A was a duplicate of the sample assigned field designation UEM-3-1-A.

14. The sample assigned field designation UEM-4-1-B was a duplicate of the sample assigned field designation UEM-5-2-B.

15. A duplicate of the Balsam field log for the October, 1987 sampling event, which accurately records dates, weather, personnel and sampling locations, is attached hereto as Document Nos. 009168 to 009171.

16. The Balsam, 1987 salt marsh soil samples were collected and shipped under a chain-of-custody. Document Nos. 009173 and 009174 are duplicates of the chain-of-custody documents with which the samples were transported by overnight courier to Wilson.

17. Samples were transported to Wilson in a cooler packed with ice to maintain a temperature of 4°C.

18. Samples were received by Wilson, together with chain-of-custody forms, duplicates of which are attached hereto as Document Nos. 012762 and 012763, on October 23, 1987. The samples were relinquished by an agent of the overnight courier and received by Jo Peterson of Wilson.

19. At the time of receipt by Wilson of the Balsam October, 1987 samples, handwritten entries were made in Wilson's sample receiving log book accurately recording the laboratory identification number and corresponding field designation for each of the October, 1987 samples. These samples were assigned Wilson file number 87-9836 and lab identification numbers 8711-1427 through 8711-1465 as accurately recorded on the Wilson sample receiving log book pages, duplicates of which are attached hereto as Document Nos. 012553 and 012554.

20. Samples were kept in refrigerated storage prior to sample preparation.

21. Soil samples were prepared for PCB analysis using a modified CLP procedure.

    21.a. Sample aliquots of approximately 10.0 g of dried soil were weighed out and mixed with 60 g of anhydrous Na_2SO_4.

    21.b. Each sample was sonicated for 3 minutes with 100 mL of 1:1 dichloromethane/acetone. Solvent was decanted and filtered with #41 Whatman filter paper.

    21.c. Each sample was sonicated two additional times with 100 mL 1:1 dichloromethane/acetone. Extracts were decanted and filtered.

    21.d. All 3 extracts from 21b and 21c were combined.

    21.e. The extract volume was then reduced to 1.0 mL using Kuderna-Danish (K-D) concentrator. 10 mL hexane were added and the volume then

reduced to 1.0 mL in K-D concentrator. 9.0 mL hexane were then added and the sample was placed in sealed vials for analysis.

22. Duplicates of pages from a Wilson sample preparation notebook reflecting the extraction of the Balsam October, 1987 samples, and accurately recording drywade determinations of analysis aliquots, are attached hereto as Document Nos. 012558, 012557 and 012556.

23. Laboratory sample nos. 8711-1438P and 8711-1464P were laboratory duplicates.

24. Laboratory sample nos. 8711-1438A and 8711-1464A were spiked with a known analyte.

25. Samples were analyzed for PCB by packed column GC/ECD using a modified EPA Method 608.

    25.a. A Hewlett-Packard 5710A gas chromatograph equipped with an autosampler and an electron capture detector was used for PCB analysis.

    25.b. The column used was a 6-foot mixed-phase packed column. The packing was 1.5% SP-2250/1.95% SP-2401 on 100-120 Supelcoport.

    25.c. The carrier gas was a 95:5 mixture of argon:methane maintained at a flow rate of 35 ml/min.

    25.d. The oven temperature was isothermal at 205°C. The detector was held at 350°C.

    25.e. The instrument was calibrated using an external standard method. Three point calibrations were performed.

    25.f. Calibration was checked every 3-5 samples using a known standard.

    25.g. A hexane blank was analyzed every 10-15 samples.

26. Duplicates of packed column GC/ECD chromatograms and integrator outputs for the standards and samples (identified by handwritten notations thereon) are attached hereto as Document Nos. 012559 through 12758A.

27. PCBs were quantified as Aroclor 1254 using 6 peaks selected from the Aroclor 1254 reference standard.

28. Chromatographic data used for quantification is identified by handwritten brackets or other indicators on integrator output showing peak areas for peaks judged to correspond with reference peaks. A sum of the area of such peaks is found in the integrator output margin for each chromatogram used for quantification.

29. Document No. 012552 is a duplicate of a table prepared by Wilson which accurately states the laboratory identification number, field sample designation and PCB concentration (Aroclor 1254) in miligrams per kilogram for each of the October, 1987 samples.

30. The analytical results reported in Document No. 012552 accurately reflect the Arochlor 1254 concentrations within the samples at the time the samples were analyzed, within the constraints of the method employed.

29a. The Wilson PCB sediment analytical data were reviewed and formed to be valid and reliable.

29b. The Wilson PCB sediment analytical data are valid and reliable.

29c. The Wilson PCB sediment analytical data were found to be acceptable for the use intended.

29d. The Wilson PCB sediment analytical data are acceptable for the uses made of these data by Balsam.

1642L

February 1988 Balsam Sediment Sampling --

IT Analytical Analysis

1. On February 24 and 25, 1988, personnel of Balsam Environmental Consultants, Inc. ("Balsam") collected sediment samples from the Acushnet River Upper Estuary. Leonard Sarapas, Tom Woodard, Brian Quinlan, Art Lima and Allen Walker of Balsam participated in the February, 1988 sampling.

2. Prior to the conduct of the February, 1988 sampling, a protocol was developed setting forth the objectives of the program and detailing the collection methods, intended sampling locations and vertical horizons, sample handling and transport, quality assurance/quality control procedures and other information. A duplicate of the Balsam protocol for the February, 1988 sampling is attached as Document Nos. 009121 to 009134 and 009404 to 009405.

3. Sediment cores were obtained using a three-inch diameter Schedule 80 PVC core barrel sampler.

4. The core barrel sampler was sized so as to permit collection of sediments to a depth of 24" below the sediment/water interface.

5. Following collection of each sediment sample, the recovery of sediment (vertical dimension) was measured and geologic descriptions of sediment material were recorded; samples to be used for thin-layer analyses were not extruded in the field and thus were not geologically described in the field.

6. Samples designated as NBH-101-SD were collected at the location having Loran C coordinates 25593.05 and 44026.51.

7. Samples designated as NBH-102-SD were collected at the location having Loran C coordinates 25594.72 and 44028.56.

8. Samples designated as NBH-103-SD were collected at the location having Loran C coordinates 25595.77 and 44030.35.

9. Samples designated as NBH-104-SD were collected at the location having Loran C coordinates 25596.14 and 44030.43.

10. Samples designated as NBH-105-SD and NBH-106-SD were collected at the location having Loran C coordinates 25596.36 and 44031.92.

11. The samples labeled as NBH-106-SD were blind duplicates of the samples designated as NBH-105-SD.

12. At each of the sampling locations designated as NBH-101-SD through NBH-105-SD, two cores were collected for transport to IT Analytical Services ("ITAS"), Knoxville, Tennessee laboratory.

13. Extrusion of these cores was conducted in the field. In each case, both the top three inches and any sediment material below 18 inches were discarded.

14. Sample cores were extruded such that sediment contacting the interior wall of the core barrel was excluded.

15. Sediment from the 3"-18" interval from the two cores was placed in a stainless steel bowl and homogenized with a stainless steel spoon, following which the homogenized sediment was transferred to pre-cleaned amber-colored glass containers supplied by ITAS, Knoxville.

16. Each such container was labeled with the date, time and field sample designation.

17. Samples designated as NBH-110-SD were collected from the location having Loran C coordinates 25597.45 and 44032.80.

18. Samples designated as NBH-111-SD were collected from the location having Loran C coordinates 25597.46 and 44032.85.

19. Samples designated as NBH-112-SD were collected from the location having Loran C coordinates 25597.45 and 44032.86.

20. Samples designated as NBH-113-SD were collected from the location having Loran C coordinates 25597.49 and 44032.95.

21. Six core samples were collected at each of the locations designated as NBH-110-SD through NBH-113-SD.

22. Following extrusion of these cores, sediment from a depth of greater than six inches below the sediment/water interface was discarded and the remaining core material was segmented into two horizons: 0"-3" and 3"-6".

23. Sample cores were extruded such that sediment contacting the interior wall of the core barrel was excluded.

24. The 0"-3" horizon sediment material from each of the six cores was homogenized in a stainless steel bowl with a stainless steel spoon and then transferred to pre-cleaned amber-colored glass containers furnished by ITAS, Knoxville.

25. Each such container was labeled with the date, time and field sample designation.

26. The same procedure was followed for the sediment from the 3"-6" horizon.

27. Samples consisting of sediment from the 0"-3" sediment horizon were identified with the suffix -01.

28. Samples consisting of sediment from the 3"-6" sediment horizon were identified with the suffix -02.

29. All of the sediment samples from the February 1988 sampling (NBH-101-SD through NBH-113-SD-02, inclusive) were placed on ice and maintained at or near 4° C following collection and during transportation to ITAS, Knoxville.

30. The Balsam February 1988 samples were collected and shipped under a chain-of-custody. Document Nos. 010313 and 010334 are duplicates of the chain-of-custody documents with which the samples were transported to ITAS, Knoxville.

31. Quality assurance/quality control procedures implemented in the course of the sampling program included washing of sampling equipment and sampler's gloved hands with a trisodium phosphate and water solution followed by a potable water rinse prior to collection or handling of each sample.

32. A duplicate of the sampling field log for the February 1988 sampling, which accurately records dates, weather, personnel, sampling activities, sample recovery and sampling locations, is attached hereto as Document Nos. 009142 through 009164.

33. On February 25, 1988, four sediment samples, together with chain-of-custody and request for analysis forms, were received by ITAS', Knoxville, Tennessee laboratory. Document Nos. 010313 and 010311 are duplicates of the chain of custody and request for analysis forms for these samples, respectively.

34. The samples received on February 25, 1988 were assigned ITAS, Knoxville Project Code BME 40786 and laboratory sample identification numbers EE 4177 through EE 4180 as accurately recorded in the ITAS sample receipt log, a duplicate of which is attached as Document No. 010278.

35. On March 1, 1988, 10 sediment samples, together with chain of custody and request for analysis forms, were received by ITAS, Knoxville. Document Nos. 010334 and 010186 are duplicates of the chain of custody and request for analysis forms for these samples, respectively.

36. The samples received on March 1, 1988 were assigned ITAS Project Code BME 40805 and laboratory sample numbers EE 4322 through EE 4329, as accurately recorded on the ITAS sample receipt

log, a duplicate of which is attached as Document Nos. 010193 and 010194.

37. The samples included in Project Codes BME 40786 and BME 40805 were prepared and analyzed together.

38. On March 2, 1988, the two containers of each sample were composited and a portion of the composited sample was put into an aluminum pan to air dry. A separate aliquot of the composited sample was weighed out at this time for percent moisture determination. The remainder of each sample was placed back into one of its original containers and stored. Portions of this stored aliquot were later used for oil and grease and pH determinations.

39. On March 7, 1988, each of the air-dried samples was broken up and sifted through a screen. Approximately 30 grams of the screened sample was used for Aroclor analysis. An additional pre-weighed aliquot of the air-dried sample (approximately 10 grams) was used for moisture determination of the air-dried sample.

40. On March 8, 1988, an additional aliquot of the composited sample was taken from the stored sample container for a second moisture determination. The later determination was conducted as a check on the initial moisture determination.

41. On March 9, 1988, air-dried sample aliquots were prepared for analysis in accordance with the Contract Laboratory Program ("CLP") low-level preparation method, with the exceptions that (1) surrogate use was omitted to avoid interference with Aroclor chromatographic patterns, and (2) matrix spike and matrix spike duplicates were not used.

42. One duplicate of sample EE 4325 was prepared.

43. One method blank was prepared. The method blank was subjected to analysis in the same fashion as the samples.

44. On March 15, 1988, the sample extracts were concentrated.

45. The sample extracts were subjected to an alumina column cleanup step.

46. Further cleanup procedures employed included florisil slurry cleanup and acid cleanup (Bellar and Lichtenberg, 1982) and mercury sulfur cleanup (SW-846 Method 3660, Third Ed.).

47. The weighing, extraction, concentration and cleanup of the samples in Project Nos. BME 40786 and BME 40805 is recorded

accurately in the ITAS, Knoxville organic extraction prep worksheets, duplicates of which are attached hereto as Document Nos. 010288 and 010206 to 010207, respectively.

48. Packed column gas chromatography/electron capture detector ("GC/ECD") analyses were performed based on SW-846 Method 8080, Second Edition.

49. Packed column GC/ECD analysis screens were performed on March 18, 1988 and March 22, 1988 for the purpose of determining the appropriate dilutions needed to generate on-scale chromatograms of the various samples. The instrument conditions for these screening analyses are accurately indicated on Document Nos. 010432 and 010470, duplicates of which are attached hereto. Duplicates of the chromatograms from the screening analyses are attached hereto as Document Nos. 010434 to 010469 and 010472 to 010489.

50. On March 22, 1988, a series of mixed standards containing Aroclor 1242, 1254 and 1260 were run at column tempatures of 210° C, 205° C and 200° C. These mixed standards, and certain additional standards run with them, are accurately identified on Document No. 010490, attached hereto. Duplicates of the chromatograms from the mixed standard runs performed at varying column temperatures are attached hereto as Document Nos. 010494 to 010498.

51. Based upon comparison of the peak resolution among the mixed standard chromatograms run at different column temperatures, a column temperature of 200° C was selected for sample runs.

52. On March 24, 1988, a three-point calibration was run for Aroclors 1242, 1248, 1254 and 1016. The concentration of these calibration standards is accurately stated in Document No. 010500, attached hereto. Duplicates of the chromatograms for the calibration standards are attached hereto as Document Nos. 010501 to 010528. The instrument used for the packed column analysis of standards and samples, a Varian 3740 gas chromatograph equipped with an electron capture detector, is accurately identified, and the instrument conditions are accurately set forth, on Document No. 010499 attached hereto.

53. Sample analyses were then performed. Sample extracts were diluted as necessary to bring the tallest peak on scale to approximately 90-95% full scale.

54. Quality control measures included injection of solvent after the fifth sample of the run sequence and then after every 10 samples.

55. An Aroclor standard was run after every 10 samples during packed column GC/ECD analysis.

56. The gas chromatograph was calibrated daily with mid-level standards of Aroclor 1242, 1248, 1254 and 1016.

57. On March 28, 1988, mixed Aroclor standards were run. These mixed standards were assigned laboratory identification numbers BW-226 through BW-230. The composition of mixed standards BW-226 through BW-230 is accurately stated in Document No. 010609, attached hereto. Duplicates of packed column GC/ECD chromatograms for mixed standards BW-226 through BW-230 are attached hereto as Document Nos. 010626 through 010635.

58. On March 29, 1988, an additional mixed Aroclor standard was run. This mixed standard was assigned laboratory identification number BW-231. The composition of mixed standard BW-231 is accurately stated in Document No. 010637, attached hereto. A duplicate of the packed column GC/ECD chromatogram for mixed standard BW-231 is attached hereto as Document Nos. 010638 to 010639.

59. Document Nos. 010432 to 010656 and 010955 to 011166 comprise duplicates of raw data packages from the packed column GC/ECD analyses of samples from ITAS, Knoxville Project Nos. BME 40786 and 40805, including chromatogram identification sheets, run log worksheets, multiple peak worksheets, three-point calibration worksheets and packed column GC/ECD chromatograms. Each chromatogram is marked to indicate the standard, sample or solvent run which it represents. The chromatograms used for quantification bear hand-written calculations above or below the recorder tracing.

60. The sample chromatograms showed evidence of mixed Aroclor residues, with alteration of standard Aroclor peak patterns. ITAS, Knoxville recorded the Aroclor residues as Aroclor 1254 and Aroclors 1016, 1232, 1242 and/or 1248. The samples were quantified as Aroclor 1242 and Aroclor 1254.

61. Quantification was performed by summing the heights of several selected peaks attributed to Aroclor 1242 and Aroclor 1254, respectively. The corresponding peaks from the daily Aroclor standards were summed and used to calculate a response factor for Aroclors 1242 and 1254.

62. Peak height measurements and peak height totals are listed on the multiple peak worksheet forms referenced above.

63. Calculations were performed on copies of the chromatograms, as indicated above.

64. The chromatograms bear notations showing the cleanup procedures used on particular samples.

65. Sample numbers referenced in Column B of Table 1 are laboratory identification numbers for the samples identified by field designation in Column A of Table 1.

66. The analytical results for laboratory sample numbers EE 4177 through EE 4180 and EE 4322 through EE 4331 for Aroclors 1016 and/or 1242 are accurately reported in Column C of Table 1.

67. The analytical results for laboratory sample numbers EE 4177 through EE 4180 and EE 4322 through EE 4331 for Aroclor 1254 are accurately reported in Column D of Table 1.

68. The analytical results for laboratory sample numbers EE 4177 through EE 4180 and EE 4322 through EE 4331 for total Aroclors are accurately reported in Column E of Table 1.

69. The analytical results as reported in Columns C, D and E of Table 1 accurately reflect the concentrations of the specified Aroclor residues within the samples at the time the samples were analyzed, within the constraints of the method employed.

70. Capillary column GC/ECD analysis of the extracts from ITAS, Knoxville, project numbers BME 40786 and BME 40805 was performed beginning on April 2, 1988. A Varian 3700 gas chromatograph, equipped with an electron capture detector and a 30-meter 0.32 mm ID capillary column with 1.5u DB5 coating was used for analysis.

71. Instrument conditions were adjusted to obtain chromatographic patters for Aroclor standards with the greatest peak resolution and baseline separation achievable.

72. Instrument conditions for the capillary GC/ECD analysis of the samples are accurately stated in the associated chromatogram identification sheets, duplicates of which are attached hereto as Documents Nos. 010745 and 010746.

73. The Aroclor standards and mixed Aroclor standards run together with the BME 40786 and BME 40805 samples in capillary column GC/ECD analysis are accurately identified in ITAS run log worksheet numbers 20693 through 20696, duplicates of which are attached hereto as Document Nos. 010658, 010657, 010747 and 010748.

74. Dibutyl chlorendate (DBC) was added as an internal standard to all standards and samples analyzed by capillary column GC/ECD.

75. A hexane solvent injection was analyzed after the fifth sample and then at least after every 10 samples during capillary column GC/ECD analysis.

76. An Aroclor standard was run after every 10 samples during capillary column GC/ECD analysis.

77. During capillary column GC/ECD analysis, dilutions of extracts were made as necessary to obtain chromatograms with the tallest peak at about 90-95 percent full scale.

78. Duplicates of the chromatograms for hexane, standards, mixed standards and samples analyzed during capillary column GC/ECD analysis of ITAS project numbers BME 40786 and BME 40805 are attached hereto as Document Nos. 010659 through 010744 and 010749 through 010953.

79. Following capillary column GC/ECD analysis, sample extracts from the BME 40786 and BME 40805 projects were placed in a freezer and stored at 4° C [?].

80. On June 16, 1989, the extracts from samples having the following field identification numbers were removed from storage: NBH-105-SD; NBH-106-SD; NBH-110-SD-02; NBH-111-SD-01; NBH-112-SD-02; NBH-113-SD-01, and NBH-113-SD-02.

81. These extracts were then assigned project code YOK 43544 and laboratory identification numbers JJ 1004 through JJ 1010, as accurately recorded on the ITAS sample receipt log, a duplicate of which is attached hereto as Document No. 010425.

82. The sample extracts from NBH-105-SD and NBH-106-SD were combined and concentrated to one ml. The combined extract was assigned laboratory identification number JJ 1004/5.

83. The sample extracts from NBH-113-SD-01 and NBH-113-SD-02 were combined and concentrated to 0.5 ml. The combined extract was assigned laboratory identification number JJ 1009/10.

84. The project YOK 43544 extracts were analyzed by packed column GC/ECD on June 27 and 28, 1989. Analysis technique was based upon SW-846 Method 8080, Second Edition.

85. Document Nos. 011087 through 011156 comprised duplicates of raw data packages from the packed column GC/ECD analyses of

samples from ITAS, Knoxville Project No. YOK 43544, including chromatogram identification sheets, run log worksheets, multiple peak worksheets and packed column GC/ECD chromatograms. Each chromatogram is marked to indicate the standard, sample or solvent run which it represents. The chromatograms used for quantification bear hand-written calculations above or below the recorder tracing.

86. The instrument conditions for the packed column GC/ECD runs of the YOK 43544 samples are accurately recorded on Document No. 011087.

87. Aroclor concentration calculations for the YOK 43544 sample extracts were performed using the same peaks and the same equation as was used to calculate concentrations for the BME 40786 and BME 40805 projects.

88. Sample numbers referenced in Column B of Table 2 are laboratory identification numbers for the samples identified by field designation in Column A of Table 2.

89. The analytical results for laboratory sample numbers JJ 1004/5, JJ 1006 through JJ 1008 and JJ 1009/10 for Aroclors 1016 N/R 1242 are accurately reported in Column C of Table 2.

90 The analytical results for laboratory sample numbers JJ 1004/5, JJ 1006 through JJ 1008 and JJ 1009/10 for Aroclor 1254 are accurately reported in Column D of Table 2.

91. The analytical results for laboratory sample numbers JJ 1004/5, JJ 1006 through JJ 1008 and JJ 1009/10 for total Aroclors are accurately reported in Column E of Table 2.

92. The analytical results as reported in Columns C, D and E of Table 2 accurately reflect the concentrations of specified Aroclor residues within the samples at the time the samples were analyzed, within the constraints of the method employed.

93. On June 30, 1989, the YOK 43544 project was transferred to W.T. Wilson (GC/MS supervisor) for Gas Chromatography/Mass Spectrometry (hereinafter referred to as GC/MS) analysis.

94. On July 6, 1989, the sample extracts were analyzed for PCBs by level of chlorination using GC/MS.

94a. The level of chlorination (homolog) analyses were performed using a Finnigan 4500 GC/MS with Winchester/70 megabyte drive and a Nova 4 computer running INCOS software.

94b. Full spectra were scanned at a rate of one scan/second over the mass range 35 to 510 amu.

94c. Spectra were taken in the EI (electron impact) mode, with 70ev electron energy.

94d. The GC was operated in the splitless injection mode using a 30 meter RTX-5 (Restek) fused silica capillary column.

94e. The GC oven was programmed to permit the elution of all PCB congeners during the analysis run.

94f. The various MS source potentials were adjusted to produce a spectrum of decaflurotriphenyl-phosphine (hereinafter referred to as DFTPP) which met the tuning specifications of the CLP analytical protocol. Document Nos. 002744 and 002745 are duplicates of the DFTPP tuning reports for the 7/6/89 GC/MS analysis runs.

95. The instrument was calibrated using Aroclor 1016, Aroclor 1242, and Aroclor 1254. In addition biphenyl and 2-chlorobiphenyl were included as standards.

96. An internal injection standard, chrysene-D12, was added to each standard solution and sample extract just prior to analysis.

97. Response factors were determined for all homolog levels present in each of the three Aroclor standards used for calibration.

97a. Response factors from all standards were averaged to produce the factors used for homolog level quantitations.

97b. Data relating to homolog level concentrations for the Aroclors of interest were obtained from the publication of Alford-Stevens et al. (1986).

97c. The Aroclor standards for the Alford-Stevens study and the YOK 43544 project were obtained as Quality Assurance Technical Materials (>95% purity) from the USEPA Repository for Toxic and Hazardous Materials, Cincinnati, OH.

98. GC/MS identifications were made using retention times and extracted ion current profiles (hereinafter referred to as EICPs).

99. Quantifications of the PCB measurements by chlorine numbers (homolog level) were made using the EICPs of the internal standard and those compounds identified as PCBs.

100. The complete data package for the 7/6/89 GC/MS analysis run was submitted to YAI for evaluation purposes. The package contained the case narrative, QC summary, sample data, and standards data.

100a. Full-scan spectra of all peaks were visually inspected to verify that only those peaks arising from PCBs were included in the quantitations.

100b. Duplicates of the complete data package for the 7/6/89 GC/MS analysis run are attached hereto as Document Nos. 002740 through 003066.

101. Confirmation of the level of chlorination analyses as well as congener-specific PCB determinations by GC/MS were performed during the period July 14-19, 1989.

101a. The analyses were performed using a Finnigan 4023 GC/MS with Winchester/70 megabyte drive and a Nova 4 computer running INCOS software.

101b. Full spectra were scanned at a rate of one scan/second over the mass range 35 to 510 amu.

101c. Spectra were taken in the EI (electron impact) mode, with 70ev electron energy.

101d. The GC was operated in the splitless injection mode using a 30 meter RTX-5 (Restek) fused silica capillary column.

101e. The GC oven was programmed to reproduce the elution of all PCB isomers obtained during the analysis run of 7/6/89.

101f. The various MS source potentials were adjusted to produce a spectrum of DFTPP which met the tuning specifications of the CLP analytical protocol. Document Nos. 003071, 003072, and 003073 are duplicates of the DFTPP tuning reports for 7/14/89, 7/17/89, and 7/19/89, respectively.

102. The instrument was calibrated with Method 680 congener standards (obtained from ANALABS) with the exception of the prescribed octachlorobiphenyl congener (BZ 200) which was unavailable at the time requested. Another octachloro-congener (BZ 194) was used in the standards in place of BZ 200. In addition to the Method 680 quantitation congeners, the standards contained three (3) retention time marker congeners (BZ 77, 104, 208).

103. The instrument was calibrated on July 14, 1989 using a three-point calibration; results were plotted, showing linearity.

104. Prior to the analysis of sample extracts on 7/14/89, comparison standards of Aroclor 1242 and 1254 and a continuing calibration standard were run. Document Nos. 012312, 012320, and 012321, herewith attached, are duplicates of the GC/MS instrument run logs for Project YOK 43544.

105. A calibration standard for each shift, containing both quantitation and retention time congeners, was evaluated against the initial calibration curve and used for quantitation of the runs within each shift.

106. Two internal injection standards, phenanthrene-D10 and chrysene-D12, were added to each standard solution and sample extract just prior to analysis.

107. Quantitations were performed as set forth in EPA Method 680 (1985). Quantitation, confirmation, and interference check ions were those given in Table 12 of Method 680.

108. Congener-specific quantitations and level of chlorination determinations were performed on sample extracts analyzed on 7/17/89.

109. On July 19, 1989, a set of Halowax standards and a mixture of Aroclor 1242 and Halowax 1099 were analyzed to confirm the presence of chlorinated naphthalenes in some of the YOK 43544 sample extracts.

110. Duplicates of the complete data packages for the analyses run July 14-19, 1989, were submitted to YAI for evaluation purposes.

111. Duplicates of the complete data packages for analyses run July 14-19, 1989, are attached hereto as Document Nos. 003067 through 003814.

112. Additional requests for data were made to ITAS by YAI during the course of data evaluations.

113. Duplicates of salient portions of the supplemental data relied upon by YAI for evaluations in the Phase II investigations are attached hereto as Document Nos. 003816 through 004043; 004117 through 004413; and 12400 through 12530.

114. All of the data described above were reviewed by YAI for correctness and validity.

115. YAI found these data to be valid and acceptable for the purpose intended.

116. These data are valid and acceptable for the purpose intended.

56521

REQUESTS FOR ADMISSIONS SECTION

TABLE 1

A	B	C	D	E
FIELD SAMPLE IDENTIFICATION	LABORATORY SAMPLE NO.	AROCLOR 1016/1242 (ppm)	AROCLOR 1254 (ppm)	TOTAL AROCLORS (ppm)
NBH-101-SD	EE 4177	3.8	4.6	8.4
NBH-102-SD	EE 4178	170	96	270
NBH-103-SD	EE 4179	9.1	13	22
NBH-104-SD	EE 4180	87	70	160
NBH-105-SD	EE 4322	330	150	480
NBH-106-SD	EE 4323	280	130	410
NBH-110-SD-01	EE 4324	1,400	2,000	3,400
NBH-110-SD-02	EE 4325	< 1,400 *	3,000	3,000
NBH-111-SD-01	EE 4326	4,600	5,300	9,900
NBH-111-SD-02	EE 4327	1,800	8,100	9,900
NBH-112-SD-01	EE 4328	7,500	4,600	12,000
NBH-112-SD-02	EE 4329	28,000	16,000	44,000
NBH-113-SD-01	EE 4330	48	100	150
NBH-113-SD-02	EE 4331	< 13 *	49	49

* Higher detection limit due to interference.

5687i

REQUESTS FOR ADMISSIONS SECTION

TABLE 2

A	B	C	D	E
FIELD SAMPLE IDENTIFICATION	LABORATORY SAMPLE NO.	AROCLOR 1016/1242 (ppm)	AROCLOR 1254 (ppm)	TOTAL AROCLORS (ppm)
NBH-105/106	JJ 1004/5	410	210	620
NBH-110-02	JJ 1006	< 1,200 *	2,800	2,800
NBH-111-01	JJ 1007	4,100	5,000	9,100
NBH-112-02	JJ 1008	25,000	16,000	41,000
NBH-113-01/02	JJ 1009/10	41	110	150

* Higher detection limit due to interference.

December 1988 Balsam Sediment Sampling
Cambridge Analytical Analysis

1. On December 12, 1988 personnel of Balsam Environmental Consultants, Inc. ("Balsam") collected sediment samples from the Acushnet River Upper Estuary. Frank Bohlen, Dave Cohen and Alan Walker participated in the December 1988 sampling.

2. Prior to the conduct of the December, 1988 sampling, a protocol was developed setting forth the objectives of the program and detailing the collection methods, intended sampling locations and vertical horizons, sample handling and transport, quality assurance/quality control procedures and other information. A duplicate of the Balsam protocol for the December, 1988 sampling is attached as Document Nos. 000740 to 000751.

3. The December, 1988 sampling was designed to provide data for characterization of the small-scale vertical distribution of sediment column PCBs and heavy metals in the Acushnet River Upper Estuary.

4. Sediment cores were obtained using a three-inch diameter Schedule 80 PVC core barrel sampler.

5. The core barrel sampler was sized so as to permit collection of sediments to a depth of 24" below the sediment/water interface.

6. Following collection of each sediment sample, the recovery of sediment (vertical dimension) was measured.

7. Following collection, sample cores were capped both at the bottom and the top of the core.

8. Cores were then labelled with the date, time and field sample designation and with an arrow indicating the end of the core corresponding with the sediment/water interface.

9. Cores were stored in a vertical position with the top up.

10. All cores were placed on ice and maintained near 4°C following collection and during transportation to University of Connecticut facilities for further processing.

11. Cores designated as FX-1 through FX-4 were collected at the location designated "FX" on Document No. 009400, a duplicate of which is attached hereto.

12. Cores designated DR-1 through DR-4 were collected at the location designated "DR" on Document No. 009400, a duplicate of which is attached hereto.

13. Four sediment cores were collected at sampling location "FX," and four sediment cores were collected at sampling location "DR."

14. Quality assurance/quality control procedures implemented in the course the December, 1988 sampling program included washing of sampling equipment and sampler's gloved hands with a trisodium phosphate and water solution followed by a potable water rinse prior to collection and handling of each sample.

15. A duplicate of the sampling log for the December, 1988 sampling, which accurately records dates, weather, personnel, sampling activities, sample recovery and sampling locations is attached hereto as Document Nos. 000756 through 000759.

16. Field collection activities for the December, 1988 Balsam sediment sampling program were conducted in accordance with the protocol therefor, except as otherwise specified in the field sampling log.

17. Following field sample collection, sediment cores were transported by Balsam personnel to University of Connecticut facilities for further processing.

18. Balsam vehicles used to transport the sediment cores to the University of Connecticut were locked when left unattended.

19. Sediment cores stored at the University of Connecticut laboratory were left in a locked room when unattended.

20. For each of the two sampling locations, two cores were frozen and archived (FX-2 and FX-3; DR-2 and DR-3) and two cores were extruded, sectioned and placed in sample containers for analysis (FX-1 and FX-4; DR-1 and DR-4).

21. Cores FX-1 and FX-4 were extruded and sectioned on December 13, 1988.

22. Cores DR-1 and DR-4 were extruded and sectioned on December 14, 1988.

23. Duplicates of Balsam daily field reports accurately detailing the extrusion and sectioning of cores FX-1, FX-4, DR-1 and DR-4 are attached hereto as Document Nos. 000733 through 000739.

24. Sediment was extruded or otherwise removed from cores FX-1, FX-4, DR-1 and DR-4 as is accurately recorded in the Balsam daily field reports; the method employed depended upon the composition of the sediment material within a particular core.

25. Sample recovery (vertical dimension) was measured following extrusion, as accurately recorded in the Balsam daily field reports.

25a. Sediment cores were not significantly disturbed during the extrusion process.

26. Cores FX-1 and FX-4 were sectioned into four one-centimeter samples, six two-centimeter samples and twelve four-centimeter samples in accordance with the protocol at Document Nos. 000743 to 000744.

27. Cores DR-1 and DR-4 were sectioned into four one-centimeter samples, fourteen two-centimeter samples and four four-centimeter samples in accordance with the protocol at Document Nos. 000744 to 000745.

28. Sectioning of samples was performed with steel wire or a stainless steel sheet.

29. In accordance with the protocol, hands and utensils were washed prior to and following each sectioning.

30. Subsamples were placed on a flat, pre-cleaned surface and the exterior edges of the subsample, which had been in contact with side walls of the core barrel sampler, were removed.

31. Subsamples then were placed into pre-cleaned glass containers, and the containers were labelled with subsample designations and date of processing.

32. To provide adequate sample volume, subsample intervals from the second extruded core for a given sample location were added to the matching subsample interval contained in the labeled glass container holding the first extruded core sample at the same location. Thus, for example, the material from the six to eight centimeter interval from core FX-1 was combined with the material from the six to eight centimeter interval from core FX-4.

33. Matching subsample intervals from the two cores for each location were homogenized and placed in a cooler to maintain sample temperature at 4°C.

34. Quality assurance/quality control "samples" were prepared for transmittal to the laboratory as follows:

34a. DRW-2: distilled, deionized water.

34b. FW-1: water used to rinse equipment, following use.

34c. FX-68: duplicate of FX-32.

34d. DR-52: duplicate of DR-6.

34e. DR-56: pre-analyzed sediment control from Long Island Sound.

34f. DR-60: pre-analyzed sediment control from Long Island Sound.

35. All subsamples from the December 1988 sampling were placed on ice and maintained at or near 4°C following sectioning and during transportation to Cambridge Analytical Associates ("CAA") in Cambridge, Massachusetts.

36. All subsamples and blanks from the December, 1988 sampling program were transported by Balsam personnel to CAA under a chain of custody. Duplicates of the chain-of-custody records for the December, 1988 samples are attached hereto as Document Nos. 010101 through 010104.

37. All Balsam subsample and blank identification numbers and requests for analyses are accurately recorded on these forms.

38. At CAA, the samples were divided into three work orders: 88-12-153 (sample numbers FX-1 to -36), 88-12-194 (sample numbers FX-40 to -68 and DR-1 to -8), and 88-12-195 (sample numbers DR-10 to -60 and FW-1 and DRW-2) and were assigned a CAA ID or "fraction" number.

39. For each work order, a confirmation letter was sent to Balsam. Included in each was a "Sample Analysis Summary," on which was listed: the Balsam sample number, the corresponding "CAA ID" number and the analysis requested ("Analysis Test Codes"). A dictionary of the test codes follows the summary sheets.

40. The Sample Analysis Test Code Dictionary Summaries referenced above are accurately rendered in Document Nos. 009580 through 009583, 009776 through 009779, and 010044 through 010046, duplicates of which are attached hereto.

41. To prepare for the analysis of PCBs as manufactured formulations (e.g., Aroclor 1254) and trace metal analyses, the soil samples were homogenized and then split; a portion was for the Aroclor analyses and the remainder was for the trace metal analyses. "Fraction" laboratory identifications ending with the letter "A" refer to sample fractions subjected to Aroclor analysis.

42. Preparation for the Aroclor analysis consisted of:

42a. Clean-up and extraction of soil samples per EPA Method 3540, as appearing in SW-846 Second Edition.

42b. The weighing, percent moisture determination and extraction of the samples is recorded accurately in the CAA worksheets listed below, duplicates of which are attached hereto.

WORK ORDER NUMBER	WORKSHEET DOCUMENT NUMBERS
88-12-153	009756-009757
88-12-194	009911-009912
88-12-195	010081-010084

43. Aroclor analyses were conducted on sediment samples per EPA Method 8080; SW-846 (Second Edition); water samples were analyzed per EPA Method 608.

43a. A known amount of the extract was injected into a Hewlett-Packard 5880A gas chromatograph ("GC") equipped with an electron capture detector ("ECD").

43b. Quality control measures included:

(1) The calibration of instrument response every 12 hours using EPA traceable standard reference solutions.

(2) The addition of surrogate standard compounds to every sample to monitor method performance.

(3) The analysis of laboratory blanks.

44. The chromatograms from packed column GC/ECD analysis of samples and quality control blanks from work orders 88-12-153, 88-12-194 and 88-12-195 contain the following information:

44a. A pictorial representation of the GC readout, plotted as intensity versus retention time of peaks.

44b. The sample number, or "ID Code", formatted as:

(1) "Work Order Number - CAA fraction number.ratio of concentration",

(e.g., 12153-3.20 means it is fraction 03A from work order 88-12-153 and it has been diluted 1:20).

(2) A designator of work order number "B" indicates a quality control blank.

44c. Tabular output listing retention time and corresponding area and height of each peak.

44d. Date of run.

44e. Instrument conditions, including oven temperature.

45. Duplicates of the chromatograms referenced above are attached hereto as the document numbers given below:

WORK ORDER NUMBER	DOCUMENT NUMBER
88-12-153	009666-009747
88-12-194	009859-009877
	-and-
	009922-009935
88-12-195	010047-010061

46. Quantification of Aroclors was done by the external standard method.

46a. Analysis of known quantities of Aroclor standards 1016, 1221, 1232, 1242, 1248, 1254, and 1260 was conducted and the instrumental response (area and retention time) for representative peaks were noted.

46b. The response of the sample extract was compared to the response of the standard solution, and an equation was generated to determine the concentration of the Aroclor in the sample.

47. Duplicates of the chromatograms of the Aroclor standards referenced above are attached hereto as the document numbers given below:

WORK ORDER NUMBER	DOCUMENT NUMBER
88-12-153	009657-009665
88-12-194	009850-009856
88-12-195	010087-010093

48. Duplicates of quantification worksheets, listing the amount of extract injected, sample weight, raw area response and calculated sample concentrations are attached hereto as the document numbers given below:

WORK ORDER NUMBER	DOCUMENT NUMBER
88-12-153	009748-009755
88-12-194	009903-009910
88-12-195	010078-010080

49. Sample numbers referenced in Column B of Tables 1 and 2 are laboratory identification numbers for the samples identified by Balsam subsample identification in Column A of Tables 1 and 2. Laboratory identification numbers include the last three digits of the CAA work orders, followed by CAA "fraction" numbers.

50. The sample depth horizons (in centimeters) for the December 1988 subsamples are set forth in Column C of Tables 1 and 2.

51. The analytical results for the December 1988 subsamples for Aroclor 1016/1242 are accurately recorded in parts per million in Column D of Tables 1 and 2.

52. The analytical results for the December 1988 subsamples for Aroclor 1254 are accurately reported in parts per million in Column E of Tables 1 and 2.

53. The analytical results as reported in Columns D and E of Tables 1 and 2 accurately reflect the concentrations of the specified Aroclor residues within the subsamples at the time the subsamples were analyzed, within the constraints of the method employed.

53a. The December 1988 thin-layer sediment sample PCB analytical data were evaluated in terms of validity and utility.

53b. These data were found to be valid and useful for the purpose intended.

53c. The data are valid and useful for the purpose intended.

54. Two depositional regimes were identified as preferred sampling stations for the December 1988 sampling program.

55. Sampling location "DR" is characterized by above-average sediment deposition.

56. PCB analysis of vertical subsection samples from the December 1988 sampling indicates significant vertical stratification of PCB concentration in Acushnet River Upper Estuary sediments.

57. At sample location "FX" PCBs were present primarily in the upper twelve inches of the sediment.

58. At sampling location "FX" very low concentrations (non-detectable) of PCBs were present at depths greater than twelve inches.

59. At sampling location "FX" the upper six centimeters of sediment had lower PCB concentrations than the six to twelve centimeter interval.

60. PCB depositional trends observed in the cores collected at sampling location "DR" were similar to those observed in cores collected from sampling location "FX."

60a. Classic PCB "diffusion tales" were observed in the samples collected from Station FX in the interval of 16 cm to 64 cm.

60b. Classic PCB "diffusion tables" were observed in the samples collected from Station DR in the interval of 16 cm to 48 cm.

1437L

REQUESTS FOR ADMISSIONS SECTION

TABLE 1

A	B	C	D	E
Balsam Subsample Identification	Laboratory Sample No.	Sample Depth (cm)	Aroclor 1016/1242 (ppm)	Aroclor 1254 (ppm)
FX - 1	153 - 01A	0 - 1	1,300	300
FX - 2	153 - 02A	1 - 2	1,100	230
FX - 3	153 - 03A	2 - 3	1,800	350
FX - 4	153 - 04A	3 - 4	2,900	390
FX - 6	153 - 05A	4 - 6	3,300	480
FX - 8	153 - 06A	6 - 8	5,600	740
FX - 10	153 - 07A	8 - 10	6,300	900
FX - 12	153 - 08A	10 - 12	5,700	870
FX - 14	153 - 09A	12 - 14	2,600	1,400
FX - 16	153 - 10A	14 - 16	3,700	1,400
FX - 20	153 - 11A	16 - 20	1,300	1,200
FX - 24	153 - 12A	20 - 24	480	1,000
FX - 28	153 - 13A	24 - 28	28	260
FX - 32	153 - 14A	28 - 32	3.8	27
FX - 36	153 - 15A	32 - 36	0.1	0.09
FX - 40	153 - 16A	36 - 40	0.08	0.02
FX - 44	153 - 17A	40 - 44	0.12	0.02
FX - 48	153 - 18A	44 - 48	0.22	0.04
FX - 52	153 - 19A	48 - 52	0.32	0.04
FX - 56	153 - 20A	52 - 56	0.45	0.08
FX - 60	153 - 21A	56 - 60	ND(0.01)	ND(0.01)
FX - 64	194 - 02A	60 - 64	ND(0.1)	ND(0.1)

REQUESTS FOR ADMISSIONS SECTION

TABLE 2

A	B	C	D	E
Balsam Subsample Identification	Laboratory Sample No.	Sample Depth (cm)	Aroclor 1016/1242 (ppm)	Aroclor 1254 (ppm)
DR - 1	194 - 04A	0 - 1	160	61
DR - 2	194 - 05A	1 - 2	210	80
DR - 3	194 - 06A	2 - 3	160	59
DR - 4	194 - 08A	3 - 4	130	50
DR - 6	194 - 09A	4 - 6	140	64
DR - 8	194 - 10A	6 - 8	210	95
DR - 10	194 - 11A	8 - 10	170	87
DR - 12	194 - 12A	10 - 12	140	58
DR - 14	194 - 13A	12 - 14	110	49
DR - 16	194 - 14A	14 - 16	90	54
DR - 18	194 - 15A	16 - 18	49	34
DR - 20	194 - 16A	18 - 20	23	12
DR - 22	194 - 17A	20 - 22	6.8	2.5
DR - 24	194 - 18A	22 - 24	4.1	0.92
DR - 26	194 - 19A	24 - 26	0.4	0.14
DR - 28	194 - 20A	26 - 28	1.2	ND(0.1)
DR - 30	194 - 21A	28 - 30	ND(0.02)	ND(0.02)
DR - 32	195 - 01A	30 - 32	ND(0.05)	ND(0.05)
DR - 36	195 - 02A	32 - 36	ND(0.05)	ND(0.05)
DR - 40	195 - 03A	36 - 40	ND(0.05)	ND(0.05)
DR - 44	195 - 04A	40 - 44	ND(0.05)	ND(0.05)
DR - 48	195 - 05A	44 - 48	ND(0.05)	ND(0.05)

March 1990 -- Balsam Sediment Sampling

American Analytical Analysis

1. On March 12, 1990, personnel of Balsam Environmental Consultants, Inc. ("Balsam") collected sediment samples from the Acushnet River upper estuary. Allen Walker and Don Coleman of Balsam, David Cohen of the University of Connecticut and Joseph Payne of Normandeau Associates, Inc. participated in the March 19, 1990 sampling.

2. The March 1990 sampling included program elements designed to provide additional data permitting enhanced definition of the small-scale vertical distribution of PCBs in upper estuary sediments and to provide additional data for biological and descriptive parameter analyses of upper estuary sediment.

3. Prior to the conduct of the March, 1990 sampling, written protocols were developed for the thin-layer and biological and descriptive parameter elements of the program.

3a. The protocol entitled "New Bedford Harbor Supplemental Thin-Layer PCB Sediment Sampling Program March 1990 Sampling Protocol," a duplicate of which is attached hereto as Document Nos. 012835 through 012847 ("the Thin-Layer Protocol"), sets forth the objectives for the thin-layer aspect of the program and details collection methods, intended sampling locations and vertical horizons, sample handling and transport, quality assurance/quality control procedures and other information.

3b. The protocol entitled "New Bedford Harbor Supplemental Thin-Layer Biological and Descriptive Parameter Sediment Sampling Program March 1990 Sampling Protocol" ("the Biological and Descriptive Parameter Protocol"), a duplicate of which is attached hereto as Document Nos. 012871 through 012886, sets forth the objectives of the biological and descriptive parameter aspects of the program and details the collection methods, intended sampling locations and vertical horizons, sample handling and transport, quality assurance/quality control procedures and other information.

4. Sediment cores were obtained using a 3-inch diameter Schedule 80 PVC core barrel sampler constructed with tapered cutting heads to allow sample collection with minimal sample disturbance and to allow increased sample recovery.

5. The core barrel sampler was sized so as to permit collection of sediments to a depth of 24" below the sediment/water interface.

6. Samples designated as NBH-STL-1 were collected at the location having Loran C coordinates 25596.8 and 44031.5.

7. Samples designated as NBH-STL-2 were collected at the location having Loran C coordinates 25597.1 and 44031.1.

8. Samples designated as NBH-STL-3 were collected at the location having Loran C coordinates 25595.6 and 44029.4.

9. Samples designated as NBH-STL-4 were collected at the location having Loran C coordinates 25592.9 and 44026.7.

10. The figure appearing on Document No. 012886, attached hereto, constitutes a reasonably accurate depiction of the four STL sampling stations.

11. At each of the STL sampling stations, five cores were collected.

12. Following collection of each sediment sample, the recovery of sediment (vertical dimension) was measured.

13. Following collection, four of the five sample cores were capped both at the bottom and at the top of the core. These cores were then labeled with the date, time and field sample designation and with an arrow indicating the end of the core corresponding with the sediment/water interface.

14. Cores were stored in a vertical position with the top up.

15. Capped cores were placed on ice and maintained at 4°C following collection and during transportation to University of Connecticut facilities for further processing.

16. The fifth core taken at each of the four sampling stations was extruded and sectioned in the field for infaunal species identification.

17. Field sectioning of samples was performed with stainless steel utensils.

18. Vertical horizons into which cores from sampling stations STL-1 through STL-4 were sectioned for infaunal species identification are accurately described in Document No. 012852, a duplicate of which is attached hereto.

19. Infaunal species identification cores were sorted from the top layer down. When a layer was found to be azooic, remaining layers were grossly examined for deep burrowing organisms.

20. Each section from the core extruded for infaunal species identification was sieved with a 0.5 mm mesh sieve. Material retained on the sieve was rinsed into a sample jar containing formaldehyde and labelled with a sample control number, station number, fraction of the core (recorded as replicates, where replicate A was the surface most fraction, B was the next fraction, etc.) and date of collection.

21. Information from these sample labels was recorded on sample control/chain-of-custody forms. Additional information recorded on chain-of-custody forms included actual vertical extent of each fraction from each sample, personnel collecting the samples and appropriate chain-of-custody signatures.

22. The biological samples were transported to Normandeau Associates, Inc. ("NAI") by Joseph Payne, an NAI employee who participated in these field sampling acivities, at or near 4°C.

23. Quality assurance/quality control procedures implemented in the course of the March, 1990 sampling program included washing of sampling equipment and sampler's gloved hands with a trisodium phosphate and water solution followed by a potable water rinse prior to collection or handling of each sample.

24. A duplicate of the sampling log for the March 1990 sampling, which accurately records dates, weather, personnel, sampling activities, sample recovery and sampling locations is attached hereto as Document Nos. 012857 through 012862.

25. Field collection activities for the March 1990 Balsam thin-layer and biological and descriptive parameter sampling were conducted in accordance with the protocols therefor, except as otherwise specified in the field sampling log.

26. Following field sample collection, four sediment cores from each of the sampling stations were transported while being maintained vertically by Balsam personnel to University of Connecticut facilities for further processing.

26a. During transport to the University of Connecticut, the samples were maintained at or near 4°C.

27. Balsam vehicles used to transport the sediment cores to the University of Connecticut were locked when left unattended.

28. Sediment cores stored at the University of Connecticut laboratory were left in the vertical position at or near 4°C in a locked room when unattended.

29. At the University of Connecticut facilities, four cores from each of the sampling stations were extruded, recovery was measured and geological characterization of the sediment was performed.

29a. Sediment cores were not significantly disturbed during the extrusion process.

30. Duplicates of Balsam daily field reports accurately detailing the extrusion and sectioning of cores from stations STL-1, STL-2, STL-3 and STL-4 are attached hereto as Document Nos. 012821 through 012828.

31. Document No. 012828 accurately records the number of cores extruded and sectioned from each station (four from STL-3; four from STL-1; three from STL-2, and three from STL-4) and the analyses (i.e., PCBs, dissolved organic carbon ("DOC") and total organic carbon ("TOC"), grain size, or radiometric) for which each core was designated.

32. Two of the cores from station STL-3 were extruded and sectioned for PCB analysis; the cognate sections (or subsamples) from the two cores were combined and homogenized to achieve necessary subsample volume.

33. One core each from stations STL-1, STL-2 and STL-4 was extruded and sectioned for PCB analysis. The zero to two centimeter ("cm") interval from the core from station STL-2 extruded and sectioned for PCB analysis was supplemented by material from the same horizon of the core from STL-2 separately extruded and sectioned for grain size analysis.

34. After extrusion, all cores were sectioned using stainless steel utensils; sliced subsamples then were placed on a flat, pre-cleaned surface and the exterior edges of the subsample which had been in contact with the interior walls of the core barrel sampler were then removed to reduce the potential for cross-contamination of the vertical profile.

35. Cores extruded and sectioned for PCB analysis were sectioned into eight 2-centimeter samples from the 0 cm-2 cm horizon through 14 cm-16 cm horizon (designated subsamples "a" through "h," in series) and twelve 4-centimeter subsamples from the 16 cm-20 cm through 60 cm-64 cm horizon (designated "i" through "t," in series).

36. Cores sectioned for grain size analysis and for DOC and TOC analysis were sectioned as follows:

36a. Redox depth was determined by visual inspection of the core and the first section represented the interval from the sediment/water interface to the redox depth.

36b. The second section represented the interval between the redox depth and 10 cm if such an interval existed.

36c. The third through fifth intervals represented the 10 cm-20 cm, 20 cm-40 cm and 40 cm-64 cm intervals, respectively.

36d. The redox depth visually determined for cores from the four stations were as follows: STL-1 - 0 cm or surface; STL-2 - 2 cm; STL-3 - 2 cm, and STL-4 - 4 cm.

37. Following sectioning, the center portion of each subsample was placed in an appropriate pre-cleaned container provided either by American Analytical Laboratories, Inc. ("AAL") (for samples to be subjected to PCB analysis) or by NAI (for samples to be subjected to grain size or DOC and TOC analysis).

38. Subsample containers were labeled with subsample designations and date of processing.

39. As a quality assurance measure, hands and utensils were washed prior to and following each sectioning for all cores.

40. Quality assurance/quality control "samples" were prepared for transmittal to AAL as follows:

40a. NBH-STL-3u: duplicate of NBH-STL-3r.

40b. NBH-STL-1u: duplicate of NBH-STL-1r.

40c. NBH-STL-1v: duplicate (from DOC/TOC core) of NBH-STL-1a.

40d. NBH-STL-2u: duplicate of NBH-STL-2l.

40e. NBH-STL-4u: duplicate of NBH-STL-4g.

40f. NBH-STL-4v: duplicate of NBH-STL-4j.

40g. NBH-QC-1: trip blank water sample supplied by AAL.

40h. NBH-QC-2: control soil sample supplied by AAL.

40i. NBH-QC-3: distilled water supplied by University of Connecticut.

40j. NBH-QC-4: distilled water provided by University of Connecticut.

40k. NBH-QC-5 and NBH-QC-6: equipment or field blanks (distilled water provided by the University of Connecticut which had been poured over sectioning/sampling equipment.)

41. All subsamples from the March 1990 sampling to be analyzed for PCBs were placed on ice and maintained at or near 4°C following sectioning and during transportation to AAL.

42. All subsamples from the March 1990 sampling to be subjected to DOC and TOC analysis or grain size analysis were placed on ice and maintained at or near 4°C following sectioning and during transportation to NAI.

43. All sediment subsamples and quality control samples from the March 1990 sampling to be subjected to PCB analysis were transported by overnight courier to AAL under a chain of custody. Duplicates of the chain-of-custody records for the March 1990 samples forwarded to AAL are attached hereto as Document Nos. 028378, 028379, 028381, 028382, 028374 and 028376.

44. All subsamples and/or quality control samples from the March 1990 sampling to be subjected to DOC and TOC or grain size analysis were transported by overnight courier to NAI under a chain-of-custody. Duplicates of the chain-of-custody records for the March 1990 samples forwarded to NAI by overnight courier for DOC and TOC or grain size analysis are attached hereto as Document Nos. 028441 and 028442.

45. Duplicates of the chain-of-custody forms for the biological parameter samples transported by Joseph Payne to NAI are attached hereto as Documents Nos. 028419 through 028421.

PCB Analysis

46. On March 15, 1990, ninety-two samples with chain-of-custody forms and requests for analysis were received from Balsam, via Federal Express, by AAL.

47. The samples were received on ice in 8 ounce wide mouth glass jars with Teflon liners in the lids.

48. The individual sample container identification numbers (IDs) were verified against the chain-of-custody sheets and assigned AAL ID numbers 2533-101 through 2533-192.

49. Laboratory IDs assigned by AAL to the March 1990 thin-layer samples and the corresponding field subsample designations, together with date of extraction and date of analysis are set forth on the table contained in Document Nos. 028310 through 028314, attached hereto.

50. Document Nos. 028310 through 028314 are duplicates of a table prepared by AAL, which has been redacted to remove references to samples not included within the March 1990 thin-layer sampling program.

51. Individual labels were printed and affixed to each sample container by AAL.

52. The samples were transferred into a laboratory refrigerator at 4°C.

53. On March 16, 1990, extraction of samples 2533-101 through 2533-192 was begun.

54. After all standing water was decanted, approximately one third of the contents of the sample was placed on a square of hexane washed aluminum foil. All stones, sticks, and/or shells were removed from the sample. The sample was spread into a circular shape and quartered. The first and third quadrants were blended together with a stainless steel spatula. Likewise, quadrants two and four were blended. Finally, the aliquot blends were combined.

55. Two to five grams of the combined, blended sample was weighted into a 400 mL Griffin beaker. The AAL ID and the weight were recorded into the analyst's laboratory journal. The AAL ID was written onto the beaker. The blended sample was returned to the original sample jar.

56. Twenty sequential samples were prepared for extraction by EPA SW-846 Method 3550 as described above.

57. Ten grams of anhydrous sodium sulfate powder that had been baked at 450°C was added and mixed into each sample. Seventy mL of pesticide grade hexane (Fisher OPTIMA) was added to each sample. Finally, each sample was spiked with 10 uL of 100 ng decachlorobiphenyl/uL.

58. After setting for at least fifteen minutes to dry, each sample was sonicated for three minutes at the maximum power of the sonicator. The sonicator was pulsed at a fifty percent frequency rate.

59. The hexane from the extraction was decanted through a chromatography column containing anhydrous sodium sulfate and glass wool and collected in a 500 mL Kuderna-Danish (K-D) flask.

60. The above extraction and decantation was repeated with 70 mL of hexane two more times.

61. The chromatograph column of anhydrous sodium sulfate was washed with about 70 mL of hexane and the elutriate collected in the same K-D flask.

62. A three ball Snyder column was then attached to the K-D flask and the contents of the flask were concentrated to less than 25 mL on a water bath.

63. The concentrated extract was transferred to a 25 mL volumetric flask. The K-D apparatus was washed with hexane and the hexane added to the 25 mL volumetric flask. The volumetric flask was completely filled in this manner.

64. Ten mL of the concentrated extract was transferred to a 15 mL centrifuge tube and washed twice with 2 mL portions of concentrated sulfuric acid. Each sulfuric acid solution was removed with a Pasteur pipet.

65. The acid washed extract was washed twice with 2 mL portions of tetrabutylammonium hydrogen sulfite (TBA) to remove sulfur (EPA SW-846, Method 3660-7.3).

66. The ten-fold concentrated extract was pipetted into a Wheaton sample vial and submitted for gas chromatographic analysis. The sample ID, the weight, the concentration factor, and the extraction date was written on each sample vial.

67. Beginning on March 16, 1990, sets of samples were removed from the refrigerator and brought to room temperature for the purpose of determining the moisture content of the sample.

68. After the sample IDs and the appropriate weights were recorded in the laboratory notebook, the samples were dried overnight at 110°C.

69. The dried samples were equilibrated to room temperature in a dessicator for a minimum of 1 hour and then weighed. The dry weight was recorded in the laboratory notebook.

70. Results of percent moisture determinations for the thin-layer samples are accurately recorded in Document Nos. 028315 through 028319.

71. Document Numbers 028315 through 028319 are duplicates of tables prepared by AAL redacted to remove references to samples other than the March 1990 thin-layer samples.

72. Document Nos. 027818 through 028217 and 028219 through 028294 comprise duplicates of chromatograms and integrator outputs from the capillary column GC/ECD analysis of the March 1990 thin-layer samples, together with standards and blanks.

73. Chromatographic data used for quantification bear check marks in the margin beside retention times associated with peaks selected for quantification.

74. Document numbers 028320 through 028327 comprise a duplicate of a table prepared by AAL, redacted to remove information pertaining to samples other than the March 1990 thin-layer samples, which accurately sets out the laboratory identification for each standard, sample or blank, the corresponding field designation (if any), the sample weight, or, for standards, the concentration of standard components, initial and final volume, area counts for peaks selected for quantification (plus two others) and decachlorobiphenyl percent recovery.

75. Chromatographic data used for quantification may be determined by comparison of handwritten notes on chromatograms with final volume information from Document Nos. 028320 through 028327.

76. On March 16, 1990, the analysis of the extracts was begun by gas chromatography with electron capture detection (GC/ECD) following the guidelines set forth in SW-846, Method 8080, September 1986.

77. AAL had been told by consultant, Dr. Anna M. Yoakum, that the chromatographic resolution of certain PCB congeners was of particular importance. AAL had submitted a chromatogram for Dr. Yoakum's approval prior to the beginning of these analyses. The chromatography column was 25 meters in length with an inside diameter of 0.25 millimeter and a 1.0 micrometer film of DB-5 from J&W.

78. As accurately recorded in Document No. 027816, a duplicate of which is attached hereto, the chromatography temperature program was as follows:

Initial Temperature	170°C
Initial Time	1 min
Temperature Program Rate 1	25°C/min
Temperature 1 Final Value	220°C
Temperature 1 Hold Time	2 min
Temperature Program Rate 2	4°C/min
Temperature 2 Final Value	250°C
Temperature 2 Final Time	2 min
Temperature Program Rate 3	25°C/min
Temperature 3 Final Value	280°C
Temperature 3 Final Time	35 min
Post Temperature	300°C
Post Time	5 min

79. The instrument calibration and analysis sequence was as follows:

1.	Aroclor 1016	10 ug/uL
2.	Aroclor 1221	10 ug/uL
3.	Aroclor 1232	10 ug/uL
4.	Aroclor 1248	10 ug/uL
5.	Aroclor 1260	10 ug/uL
6.	Aroclor 1242	5 ug/uL
7.	Aroclor 1242	10 ug/uL
8.	Aroclor 1242	20 ug/uL
9.	Aroclor 1254	5 ug/uL
10.	Aroclor 1254	10 ug/uL
11.	Aroclor 1254	20 ug/uL
12.	Aroclor 1242/1254	5/15 ug/uL
13.	Aroclor 1242/1254	10/10 ug/uL
14.	Aroclor 1242/1254	15/5 ug/uL
15.	Laboratory Control	
16-20.	Samples	
21.	Blank	
22-26.	Samples	
27.	Aroclor 1242/1254	5/15 ug/uL
28-32.	Samples	
33.	Blank	
34-38.	Samples	
39.	Aroclor 1242/1254	10/10 ug/uL
40-44.	Samples	
45.	Blank	
46-50.	Samples	
51.	Aroclor 1242/1254	15/5 ug/uL
	Repeat 16-50.	
99.	Aroclor 1242	10 ug/uL
100.	Aroclor 1254	10 ug/uL

80. Based on the first chromatogram of a sample, the initial ten fold concentrate was either accepted, further concentrated, or diluted so that no more than three or four peaks were off the recorder scale.

81. The AAL ID, the Balsam ID, the data necessary to calculate percent moisture, and the data necessary to calculate the PCB concentration was entered into a Lotus spreadsheet.

82. Percent moisture was calculated from the following equation:

$$\% \text{ Moisture} = \frac{(\text{wet sample weight} - \text{dry sample weight})}{\text{wet sample weight}} \times 100\%$$

83. All chromatograms showed the presence of Aroclor 1242 and/or 1016 in addition to Aroclor 1254.

83a. Furthermore, all chromatograms showed significant sample degradation.

83b. Since the initial degradation of Aroclor 1254 causes an increase in some congener concentrations characteristic of 1242 and since the degradation of all congeners is not equal, one must judiciously select the quantitation peaks in order to accurately determine the original ratios of the Aroclors.

83c. Based on Dr. Yoakum's advice, Aroclor 1242 was quantitated using an average response factor based on the area of the peaks at 7.97, 8.73, and 9.04.

83d. Likewise, based on Dr. Yoakum's advice, Aroclor 1254 was quantitated using average response factors based on the area of the peaks at 13.90, 14.35, and 16.02.

83e. The first Aroclor 1242 peak contains congeners 16 and 32 (IUPAC numbering system); the second peak contain congeners 31 and 28; the third peak contains congeners 20, 21, 33, and 53.

83f. The first Aroclor 1254 peak contains congeners 87 and 115; the second peak is congener 153; the third peak is congener 138.

83g. Each Aroclor was quantitated as the average of the concentrations calculated from the three individual peaks characteristic of the particular Aroclor.

84. Document Nos. 028305 through 028309 comprise a duplicate of the AAL laboratory report for the March, 1990 thin-layer samples, accurately setting forth the laboratory ID number for each sample, the field designation, percent moisture, Aroclor 1016/1242 concentration in parts per million, Aroclor 1254 concentration in parts per million and total Aroclors.

85. The total reported PCB value is the sum of the average for Aroclor 1242/1016 and the average for Aroclor 1254. All the data has been reported to two significant figures.

86. The analytical results as reported in Document Nos. 028305 through 028309 accurately represent the concentrations of the specified Aroclor residues within the samples at the time samples were analyzed, within the constraints of the method employed.

87. Quality control was maintained throughout by cross checking standards from different vendors (ULTRA and SUPELCO) and the EPA in the case of Aroclor 1242.

88. Decachlorobiphenyl was added as an internal surrogate spike to all standards and samples.

89. EPA standard reference material (SRM), PCB in Sediment Group 3 #0470, was analyzed as a laboratory control sample in conjunction with this project. This particular SRM contains a mixture of Aroclor 1242 and 1254.

90. A hexane solvent blank was analyzed after every ten samples during the analysis.

91. An Aroclor standard or mixed Aroclor standard was analyzed after every ten samples during the analysis.

92. Duplicate analyses of the samples were performed periodically.

93. Document Nos. 028297 through 028301 comprise duplicates of quality control results, redacted to remove references to samples other than the March 1990 thin-layer samples, including data for laboratory duplicates and blanks and decachlorobiphenyl recovery. Document Nos. 028344 through 028371 comprise duplicates of AAL laboratory notebook pages, redacted to remove references to samples other than the March 1990 thin-layer samples, including a project narrative and handwritten notes from various steps of the extraction and analysis process.

94. Document Nos. 028344 through 028371 constitute records made by AAL personnel having knowledge of the matters recorded therein at a time when such matters were fresh in their memories, which memories correctly reflected such knowledge.

94a. The AAL PCB sediment analytical data were reviewed with respect to analytical validity and program utility.

94b. The AAL PCB sediment analytical data were found to be valid and acceptable for the use intended.

94c. The AAL PCB sediment analytical data are valid and acceptable for the use intended.

94d. The AAL PCB sediment analytical data were found to be acceptable in accurately describing the vertical small-scale environmental distribution of PCBs in Upper Estuary sediment.

94e. The AAL PCB sediment analytical data accurately describe the vertical small-scale environmental distribtuion of PCBs in Upper Estuary sediment.

Biological and Descriptive Parameter Analysis

95. The biological samples were received by NAI under chain of custody on March 13, 1990.

96. In the laboratory, biological samples were processed in the following manner:

96a. At each station, replicate A (the surfacemost portion of the core) was processed first. When animals were present, the next deeper layer was processed. When an azooic layer was reached, deeper layers were examined only for large organisms (easily visible to the naked eye).

96b. Initial processing (sorting) was accomplished using a dissecting microscope. All animals were removed from the sediment and other detritus.

96c. All organisms removed were identified to the lowest possible taxonomic level and enumerated. Raw counts were converted to numbers per square meter by dividing by $0.00385m^2$, the surface area of the sampling device.

97. Document No. 012853 is a duplicate of a table prepared by NAI accurately setting forth sampling station number, depth in core, species observed and abundance in number per square meter.

98. No deep-burrowing organisms were observed in any of the cores.

99. Sediment samples collected for DOC and TOC and grain size analysis were delivered to NAI by Federal Express on March 15, 1990.

99a. A chain-of-custody form initiated by Balsam was signed by George Reich, NAI, upon receipt of samples.

100. Sediment samples for grain size analysis were processed in NAI's NH laboratory using three procedures - wet sieving, dry sieving and pipette analysis.

101. Wet sieving was used to separate sand and gravel fractions from silt and clay. The procedure involved:

101a. Placing approximately 20-50 grams of sample in a glass jar labelled with sample control number.

101b. Sodium hexametaphosphate solution was added to disperse the sample.

101c. Dispersed sediment was poured into a 63 u (micron) stainless steel sieve and washed with a fine spray of dispersant.

101d. Material retained on the sieve was reserved for dry sieve analysis. Material (including liquid) passing through the sieve was reserved for pipette analysis.

102. Dry sieve analysis required the following procedures:

102a. Sediment (sand and gravel) retained on the 63 micron sieve was rinsed with tap water to remove dispersant and salt, washed into a 50ml beaker labeled with sample control number and allowed to settle. Supernatant was discarded.

102b. Beakers of sediment were dried overnight at 103-105°C. Cooled aggregates were broken up and transferred to the top of a nest of sieves (in descending order - 2.0mm, 1.0mm, 0.5mm, 0.25mm, 0.125mm and 0.063mm mesh sieves).

102c. The covered nest of sieves was mechanically shaken for 10 minutes.

102d. Contents of each sieve was weighed to the nearest 0.01 gram, subtracting the weight of the weighing vessel.

103. Pipette analysis for silt and clay separation used the following procedures:

103a. Material obtained from the wet-sieve procedure was diluted to 1000ml in a graduated cylinder with dispersant and allowed to reach room temperature.

103b. Temperature was maintained at a constant level throughout the analysis.

103c. The material in the cylinder was stirred vigorously to distribute solids homogeneously.

103d. 20ml aliquots of sample were withdrawn by pipette from a depth of 20cm 20 seconds after mixing to obtain silt plus clay and 54 minutes, 2 seconds after mixing to obtain clay fraction.

103e. Each aliquot was placed in a 50ml beaker labeled with its weight and transferred to a 103-105°C oven for evaporation.

103f. Dried samples were cooled to room temperature and allowed to equilibrate with atmospheric moisture. Weight was determined to 0.0001 gram.

104. Total dry weight of sediment analyzed equalled the sum of the dry weights obtained through dry-sieve and pipette analyses. Results were reported as percentages of dry weight by grain size category.

105. Document No. 012854 is a duplicate of a table prepared by NAI accurately setting forth the results of grain size analysis of the March 1990 samples, providing with respect to each sample (identified by field designation) percent gravel, percent sand, percent silt and percent clay.

106. The results of NAI's grain size analysis, as set forth in Document No. 012854, accurately reflect the geologic composition of the sediment samples taken for grain size analysis in the course of the March 1990 sampling.

107. Sediment samples for DOC and TOC analysis were shipped on ice to NAI's SC laboratory for analysis on March 15, 1990. Samples were received on March 16, 1990 and logged into the laboratory's daily log.

108. DOC and TOC analyses were performed by Bradley Taylor, Assistant Laboratory Manager.

109. DOC analysis followed the method identified as EPA 415.1 appearing in EPA 1978 Methods for Chemical Analysis of Water and Wastes (EPA-600/4-79-020). This method is based on the conversion of sample carbon into carbon dioxide for measurement by a nondispersive infrared analyzer. NAI used a Beckman 915 TOC Analyzer with compressed breathing air as the carrier-gas.

110. Procedures for this method are described in EPA-600/4-79-020. Several steps are specific to the individual sample. The following steps were applied to the New Bedford samples:

110a. Ten (10) grams of sediment were mixed in 10 milliliters of distilled water. The mixture was shaken vigorously for 10 minutes on a laboratory shaker.

110b. The slurry was immediately filtered through a 45 micron membrane filter. An aliquot of the filtrate was injected into Beckman 915.

110c. The Beckman 915 determines both Total Carbon (organic plus inorganic carbon) and Inorganic Carbon using successive identical aliquots.

110d. Total Organic Carbon is the difference between these quantities. These analyses and calculations were performed on the March 1990 samples.

111. A linear regression was performed on the concentrations of standard solutions and their corresponding peak heights. The following equations were determined for this study from the standard solutions:

111a. Total Carbon:
Concentration (mg/l)=(peak height in mm-13.4353)/ 3.8819;

Coefficient of Correlation=0.9987

111b. Inorganic Carbon:
Concentration (mg/l)=(peak height in mm-5.5278)/3.4016;

Coefficient of correlation = 0.9986

111c. Concentration of each sample was determined by measuring the peak height for total and inorganic carbon and inserting into the referenced formulae.

111d. Dissolved organic carbon is the difference between the two referenced equations.

112. TOC analysis was based on EPA Method 160,4 (described in EPA.1983. Methods for Chemical Analysis of Water and Wastes. EPA 600/14-79-080) and Standard Method 209F (described in Amer. Public Health Assoc . 1985. Standard Methods for the Examination of Waste and Wastewater) for percent volatile solids.

113. EPA 160.4/SM 209F followed these steps:

113a. A known quantity (weight) of sediment was evaporated to dryness at 105°C (one hour) cooled in a desiccator for four hours and reweighed.

113b. Residue from the evaporation step was transferred to a cool muffle furnace, heated to 550°C and then was ignited for one hour. After cooling in the desiccator, final weight was obtained,

113c. Percent volatile solids was calculated as weight of dried sample minus weight of ignited sample; result divided by weight of dried sample; result multiplied by 100,

114. Extrapolation of percent volatile solids to TOC is based on the ratio between organic material and organic carbon ln solid matrices, determined to be J.72. The assumption is made that all volatile components of the sample are organic.

114a. Percent volatile solids was converted to weight units (milligrams per kilogram) by multiplying by 10000 (equivalent to total organic material).

114b. The result of his calculation was divided I)y 1.72 to obtain carbon

115. Document Nos. 012855 and 012856 are duplicates of tables prepared by NAI accurately setting forth the NAI laboratory ID number for each sample, the Balsom field designation for each sample, with the NAI field designation for each sample in parenthesis and the results of TOC analysis in parts per million and DOC analysis in milligrams per liter.

116. Document numbers 028422 through 028431 comprise duplicates of NAI handwritten data for the biological samples.

117. Documents numbers 028432 through 028435 comprise handwritten data recorded during grain size analysis.

118. Documents numbers 028437 through 028440 comprise handwritten raw data recording results of DOC and TOC analysis of the March, 1990 samples.

RADIOMETRIC SEDIMENT ANALYSES

119. A sediment core was collected at Station STL-1 for radiometric (lead-210) analysis by Louisiana State University Marine Consortium Center (LUMCON).

120. The lead-210 core was received by LUMCON under chain-of-custody on April 9, 1990.

121. Attachment Q.III.0001 is a duplicate of the completed chain-of-custody form.

122. In the laboratory, lead-210 analyses were performed on six samples from 0 cm-6 cm, 6 cm-8 cm, 8 cm-10 cm, 10 cm-12 cm, 12 cm-14 cm, and 14 cm-16 cm.

123. Attachment Q.III.0002 is a duplicate of the analytical laboratory results from LUMCON.

124. The LUMCON lead-210 analytical results indicate a sedimentation rate of 0.98 cm/yr. in the vicinity of Station STL-1.

125. The plots of lead-210 strongly indicate a sedimentation rate of 0.98 cm/yr. in the vicinity of Station STL-1.

126. The sedimentation rate in the vicinity of Station STL-1 is 0.98 cm/yr.

127. The LUMCON predicted sedimentation rate compares very favorably with the rates predicted by Summerhayes, Teeter, and Bohlen.

1650L

NUS/GZA Grid Metals: Chemtech 5575

1. As part of EPA's NUS/GZA grid sampling program, Chemtech Consulting Group (Chemtech) analyzed samples MAB 390-MAB 400 and samples MAC 626 - MAC 642 for inorganics.

   1.a. Collection station locations for EPA Sample Nos. MAB 390 - MAB 400 and MAC 626- MAC 641 are recorded in the Inorganics Traffic Reports contained in Attachment Doc. No. Q.III.0025, attached hereto.

   1.b The locations from which sample Nos. MAB 390 - MAB 400 and MAC 626 - MAC 641 were collected are accurately depicted in Plaintiffs' Document Nos. 491170 to 491674.

   1.c. Attachment Doc. No. Q.III.0025 comprises the complete raw data package for the Chemtech inorganics analysis of Sample Nos. MAB 390 - MAB 400 and MAC 626 - MAC 641.

   1.d. Table 1 hereof accurately states the results for copper of Chemtech inorganics analysis of Sample Nos. MAB 390 - MAB 400 and MAC 626 - MAC 642.

   1.e. The copper concentrations set forth in Table 1 accurately reflect the concentration of copper in the sediment at the time the samples were collected.

2. The Chemtech inorganics data were reviewed for validity by an EPA contractor.

   2.a The Chemtech results were not rejected by the EPC data validation contractor.

   2.b. The Chemtech data set was not qualified by the EPA data validation contractor.

   2.c. The Chemtech inorganics data was generated as part of EPA's RI/FS for the New Bedford Harbor Superfund site.

   2.d. The Chemtech inorganics data are included in the administrative record for the New Bedford Harbor Superfund site.

NUS/GZA GRID COPPER 5575

TABLE 1

EPA Sample No.	Lab Sample ID No.	Results Copper mg/kg (Dry Weight)
MAB 390	G2-620-01	463
MAB 391	G2-620-02	113
MAB 392	G2-620-03	224
MAB 393	G2-620-04	1950
MAB 394	G2-620-05	2190
MAB 395	G2-620-06	1460
MAB 396	G2-620-07	2140
MAB 397	G2-620-08	792
MAB 398	G2-620-09	884
MAB 399	G2-620-10	1190
MAB 400	G2-620-11	541
MAC 626	G2-620-12	1010
MAC 627	G2-620-13	496
MAC 628	G2-620-14	541
MAC 629	G2-620-15	493
MAC 630	G2-620-16	497
MAC 631	G2-620-17	608
MAC 632	G2-620-18	379

MAC 633	G2-620-19	187
MAC 634	G2-620-20	40
MAC 635	G2-620-21	204
MAC 636	G2-620-22	97
MAC 637	G2-620-23	20
MAC 638	G2-620-24	195
MAC 639	G2-620-25	154
MAC 640	G2-620-26	N/D
MAC 641	G2-620-27	480
MAC 642	G2-620-28	N/D

NUS/GZA Grid Metals: Chemtech 5549

1. As part of EPA's NUS/GZA grid sampling program, Chemtech Consulting Group (Chemtech) analyzed samples MAB 343-MAB 349, and MAC 672 - MAC 700 for inorganics.

   1.a. Collection station locations for EPA Sample Nos. MAB 343-MAB 349, and MAC 672 - MAC 700 are recorded in the Inorganics Traffic Reports contained in Attachment Doc. No. Q.III. 0024, attached hereto.

   1.b The locations from which sample Nos. MAB 343-MAB 349, and MAC 672 - MAC 700 were collected are accurately depicted in Plaintiffs' Document Nos. 491170 to 491674.

   1.c. Attachment Doc. No. Q.III. 0024 comprises the complete raw data package for the Chemtek inorganics analysis of Sample Nos. MAB 343-MAB 349, and MAC 672 - MAC 700.

   1.d. Table 1 hereof accurately states the results for copper of Chemtek inorganics analysis of Sample Nos. MAB 343-MAB 349, and MAC 672 - MAC 700.

   1.e. The copper concentrations set forth in Table 1 accurately reflect the concentration of copper in the sediment at the time the samples were collected.

2. The Chemtek inorganics data were reviewed for validity by an EPA contractor.

   2.a The Chemtek results were not rejected by the EPC data validation contractor.

   2.b. The Chemtek data set was not qualified by the EPA data validation contractor.

   2.c. The Chemtek inorganics data was generated as part of EPA's RI/FS for the New Bedford Harbor Superfund site.

   2.d. The Chemtek inorganics data are included in the administrative record for the New Bedford Harbor Superfund site.

NUS/GZA GRID COPPER CHEMTECH 5549

TABLE 1

EPA Sample No.	Lab Sample ID No.	Results Copper mg/kg (Dry Weight)
MAB343	G2-618-01	90
MAB344	G2-618-02	58
MAB345	G2-618-03	137
MAB346	G2-618-04	N/D
MAB347	G2-618-05	N/D
MAB348	G2-618-06	2790
MAB349	G2-618-07	1550
MAC672	G2-618-08	N/D
MAC673	G2-618-09	1520
MAC674	G2-618-10	362
MAC675	G2-618-11	52
MAC676	G2-618-12	652
MAC677	G2-618-13	1250
MAC678	G2-618-14	N/D
MAC679	G2-618-15	N/D
RAC680	G2-618-16	1070
MAC681	G2-618-17	N/D
MAC682	G2-618-18	N/D
MAC683	G2-618-19	222

MAC684	G2-618-20	292
MAC685	G2-618-21	36
MAC686	G2-618-22	662
MAC687	G2-618-23	497
MAC688	G2-618-24	134
MAC689	G2-618-25	85
MAC690	G2-618-26	737
MAC691	G2-618-27	408
MAC692	G2-618-28	524
MAC693	G2-618-29	27
MAC694	G2-618-30	310
MAC695	G2-618-31	43
MAC696	G2-618-32	N/D
MAC697	G2-618-33	75
MAC698	G2-618-34	107
MAC699	G2-618-35	96
MAC700	G2-618-36	N/D

NUS/GZA Grid Metals: VERSAR 5450

1. As part of EPA's NUS/GZA grid sampling program, Versar Inc. (Versar) analyzed samples MAC 645 - MAC 671 for inorganics.

   1.a. Collection station locations for EPA Sample Nos. MAC 645 - MAC 671 are recorded in the Inorganics Traffic Reports contained in Attachment Doc. No. Q.III. 0026, attached hereto.

   1.b The locations from which sample Nos. MAC 645 - MAC 671 were collected are accurately depicted in Plaintiffs' Document Nos. 491170 to 491674.

   1.c. Attachment Doc. No. Q.III. 0026 comprises the complete raw data package for the Versar inorganics analysis of Sample Nos. MAC 645 - MAC 671.

   1.d. Table 1 hereof accurately states the results for copper of Versar inorganics analysis of Sample Nos. MAC 645 - MAC 671.

   1.e. The copper concentrations set forth in Table 1 accurately reflect the concentration of copper in the sediment at the time the samples were collected.

2. The Versar inorganics data were reviewed for validity by an EPA contractor.

   2.a The Versar results were not rejected by the EPC data validation contractor.

   2.b. The Versar data set was not qualified by the EPA data validation contractor.

   2.c. The Versar inorganics data was generated as part of EPA's RI/FS for the New Bedford Harbor Superfund site.

   2.d. The Versar inorganics data are included in the administrative record for the New Bedford Harbor Superfund site.

NUS/GZA GRID COPPER 5450

TABLE 1

EPA Sample No.	Lab Sample ID No.	Results Copper mg/kg Dry Weight)
MAC 645	8407	422
MAC 646	8408	145
MAC 647	8409	32
MAC 648	8410	271
MAC 649	8411	167
MAC 650	8412	141
MAC 651	8413	95
MAC 652	8414	777
MAC 653	8415	319
MAC 654	8416	N/D
MAC 655	8417	156
MAC 656	8418	20
MAC 657	8419	N/D
MAC 658	8420	145
MAC 659	8421	119
MAC 660	8422	N/D
MAC 661	8423	24
MAC 662	8424	17
MAC 663	8425	N/D

MAC 664	8426	65
MAC 665	8427	54
MAC 666	8428	22
MAC 667	8429	N/D
MAC 668	8430	N/D
MAC 669	8431	127
MAC 670	8432	531
MAC 671	8433	272

NUS/GZA Grid Metals: VERSAR 5810

1. As part of EPA's NUS/GZA grid sampling program, Versar, Inc. (Versar) analyzed samples MAD 533 - MAD 535 for inorganics.

   1.a. Collection station locations for EPA Sample Nos. MAD 533 - MAD 535 are recorded in the Inorganics Traffic Reports contained in Attachment Doc. No. Q.III. 0026A attached hereto.

   1.b The locations from which sample Nos. MAD 533 - MAD 535 were collected are accurately depicted in Plaintiffs' Document Nos. 491170 to 491674.

   1.c. Attachment Doc. No. Q.III.0026A comprises the complete raw data package for the Versar inorganics analysis of Sample Nos. MAD 533 - MAD 535.

   1.d. Table 1 hereof accurately states the results for copper of Versar inorganics analysis of Sample Nos. MAD 533 - MAD 535.

   1.e. The copper concentrations set forth in Table 1 accurately reflect the concentration of copper in the sediment at the time the samples were collected.

2. The Versar inorganics data were reviewed for validity by an EPA contractor.

   2.a The Versar results were not rejected by the EPC data validation contractor.

   2.b. The Versar data set was not qualified by the EPA data validation contractor.

   2.c. The Versar inorganics data was generated as part of EPA's RI/FS for the New Bedford Harbor Superfund site.

   2.d. The Versar inorganics data are included in the administrative record for the New Bedford Harbor Superfund site.

NUS/GZA GRID COPPER VERSAR 5810

TABLE 1

EPA Sample No.	Lab Sample ID No.	Results Copper mg/kg (Dry Weight)
MAD 533	2001	N/D
MAD 534	2002	N/D
MAD 535	2003	N/D

1731L

NUS/GZA Grid Sampling: ERCO ABN Analysis

1. As part of EPA's NUS/GZA grid sampling program, Energy Resources Co., Inc. (ERCO) analyzed sediment Sample Nos. AF180 to AF187 for Hazardous Substance List Base Neutral and Acid Extractable (HSL-ABN) organic compounds.

   1.a. The raw data packages for these samples are provided in Plaintiffs' Document Nos. 631001 - 631698.

   1.b. The results of the HSL-ABN analyses are presented in Plaintiffs' Document Nos. 631129, 631133, 631137, 631141, 631145, 631149, 631152 and 631156.

   1.c. Samples AF180 to AF187 were collected at the locations accurately depicted in Plaintiffs' Document Nos. 491532 to 491674.

2. This data set was collected and analyzed as part of EPA's Remedial Investigation and Feasibility Study for the New Bedford Harbor Superfund site.

3. The results of ERCO's analysis of Sample Nos. AF180 to AF187 are included in the Administrative Record of the New Bedford Harbor Superfund site.

4. NUS performed the data validation of the ERCO data set.

   4.a The NUS data validation report for the ERCO data set is contained in Plaintiffs' Document Nos. 631690 - 631698.

5. ERCO's results from analysis of Sample Nos. AF180 to AF187 show that concentrations of certain polynuclear aromatic hydrocarbons in such samples exceed relevant sediment quality criteria.

NUS/GZA Grid Sampling: CAA ABN Analysis

1. As part of EPA's NUS/GZA grid sampling program, Cambridge Analytical Associates (CAA) analyzed sediment Sample Nos. AE866 to AE872 and AF176 to AF179 for Hazardous Substance List Base Neutral and Acid Extractable (HSL-ABN) organic compounds.

   1.a. The raw data packages for these samples are provided in Plaintiffs' Document Nos. 621001 to 621888.

   1.b. The results of the HSL-ABN analyses are presented in Plaintiffs' Document Nos. 621550 - 621551, 621555 - 621556.

   1.c. Samples AE866 to AE872 and AF176 to AF179 were collected at the locations accurately depicted in Plaintiffs' Document Nos. 491532 to 491674.

2. This data set was collected and analyzed as part of EPA's Remedial Investigation and Feasibility Study for the New Bedford Harbor Superfund site.

3. The results of Cambridge Analytical Associates (CAA) analysis of Sample Nos. AE866 to AE872 and AF176 to AF179 are included in the Administrative Record of the New Bedford Harbor Superfund site.

4. NUS performed the data validation of the Cambridge Analytical Associates (CAA) data set.

   4.a The NUS data validation report for the Cambridge Analytical Associates (CAA) data set is contained in Plaintiffs' Document Nos. 621537 - 621558.

5. Cambridge Analytical Associates (CAA) results from analysis of Sample Nos. AE866 to AE872 and AF176 to AF179 show that concentrations of certain polynuclear aromatic hydrocarbons in such samples exceed relevant sediment quality criteria.

NUS/GZA Grid Sampling: PEI ABN Analysis

1. As part of EPA's NUS/GZA grid sampling program, PEI analyzed sediment Sample Nos. AF543 and AF801 through AF819 for Hazardous Substance List Base Neutral and Acid Extractable (HSL-ABN) organic compounds.

   1.a. The raw data packages for these samples are provided in Plaintiffs Document Nos. 641001 to 643224.

   1.b. The results of the HSL-ABN analyses are presented in Plaintiffs' Document Nos. 642432 - 642433, 642445 - 642446, 642458 - 642459 and 642471 - 642472.

   1.c. Samples AF543 and AF801 through AF819 were collected at the locations accurately depicted in Plaintiffs' Document Nos. 491532 to 491674.

2. This data set was collected and analyzed as part of EPA's Remedial Investigation and Feasibility Study for the New Bedford Harbor Superfund site.

3. The results of PEI analysis of Sample Nos. AF543 and AF801 through AF819 are included in the Administrative Record of the New Bedford Harbor Superfund site.

4. NUS performed the data validation of the PEI data set.

   4.a The NUS data validation report for the PEI data set is contained in Plaintiffs' Document Nos. 642416 - 642475.

5. PEI's results from analysis of Sample Nos. AF543 and AF801 through AF819 show that concentrations of certain polynuclear aromatic hydrocarbons in such samples exceed relevant sediment quality criteria.

NUS/GZA Grid Sampling: PEI/PEDCO ABN Analysis

1. As part of EPA's NUS/GZA grid sampling program, PEI/PEDCO analyzed sediment Sample Nos. AE820 to AE824 for Hazardous Substance List Base Neutral and Acid Extractable (HSL-ABN) organic compounds.

   1.a. The raw data packages for these samples are provided in Plaintiffs' Document Nos. 511167 - 513056.

   1.b. The results of the HSL-ABN analyses are presented in Plaintiffs' Document Nos. 511952 - 511953.

   1.c. Samples AE820 to AE824 were collected at the locations accurately depicted in Plaintiffs' Document Nos. 491532 to 491674.

2. This data set was collected and analyzed as part of EPA's Remedial Investigation and Feasibility Study for the New Bedford Harbor Superfund site.

3. The results of PEI/PEDCO's analysis of Sample Nos. AE820 to AE824 are included in the Administrative Record of the New Bedford Harbor Superfund site.

4. NUS performed the data validation of the PEI/PEDCO data set.

   4.a The NUS data validation report for the PEI/PEDCO data set is contained in Plaintiffs' Document Nos. 511941 - 511960.

5. PEI/PEDCO's results from analysis of Sample Nos. AE820 to AE824 show that concentrations of certain polynuclear aromatic hydrocarbons in such samples exceed relevant sediment quality criteria.

NUS/GZA Grid Sampling: IT ABN Analysis

1. As part of EPA's NUS/GZA grid sampling program, International Technology Analytical Services, Stewart Laboratories Division (IT) analyzed sediment Sample Nos. AF227 to AF233 for Hazardous Substance List Base Neutral and Acid Extractable (HSL-ABN) organic compounds.

   1.a. The raw data packages for these samples are provided in Plaintiffs' Document Nos. 581001 - 582671.

   1.b. The results of the HSL-ABN analyses are presented in Plaintiffs' Document Nos. 582142 - 582143.

   1.c. Samples AF227 to AF233 were collected at the locations accurately depicted in Plaintiffs' Document Nos. 491532 to 491674.

2. This data set was collected and analyzed as part of EPA's Remedial Investigation and Feasibility Study for the New Bedford Harbor Superfund site.

3. The results of IT's analysis of Sample Nos. AF227 to AF233 are included in the Administrative Record of the New Bedford Harbor Superfund site.

4. NUS performed the data validation of the IT data set.

   4.a The NUS data validation report for the IT data set is contained in Plaintiffs' Document Nos. 582138 - 582158.

5. IT's results from analysis of Sample Nos. AF227 to AF233 show that concentrations of certain polynuclear aromatic hydrocarbons in such samples exceed relevant sediment quality criteria.

METALS CONTAMINATION IN THE NEW BEDFORD HARBOR

1. A report entitled "Mass Estimates of Heavy Metals in New Bedford Harbor Area Sediment," dated May 15, 1990, was issued which depicts heavy metal concentrations reported in sediment in three areas of New Bedford Harbor in depth intervals of 0-6 inches, 12-18 inches and 24-30 inches beneath the water-sediment interface. This report, hereinafter referred to as the Mass Estimates report, summarizes metals data developed in the GZA/NUS grid sampling program.

2. This Mass Estimates report is attached as Attachment Doc. Q.III.27.

3. Data are provided in the Mass Estimates report for eleven heavy metals including copper, lead, mercury, nickel, chromium, zinc, cadmium, arsenic, aluminum, tin, and vanadium.

4. Figures 1-1 through 1-11 in the Mass Estimates report illustrate the reported concentrations of the eleven heavy metals within the three respective depth intervals at the sampling locations reported by GZAD/NUS in the middle harbor area.

5. Figures 2-1 through 2-11 in the Mass Estimates report illustrate the reported concentrations of the eleven heavy metals within the three respective depth intervals at the sampling locations reported by GZAD/NUS in the lower harbor area.

6. Figures 3-1 through 3-11 in the Mass Estimates report illustrate the reported concentrations of the eleven heavy metals within the three respective depth intervals at the sampling locations reported by GZAD/NUS in the outer harbor area.

7. Figures 1-1 through 3-11 accurately represent the locations from which samples were collected during the GZAD/NUS study.

8. Figures 4-1 through 4-6 in the Mass Estimates report illustrate concentration isopleths of copper, lead, mercury, nickel, chromium, and zinc within the 0-6 inch sediment depth interval in the middle harbor based upon the data reported by GZAD/NUS as shown in this report.

9. Figures 5-1 through 5-6 in the Mass Estimates report illustrate concentration isopleths of copper, lead, mercury, nickel, chromium, and zinc within the 0-6 inch sediment depth interval in the lower harbor based upon the data reported by GZAD/NUS.

10. Figures 6-1 through 6-3 in the Mass Estimates report illustrate concentration isopleths of copper, choromium, and zinc within the 0-6 inch sediment depth interval in the outer harbor based on the data reported by GZAD/NUS.

11. The concentration isopleths shown on figures 4-1 through 6-3 were generated using a technique called kriging.

    a. Figures 4-1 through 6-3 in Attachment A are a true and accurate representation of the concentration isopleths produced from the kriging conducted on data shown in Attachment A.

12. The kriging was applied as a portion of an interpolative technique developed by Golden Software of Golden, Colorado and contained within a software package developed by Golden Software termed SURFER.

13. Kriging is an interpolative technique based on statistical regression methods which can be used to estimate or predict the value of a variable, V, at an unsampled location, in an X-Y-Z space from irregularly spaced data that are distributed within the X-Y-Z space.

14. Kriging is a statistical technique that allows sample data to be gridded for purposes of generating isopleth maps.

15. Kriging uses sample data values to estimate the value of unsampled areas or points.

16. Kriging recognizes that samples that are closer to the area or point to be estimated should influence the estimated value more heavily than samples that are further away and uses a spatial correlation function known as a variogram to help assign the optimal weight to each sample used during the estimation.

17. Kriging is statistically a Best Linear Unbiased Estimator (BLUE).

18. In statistical terms, "Best" is defined as that method which produces the least errors during the estimation process.

19. The kriging technique produces fewer errors during the estimation process than other estimators.

20. Kriging is an unbiased estimator.

21. In statistical terms, "Unbiased" is defined as a method which will not systematically overestimate or systematically underestimate the estimated values.

22. The United States Environmental Protection Agency (USEPA) has recommended kriging as a tool for developing isopleth maps (Data Quality Objectives For Remedial Response Activities - Development Process - EPA/540/G-87/003 - OSWER Directive 9355.0-7B; and Data Quality Objectives For Remedial Response Activities - Example Scenario At A Site With Contaminated Soils and Groundwater - EPA/540/G-87/004-OSWER Directive 9355.0-7B).

23. The values assigned to V for the kriging done for the Mass Estimates report were based upon the heavy metal concentration data from the 0-6 inch sediment interval.

24. The heavy metal concentration at sampling locations shown on the figures in Attachment A were assigned an X-Y grid location within a grid system developed around the respective harbor area.

25. The Golden Software SURFER program uses a linear variogram and a regionalized variable theory technique in its kriging application.

26. SURFER is one of the most commonly used kriging software packages to estimate data at unsampled locations.

27. The heavy metal concentration isopleths shown on figures 4-1 through 6-3 in the Mass Estimates report are an accurate interpolation of the heavy metals within the 0-6 inch sediment interval of the respective harbor areas.

28. The isopleths in the middle harbor area, 0-6 inches depth interval, show extensive copper contamination with the highest concentration near the west-central shore and dispersing generally east and south of this location.

29. This west-central area of the middle harbor appears to be a source for copper contamination.

30. Highest concentrations of copper in the lower harbor area occur in the northern portion, closest to the suspected source of copper contamination, and decrease in concentration to the south.

31. Copper concentrations rise somewhat in the outer harbor area just south of the Cornell Dubilier Electronics, Inc. facility.

32. Other metals including lead, mercury, nickel, chromium, and zinc indicate a source area near the west-central shore of the middle harbor area with extensive contamination disseminating from this source area in a generally southerly direction (Figures 4-2 to 4-6 of the Mass Estimates report).

6317i

7.b.4 Congeners C50, C70, C82, C153, C155 and C167 were purported to be present in the dissolved elutriate as characterized in Table 9 of COE Report No. 3.

7.b.5 Congener C8, a relatively water soluble PCB congener was purported to be present in the whole elutriate but not in the dissolved elutriate.

7.c The double homogenization process performed by COE, as described by Averett, is sufficient to preclude the kind of inconsistencies noted above.

7.d The inconsistencies noted above are the result of incorrect analytical procedures and/or incorrect interpretation of analytical data.

7.d.1 The results reported in Tables 2, 6, 9 and 2A, purported to represent the PCB congener distribution in all or any part of the PCB upper estuary composite sediment samples are wrong.

7.d.2 Any calculations, observations or conclusions in this or any other report based on the results of the composite sediment analysis for PCB's are incorrect.

8. The "hot spot" sediment sample is purported to be homogeneous.

8.a. If the hot spot sediment sample is homogeneous then the subsamples of the main stock sample used for the elutriate should have a similar distribution of PCB congener concentrations within the limits of reproducibility of the analytical methodology.

8.b. The congener distributions from the analysis of the "hot spot" sediment presented in Table 2 should be equivalent to those found in the whole elutriate as presented in Tables 8 and 11.

8.b.1 The dilution or potential alternation of the congener in the total elutriate testing will not cause the total or substantial elimination of any congener.

8.b.2 The dilution or potential alteration of the congeners in the total elutriate caused by the site water used in the elutriate testing will not cause substantial selective losses of any congener.

8.b.3 Congener C143 is not found to be present in measurable quantity in the whole elutriate as characterized in Table 8 of COE Report No. 3.

8.b.3.1 Congener C143 is reported to be present in the "hot spot" sediment sample as presented in Table 2 of COE Report No. 3.

8.b.4 Congeners C52 and C97 are purported to be substantially and selectively reduced in the total elutriate relative to their proportions in the "hot spot" sediment sample.

8.b.5 Congener C105 is purported to be absent from the "hot spot" sediment as reported in Table 2 of COE Report 3.

8.b.5.a Congener C105 is purported to be present in the total elutriate in Table 8 of COE Report 3.

8.b.5.b Congener C105 cannot be present in the total elutriate for hot spot sediments.

8.b.6 Congeners C50 and C155 are not found to be present in measureable quantity in the whole elutriate as characterized in Table 11 of COE Report 3.

8.b.6.a Congeners C50 and C155 are reported to be present in the "hot spot" sediment sample as presented in Table 2 of COE Report 3.

8.b.7 Congeners C50 and C77 are purported to be present in the dissolved elutriate as characterized in Table 11 of COE Report 3.

8.b.7.a Congeners C50 and C77, if truly not present, in the total sample cannot be present in any subsequent fraction of the total sample.

8.c The double homogenization process as described by Averett is sufficient to preclude the kind of inconsistencies noted above.

8.d The inconsistencies noted above are the result of incorrect laboratory procedures and/or calibrations and/or incorrect interpretations of analytical data.

8.d.1 The results reported in Tables 2, 8 and 11 purported to represent to the PCB congener distribution in sediment from the "hot spot" area of NBH are incorrect.

8.d.2 Any calculations, observations or conclusions in this or any other report, based on the results of "hot spot" sediment analysis for PCB's presented in this report are incorrect.

9. The chromatographic data for the Aroclor and total PCB analyses of the composite and "hot spot" sediment samples from the upper estuary of NBH are presented as BN P03713 to BN P04014 (AVX BNs, used in Averett deposition).

9.a The data shows that several factors characteristic of bad chromatography are present.

9.a.1 The sample extracts have been inadequately cleaned.

9.a.2 The GC oven temperature is programmed to increase too rapidly or started too hot or both.

9.a.3 There are many unresolved peaks.

9.a.3.a Unresolved packs indicate improper GC conditions.

9.a.4 The baseline is somewhere below zero for all the "confirmatary" work.

9.a.5 The baseline on the quantitation column indicates a bad septum or unresolved non-PCB interferences coeluting under the purported PCB peaks.

9.b Quantitation based on the chromatograms from this study can be no better than an order of magnitude estimate.

9.c The data presented is of similar quality to the results presented in COE Report 3.

9.c.1 The data demonstrate a general lack of skill in gas chromatography.

9.d Results obtained for Aroclors and total PCB's should not be included in the NBH data base.

10. Chromatograms of the pairs or trios of congeners of PCB are shown in BN PO3713 to PO3831.

10.a. The chromatograms demonstrate contamination of the congener solutions used for calibration.

10.b. PO3774 purports to be the chromatogram of congeners 77 and 185 but shows 5 major peaks, 3 medium peaks and numerous small peaks.

10.c. PO3751 purports to be a similar mixture to PO3774 but shows four additional medium intensity peaks.

10.d. PO3755 purports to be a mixture of congeners 97 and 143 but the chromatogram has 3 additional peaks of lesser intensity.

10.e. The retention times of the 2 major peaks have been manually adjusted apart (for reporting) in PO3755 and others.

10.f. PO3759, purported to be a chromatogram of congener #170, shows no major peak in the area of the expected retention time which is >30 minutes. [Ref. Ericson p. 191 determined from information in this ref. and PO 3757].

10.g. PO3766, according to the log sheet (PO3713), is the chromatogram of congeners 44, 143, and 170.

10.g.1. According to the labels on the chromatogram, this sample contained congeners 44, 82, and 143 along with an unresolved lump following the alleged 143 peak.

10.h. PO3768, according to the log sheet (PO3713), is the chromatogram of congeners 82 and 105.

10.h.1. According to the labels on the chromatogram, this sample contained congener 82 and an unresolved lump peaking at about 26.5 min.

10.i. Congener C50, a tetrachlorobiphenyl, coelutes with one of the major trichlorobiphenyl congeners present in A1242.

10.i.1. C50 cannot be measured in NBH sediments using GC/ECD techniques.

10.j. Congener C155 does not occur in A1016, A1242 or A1254.

10.j.1. The presence of C155 as represented in Tables 2, 8 and 9 is incorrect.

10.k. The chromatogram labeled #1 BIPHYL is the chromatogram of the mixture of congeners being used as the standard for congener specific qualitative and quantitative analysis for results presented in COE Report 3.

10.k.1. The congener C101 elutes at 20.592 minutes.

10.k.1.a. Congener C101 was misidentified as C143.

10.k.1.b. Congener C143 elutes at 24.668 minutes.

10.k.2. Congener C138 is assigned to two peaks in this chromatogram; 25.806 and 27.258 minutes.

10.k.2.a. Congener 105 elutes at 25.806 minutes.

11. Congener identifications in COE Report 3 are unreliable.

NBH
5.3.18

Volume IV of RFAS

IV. FATE AND TRANSPORT

9000. The hydrographic structure within New Bedford Harbor is typical of that observed in the majority of New England estuarine embayments.

9001. New Bedford Harbor represents the boundary area between the Acushnet River and Buzzards Bay.

9002. The main axis of the system is oriented north-south extending over a distance of approximately 3.5 nm.

9003. The geometry of the system is dominated by several man-made structures that constrict the natural flows.

9004. The most prominent structure is the hurricane barrier located near the southern limit of the system.

9005. Construction of the hurricane barrier was completed in 1966.

9006. In its closed position, the barrier effectively

eliminates significant flows within the harbor.

9007. In addition to the hurricane barrier, system characteristics are affected by three other structures, a small dam spanning the Acushnet River and forming the northern limit of the estuary, and two roadway bridges, Coggeshall Street and I-195.

9008. Both bridges are presently on partial causeways which extend into the water significantly reducing cross-sectional area and affecting local flow conditions.

9009. Water depths in the system display significant spatial variability.

9010. In the area to the north of the Coggeshall Street Bridge, depths are generally shallow with maxima of approximately 6 feet within a narrow channel along the western margin.

9011. To the east and north of this channel, depths progressively shoal over broad flats fronting areas of intertidal marsh.

9012. Significant areas of these flats are regularly exposed during spring tidal conditions.

9013. South of the Coggeshall Street/I-195 bridges water depths increase with maxima of approximately 30 feet within the dredged navigational channel and associated turning basin.

9014. Circulation within the harbor of New Bedford is dominated by the combination of astronomical tides and surface wind stress.

9015. Tidal range within New Bedford Harbor varies from approximately 0.7 to 1.7 m.

9016. Current speeds within New Bedford Harbor display significant spatial and temporal variability with peak values in excess of 50 cm/sec within the constrictions formed by the hurricane barrier, and the I-195 and Coggeshall Street roadway bridges.

9017. Current speeds in the areas away from the constrictions are generally lower with average values ranging between 5 and 15 cm/sec.

9018. Current directions are typically controlled by local bathymetry and wind direction.

9019. Winds acting along the axis of the system, from

northerly or southerly quadrants, are most effective in producing wind driven currents.

9020. Freshwater enters New Bedford Harbor via the discharge from the Acushnet River.

9021. Estimated average streamflow from the Acushnet River equals approximately 30 cfs.

9022. Periodic storm conditions with recurrence intervals of once in 25 to once in 50 years can increase estimated discharge to values ranging from approximately 500 to 1400 cfs.

9023. The freshwater inflows mix with the higher salinity water of Buzzards Bay producing a density gradient in the horizontal with salinity values progressively increasing from north to south through the estuary and harbor.

9024. Density gradients over the vertical are generally weak with near complete mixing favored by the combination of shallow water depths and local currents.

9025. Density gradients on both the horizontal and vertical can be expected to display significant temporal variability as a function of streamflow, tidal state, and wind stress conditions.

9026. The spatial variation in water column densities favors the generation of gravitational flows characteristic of estuarine systems.

9027. In general, these flows favor surface outflows of lighter fresher waters and associated constituents and concurrent bottom inflows of saltier, more dense, water.

9028. Current meter observations (ASA, 1986; Teeter, 1988) at several locations in New Bedford Harbor however, show these flows to be quite variable in character.

9029. Surface flows in the estuary are typically seaward with speeds varying between 1 and 16 cm/sec.

9030. Average values are approximately 5 cm/sec.

9031. Mean bottom currents are landward at speeds of approximately 2 cm/sec.

9032. Over extended periods of time, bottom flows moved alternately seaward (at maximum speeds of approximately 10 cm/sec) and landward (maximum speeds of approximately 6 cm/sec).

9033. These variations in net current flux appear to be

driven by nonlocal wind forcing at the mouth of the harbor.

9034. The spatial and temporal variability characterizing the New Bedford Harbor hydrography establish particular constraints which are important to take into consideration when designing sampling programs intended to provide quantitative estimates of mass transport.

9035. Surficial sediments throughout the New Bedford Harbor system are generally fine-grained with a dominance of silt-clay cohesive materials in the area north of the Coggeshall Street Bridge.

9036. South of the bridges surficial texture displays more significant spatial variability with increasing concentrations of silts and fine sands.

9037. The major features of the geological structure of New Bedford Harbor were formed during the period of the last glacial advance that terminated approximately 15,000 to 18,000 years ago.

9038. Since that time sediments have continued to be introduced into the Harbor by the combined effects of streamflows and intruding tidal waters.

9039. Estuarine circulation favors retention of sedimentary materials introduced to the Harbor, resulting in a net accretion of materials along the sediment-water interface at rates varying from approximately .2 to 4 cm/y depending upon location.

9040. Results of Lead 210 analysis of a core taken in the course of the March 1990 Balsam Sampling Program indicates that the sedimentation rate in the top 16 cm is approximately .98 cm per year.

9041. Observations indicate that sedimentation rates increased after completion of the hurricane barrier and the reconstruction of the Coggeshall Street and I-195 roadway bridges.

9042. Sediments accumulating along the sediment-water interface initially form a high water content assemblage with relatively low shear strength.

9043. The materials along the sediment-water interface are easily displaced by ambient tidal currents and/or surface wave associated velocities.

9044. As a result, a sediment particle can experience several cycles of resuspension, transport and deposition before

final storage within the sediment column.

9045. The regular resuspension of the near-surface sediment layers results in persistent suspended material transport throughout the Upper Harbor-Estuary areas.

9046. These materials acting in combination with sediment supplied from upland and offshore source areas produces suspended material concentrations ranging between 5 and 80 mg/1.

9047. Concentration levels as well as the rate and distance of suspended material transport are dependent upon the prevailing environmental conditions, both oceanographic and meteorological.

9048. Bed form morphology in the Upper Estuary of New Bedford Harbor is typically smooth.

9049. Ambient currents in the Upper Estuary produce little variation to the predominant smooth morphology of the bed forms in the Upper Estuary of New Bedford Harbor.

9050. As a result of the range of factors governing suspended material concentrations, transport rates and routes can be expected to display significant spatial and temporal variability.

9051. Transport characteristics are expected to be particularly sensitive to the frequency and intensity of storm events.

9052. The hydrophobic nature of PCBs favors adsorbtion of these materials by suspended organic and inorganic particulates in the receiving water body.

9053. Following adsorbtion, subsequent PCB transport is governed by the same range of factors affecting suspended material transport including tidal currents, gravitational circulation, wind driven flows and mass settling.

9054. As in the case of suspended material transport, this combination of factors is expected to favor significant spatial and temporal variability in PCB mass transport.

9055. Laboratory analyses of core samples show significant variations in PCB concentration over the vertical of the sediment column.

9056. Samples obtained within the area north of the Coggeshall Street Bridge show maximum concentrations of PCB in the vicinity of the 10 cm depth horizon of the core.

9057. Concentrations of PCB decrease progressively both above and below this horizon.

9058. The spatial gradients in PCB concentrations favor diffusive transport of PCB over both the horizontal and the vertical.

9059. Transport of PCBs from the Upper-Estuary is caused by diffusive processes acting in combination with advection of particulates induced by local circulation and bioturbation; these mechanisms affect the structure and fabric of the sediment column.

9060. Field observations have reported seaward fluxes of PCBs varying from less than 100 kg/yr to nearly 1300 kg/yr.

9061. This variability is in part the result of the variability inherent in the factors governing particulate and associated PCB transport.

9062. This variability establishes constraints on any field sampling effort.

9063. Sampling design for field studies of sediment and contaminant flux must be sensitive to system variability and as free as possible from operator or protocol associated biases.

9064. The majority of sediment and contaminant flux studies to date have provided limited indication that sampling protocols were designed to satisfy required sampling criteria.

9065. As a result it is difficult to establish the accuracy of the sediment and PCB flux estimates.

9066. Of the available field observations, those providing the longest record over the widest possible range of environmental conditions with sampling conducted at reasonably high frequencies allow the most accurate estimates of mass flux.

9067. ASA (1990) provides the best documentation of the variability of system characteristics affecting PCB flux.

9068. Flux studies conducted by ASA (1990) provide the best estimate of PCB flux from the Upper Estuary of New Bedford Harbor.

9069. Studies by ASA (1990), indicate an average seaward PCB flux of approximately 430 kg/yr.

9070. Development of remediation plans intended to isolate PCBs from the estuarine system and adjoining coastal waters should include consideration of the natural characteristics

affecting sediment and PCB transport.

9071. Mechanical removal of contaminated sediments has the potential to increase the seaward flux of PCB due to agitation associated with resuspension of sediments, exposure of the higher concentration sediment horizons, and/or modification of the hydrodynamic regime.

9072. With the progressive increase in sea-level stand, natural processes will continue to favor accretion of sediments along the sediment-water interface.

9073. The process will result in the progressive burial of the higher concentration horizons and reduction of the flux of PCB from the sediment column to the overlying water.

9074. Natural deposition can be supplemented by man-made placement of sediments to speed the burial processes.

9075. Laboratory studies have shown that sediment deposition will form an effective barrier and serve to isolate a variety of organic contaminants from the overlying water column.

9076. Approximately 35 cm of sediment has been shown to form an effective barrier to the flux of organic contaminants from the sediment bed. (Gunnison and Sturgis, 1988).

Circulation and Pollutant Transport Model of New Bedford Harbor, Applied Science Associates Inc., Narragansett, Rhode Island 02882, July, 1986

9077. Attachment Q.IV. 0002 is a true and accurate copy of a report entitled Circulation and Pollutant Transport Model of New Bedford Harbour, Applied Science Associates, Inc., Narragansett, Rhode Island 02882, July, 1986.

9078. Attachment Q.IV 0002 is a public record setting forth the activities of the office or agency; or matters observed pursuant to duty imposed by law as to which matters there was a duty to report; or factual findings resulting from an investigation made pursuant to authority granted by law.

9079. Attachment Q.IV 0002 is a business record, which was prepared and received and kept in the ordinary course of business; it was in the ordinary course of business to prepare, keep and maintain such records; and the record was made at or near the time of a regularly conducted business activity by or from information transmitted by a person with knowledge of such activity.

9080. Attachment Q.IV 0002 is a business record of acts, events, conditions, opinions or diagnoses, made at or near the

time by, or from information transcribed by, a person with knowledge, kept in the course of a regularly conducted business activity, and it was the regular practice of that business activity to make the record.

9081. This report details the results of an investigation of circulation and pollutant transport dynamics in the Acushnet River estuary and the adjoining harbor of New Bedford, Massachusetts.

9082. A careful review of previous investigations conducted in and adjacent to the harbor was used to establish the hydrodynamic and sedimentological setting within the harbor-estuary.

9083. Previous current meter observations in the harbor were supplemented in this investigation by a short series of measurements on June 20, 1986 at the I-195 roadway bridge causeway.

9084. Currents were also measured at the hurricane barrier on June 20, 1986.

9085. Current measurements at the I-195 bridge and the hurricane barrier extended for a period of approximately 12.5 hours or one complete tidal cycle.

9086. Some additional current measurements were also made on June 20, 1986 in the center of the channelway in the vicinity of the Aerovox facility in the upper harbor-estuary.

9087. The flood tide dominates the tidal cycle.

9088. Review of historical data indicate that winds can exert significant influence on circulation within New Bedford Harbor.

9089. Analysis of the energy spectrum of current fluctuations in the lower harbor by Signell, 1982 shows a large amount of energy is present between the M2 tidal period (12.42 hours) and the surface wave period (secs).

9090. Such energy could be produced by system seiche or the presence of internal waves.

9091. The presence of such low frequency variations must be considered in the design of sampling protocols.

9092. Studies are available detailing the characteristics of the sedimentary system within the harbor-estuary. Summerhayes, et al. (1977) appears to represent the primary source of data to date.

9093. Summerhayes (1977) estimates a deposition rate in New Bedford Harbor of between 1 cm and 4 cm per year.

9094. Sediments throughout the deeper and lower energy areas of the harbor-estuary consist primarily of fine grained materials.

9095. Sediments throughout the harbor appear to contain relatively high concentrations of a variety of trace elements including lead, copper, zinc, and chromium.

9096. In many areas these concentrations exceed the limits permitted for dredging and open water disposal.

9097. To evaluate potential particulate and pollutant transport characteristics a simple one-dimensional unsteady flow model was implemented (ASA, 1986) and used to predict the deposition of particles in the range 15.6 to 1.9 microns placed in suspension initially in the vicinity of the Aerovox facility.

9098. The variety of historical data and supplementary observations obtained as part of this study were used to establish the initial conditions for this model (ASA, 1986) and to provide a measure of verification.

9099. Experimental data obtained by Heavers in 1983

indicated critical erosion velocities for sediments within New Bedford harbor of approximately 20 to 30 cm/sec.

9100. The laboratory erosion data indicate that the potential for significant sediment erosion in the vicinity of the Aerovox facility in the upper harbor-estuary is extremely limited.

9101. Evaluations indicate that the presence of sediment surface waves can significantly increase boundary sheer stress and the potential for sediment erosion.

9102. Reviews of the historical wind data indicate that wind waves sufficient to induce sediment erosion will occur approximately once every 1.25 years with a duration of approximately 1 hour.

9103. PCB transport was evaluated using a two-dimensional vertically averaged finite element numerical model. The model used the same grid applied in the hydrodynamic studies.

9104. PCB was tested as a conservative substance with no deposition or resuspension permitted.

9105. Model results with a primary source located in the vicinity of the Aerovox facility show fairly good agreement with

to February 27, 1989, are shown on page C-3.

9244. Power spectra for the current and sea surface elevation records are shown on pages C-4 through C-9, with the north-south component represented by the solid lines and east-west component represented by the dashed lines.

9245. The information shown in Appendix C accurately reflects the data collected.

9246. The information shown in Appendix C accurately represents the conditions of the properties measured over the periods measured.

9247. The plaintiffs have no evidence to present that demonstrates that the information shown in Appendix C does not accurately reflect the properties measured over the periods measured.

9248. As shown in Appendix C, power spectral analyses of the currents show high frequency variability in the currents that is typically broad band, with periods ranging from approximately 9249.0 to 1.4 hours, which corresponds to the approximate first order seiching period of 1.2 hours for upper New Bedford Harbor.

The Analysis of the Samples

A. Enseco

9250. Enseco/ERCO ("Enseco") is an analytical laboratory which is located in Cambridge, Massachusetts.

9251. In connection with the ASA Transport Study, Enseco received from ASA two sets of water samples for analysis.

9252. The two sets of water samples received by Enseco from ASA were collected by ASA during the first and second sample collection surveys, respectively, conducted as part of the ASA Transport Study.

9253. The two sets of water samples were transferred from ASA to
Enseco, which is accurately reported in documents bearing NM&F Bates number 4414-5397.

9254. Documents bearing NM&F Bates number 4414-5397, documents Q.IV.0005, Q.IV.0006, and Q.IV.0013 attached hereto are admissible in evidence.

9255. Documents bearing NM&F Bates number 4414-5397 and documents Q.IV.0005, Q.IV.0006, and Q.IV.0013 attached hereto and documents Q.IV.0005 and Q.IV.0006 are business records,

which were prepared or received and kept in the ordinary course of business; it was the ordinary course of business for Enseco to prepare, keep and maintain such records; and the record was made or prepared at or near the time of a regularly conducted business activity of Enseco by or from information transmitted by a person with knowledge of such activity.

9256. Enseco analyzed the two sets of water samples it received from ASA for PCBS, in accordance with EPA CLP Statement of Work 2/88.

9257. CRL, a "sister company" to Enseco, analyzed the two sets of water samples Enseco received from ASA for total suspended solids ("TSS") .

9258. The samples analyzed by Enseco were prepared in a manner consistent with the methods described in EPA CLP Statement of Work 2/88.

9259. The samples analyzed by Enseco were analyzed in a manner consistent with the methods described in EPA CLP Statement of Work 2/88.

9260. The samples analyzed by CRL were prepared in a manner consistent with Standard Method 160.1.

9261. The samples analyzed by CRL were analyzed in a manner

consistent with Standard Method 160.1.

9262. The samples analyzed by Enseco were prepared and analyzed in a manner consistent with the quality assurance and quality control procedures described in EPA CLP Statement of Work 2/88.

9263. The samples analyzed by CRL were prepared and analyzed in a manner consistent with the quality assurance and quality control procedures described in Standard Method 160.1.

9264. Each sample received by Enseco from ASA was assigned a laboratory identification number.

9265. The laboratory identification numbers assigned by Enseco to the samples received from ASA are accurately reported in documents bearing NM&F Bates number 4414-5397 and documents Q.IV.0005 and Q.IV.0006 attached hereto.

9266. Each sample received by Enseco from ASA was prepared for analysis by Enseco or CRL, as accurately reported in documents bearing NM&F Bates number 4414-5397, and documents Q.IV.0005 and Q.IV.0006 attached hereto.

9267. Each prepared sample was analyzed by Enseco or CRL, as accurately reported in documents bearing NM&F Bates number 4414-5397, and documents Q.IV.0005 and Q.IV.0006 attached

hereto.

9268. Enseco and CRL reported the results of their analyses in a separate data pack for each set of water samples, and each such data pack was produced in accordance with EPA CLP Statement of Work 2/88.

9269. One of the data packs produced by Enseco/CRL comprises the documents bearing NM&F Bates numbers 4414-4989, and document Q.IV.0005 attached hereto.

9270. The documents bearing NM&F Bates numbers 4414-4989 and document Q.IV.0005 attached hereto, are admissible in evidence.

9271. The documents bearing NM&F Bates numbers 4414-4989 and document Q.IV.0005 attached hereto, are business records, which were prepared or received and kept in the ordinary course of business; it was the ordinary course of business for Enseco to prepare, keep and maintain such records; and the record was made or prepared at or near the time of a regularly conducted business activity of Enseco by or from information transmitted by a person with knowledge of such activity.

9272. Another data pack produced by Enseco/CRL comprises the

documents bearing NM&F Bates numbers 4490-5397 and documents Q.IV.0005 and Q.IV.0006 attached hereto.

9273. The documents bearing NM&F Bates numbers 4490-5397 and documents Q.IV.0005 and Q.IV.0006 attached hereto, are admissible in evidence.

9274. The documents bearing NM&F Bates numbers 4490-5397 and documents Q.IV.0005 and Q.IV.0006 attached hereto, are business records, which were prepared or received and kept in the ordinary course of business; it was the ordinary course of business for Enseco to prepare, keep and maintain such records; and the record was made or prepared at or near the time of a regularly conducted business activity of Enseco by or from information transmitted by a person with knowledge of such activity.

9275. The analytical results reported in documents bearing NM&F Bates numbers 4414-5397 and documents Q.IV.0005 and Q.IV.0006 attached hereto, accurately reflect the presence or absence of PCBs in the water samples at the time the samples were analyzed by Enseco/CRL.

9276. The analytical results reported in documents bearing NM&F Bates numbers 4414-5397 and documents Q.IV.0005 and Q.IV.0006 attached hereto, accurately reflect the presence or absence of

PCBs in the matrix from which the samples were collected at the time the samples were collected.

9277. The analytical results reported in documents bearing NM&F Bates numbers 4414-5397 and documents Q.IV.0005 and Q.IV.0006 attached hereto, accurately reflect the concentrations of PCBs in the matrix from which the samples were collected at the time the samples were collected.

9278. The plaintiffs have no evidence to present that demonstrates that the information reported in documents bearing NM&F Bates numbers 4414-5397 and documents Q.IV.0005 and Q.IV.0006 attached hereto, does not accurately reflect the presence of absence of PCBs in the water samples analyzed by Enseco/CRL.

9279. The plaintiffs have no evidence to present that demonstrates that the information reported in documents bearing NM&F Bates numbers 4414-5397 and documents Q.IV.0005 and Q.IV.0006 attached hereto, does not accurately reflect the concentrations of PCBs in the water samples analyzed by Enseco/CRL.

9280. The plaintiffs have no evidence to present that demonstrates that the information reported in documents bearing NM&F Bates numbers 4414-5397 and documents Q.IV.0005 and

Q.IV.0006 attached hereto, does not accurately reflect the presence of absence of PCBs in the matrix from which the samples were collected at the time the samples were collected.

9281. The plaintiffs have no evidence to present that demonstrates that the information reported in documents bearing NM&F Bates numbers 4414-5397 and documents Q.IV.0005 and Q.IV.0006 attached hereto, does not accurately reflect the concentrations of PCBs in the matrix from which the samples were collected at the time the samples were collected.

9282. The analytical results of the PCB and TSS analyses conducted by Enseco/CRL are summarized on pages A-4 through A-6 (Appendix A1) of the ASA Transport Study Report.

9283. Appendix A1 is admissible in evidence.

9284. Appendix A1 of the ASA Transport Study Report is a business record, which was prepared or received and kept in the ordinary course of business; it was the ordinary course of business for ASA to prepare, keep and maintain such records; and the record was made or prepared at or near the time of a regularly conducted business activity of ASA by or from information transmitted by a person with knowledge of such activity.

9285. The data tables of Appendix A1 are described on pages A-2 and A-3.

9286. The analytical results of the PCB and TSS analyses conducted by Enseco/CRL are shown on pages A-4 through A-6 of Appendix A1.

9287. The information shown on pages A-4 through A-6 of Appendix
A1 accurately reflects the samples collected by ASA and the analytical results reported by Enseco/CRL.

9288. The plaintiffs have no evidence to present that demonstrates that the information shown on pages A-4 through A-6 of Appendix A1 does not accurately reflect the samples collected by ASA and the analytical results reported by Enseco/CRL.

9289. The information shown on pages A-4 through A-6 of Appendix
A1 accurately reflects the compositions of the water samples analyzed by Enseco/CRL.

9290. The plaintiffs have no evidence to present that demonstrates that the information shown on pages A-4 through A-6 of Appendix A1 does not accurately reflect the compositions of the water samples analyzed by Enseco/CRL.

9291. The information shown on pages A-4 through A-6 of Appendix
A1 accurately reflects the composition of the water from which the samples analyzed by Enseco/CRL were taken.

9292. The plaintiffs have no evidence to present that demonstrates that the information shown on pages A-4 through A-6 of Appendix A1 does not accurately reflect the composition of the water from which the samples analyzed by Enseco/CRL were taken.

9293. The information shown on pages A-4 through A-6 of Appendix
A1 accurately represents the composition of the water passing through the Coggeshall Street Bridge transect in New Bedford Harbor and the water at the upstream and downstream locations at the times sampled.

9294. The plaintiffs have no evidence to present that demonstrates that the information shown on pages A-4 through A-6 of Appendix A1 does not accurately represent the composition of the water passing through the Coggeshall Street Bridge transect in New Bedford Harbor and the water at the upstream and downstream locations at the times sampled.

9295. The quality assurance and quality control procedures

adhered to during Enseco/CRL's preparation and analysis of the samples received from ASA are accurately reflected in the documents bearing NM&F Bates number 4414-5397 and documents Q.IV.0005 and Q.IV.0006 attached hereto.

9296. The plaintiffs have no evidence to present that demonstrates that the information shown in documents bearing NM&F Bates number 4414-5397 and documents Q.IV.0005 and Q.IV.0006 attached hereto, does not accurately reflect the quality assurance and control procedures adhered to during Enseco/CRL's preparation and analysis of the samples received from ASA.

9297. The results of the quality assurance and quality control procedures adhered to during Enseco/CRL's preparation and analysis of the samples received from ASA indicate that the data reported by Enseco/CRL is valid and reliable.

9298. The plaintiffs have no evidence to present that demonstrates that the results of the quality assurance and quality control procedures adhered to during Enseco/CRL's preparation and analysis of the samples received from ASA indicate that the data reported by Enseco/CRL is not valid and reliable.

9299. Upon completion of its analyses, Enseco transmitted

copies

of the documents marked as bearing NM&F Bates number 4414-5397 and documents Q.IV.0005 and Q.IV.0006 attached hereto, to ASA.

B. Ceimic Corporation

9300. Ceimic Corporation ("Ceimic") is an analytical laboratory which is located in Narragansett, Rhode Island.

9301. In connection with the ASA Transport Study, Ceimic received from ASA seven sets of water samples for analysis.

9302. The seven sets of water samples received by Ceimic from ASA were collected by ASA during the third, fourth, fifth, sixth, seventh, eighth and ninth sample collection surveys, respectively, conducted as part of the ASA Transport Study.

9303. The seven sets of water samples were transferred from ASA to Ceimic, which is accurately reported in the documents bearing NM&F Bates numbers 1087-2364, 5398-6859 and documents Q.IV.0007, Q.IV.0008, Q.IV.0009, Q.IV.0010, Q.IV.0011, Q.IV.0012 and Q.IV.0013 attached hereto.

9304. Documents bearing NM&F Bates numbers 1087-2364, 5398-6859 and documents Q.IV.0007, Q.IV.0008, Q.IV.0009, Q.IV.0010, Q.IV.0011, Q.IV.0012 and Q.IV.0013 attached hereto, are

admissible in evidence.

9305. Documents bearing NM&F Bates numbers 1087-2364 and 5398-6859 and documents Q.IV.0007, Q.IV.0008, Q.IV.0009, Q.IV.0010, Q.IV.0011, Q.IV.0012 and Q.IV.0013 attached hereto are business records, which were prepared or received and kept in the ordinary course of business; it was the ordinary course of business for Ceimic to prepare, keep and maintain such records; and the record was made or prepared at or near the time of a regularly conducted business activity of Ceimic by or from information transmitted by a person with knowledge of such activity.

9306. Ceimic analyzed the seven sets of water samples it received from ASA for PCB, in accordance with EPA CLP Statement of Work 2/88.

9307. Ceimic analyzed the first four (4) sets of water samples it received from ASA, which samples were collected during the third, fourth, fifth and sixth sample collection surveys, for TSS.

9308. The samples analyzed by Ceimic were prepared in a manner consistent with the methods described in EPA CLP Statement of Work 2/88.

9309. The samples analyzed by Ceimic were analyzed in a manner consistent with the methods described in EPA CLP Statement of Work 2/88.

9310. The samples analyzed by Ceimic were prepared and analyzed in a manner consistent with the quality assurance and quality control procedures described in EPA CLP Statement of Work 2/88.

9311. Each sample received by Ceimic from ASA was assigned a laboratory identification number.

9312. The laboratory identification numbers assigned by Ceimic are accurately reported in the documents bearing NM&F Bates numbers 1087-2364, 5398-6859 and documents Q.IV.0007, Q.IV.0008, Q.IV.0009, Q.IV.0010, Q.IV.0011 and Q.IV.0012 attached hereto.

9313. Each sample received by ceimic from ASA was prepared for analysis by ceimic, as accurately reported in the documents bearing NM&F Bates numbers 1087-2364, 5398-6859 and documents Q.IV.0007, Q.IV.0008, Q.IV.0009, Q.IV.0010, Q.IV.0011 and Q.IV.0012 attached hereto.

9314. Each prepared sample was analyzed by Ceimic, as accurately
reported in the documents bearing NM&F Bates numbers 1087-2364, 5398-6859 and documents Q.IV.0007, Q.IV.0008, Q.IV.0009,

Q.IV.0010, Q.IV.0011 and Q.IV.0012 attached hereto.

9315. Ceimic reported the results of its analyses in a separate data pack for each set of water samples, and each such data pack was produced in accordance with EPA CLP Statement of Work 2/88.

9316. The seven data packs generated by Ceimic comprise the documents bearing NM&F Bates numbers 1087-2364, 5398-6859 and documents Q.IV.0007, Q.IV.0008, Q.IV.0009, Q.IV.0010, Q.IV.0011 and Q.IV.0012 attached hereto.

9317. The documents bearing NM&F Bates numbers 1087-2364, 5398-6859 and documents Q.IV.0007, Q.IV.0008, Q.IV.0009, Q.IV.0010, Q.IV.0011 and Q.IV.0012 attached hereto, are admissible in evidence.

9318. The documents bearing NM&F Bates numbers 1087-2364, 5398-6859 and documents Q.IV.0007, Q.IV.0008, Q.IV.0009, Q.IV.0010, Q.IV.0011 and Q.IV.0012 attached hereto, are business records, which were prepared or received and kept in the ordinary course of business; it was the ordinary course of business for Ceimic to prepare, keep and maintain such records; and the record was made or prepared at or near the time of a regularly conducted business activity of Ceimic by or from information transmitted by a person with knowledge of such activity.

9319. The analytical results reported in documents bearing NM&F Bates numbers 1087-2364 and 5398-6859 and documents Q.IV.0007, Q.IV.0008, Q.IV.0009, Q.IV.0010, Q.IV.0011 and Q.IV.0012 attached hereto, accurately reflect the presence or absence of PCBs in the water samples at the time the samples were analyzed by Ceimic.

9320. The analytical results reported in documents bearing NM&F Bates numbers 1087-2364, 5398-6859 and documents Q.IV.0007, Q.IV.0008, Q.IV.0009, Q.IV.0010, Q.IV.0011 and Q.IV.0012 attached hereto, accurately reflect the concentrations of PCBs in the water samples analyzed by Ceimic at the time the samples were analyzed by Ceimic.

9321. The analytical results.reported in documents bearing NM&F Bates numbers 1087-2364, 5398-6859 and documents Q.IV.0007, Q.IV.0008, Q.IV.0009, Q.IV.0010, Q.IV.0011 and Q.IV.0012 attached hereto, accurately reflect the presence or absence of PCBs in the matrix from which the samples were collected at the time the samples were collected.

9322. The analytical results reported in documents bearing NM&F Bates numbers 1087-2364, 5398-6859 and documents Q.IV.0007, Q.IV.0008, Q.IV.0009, Q.IV.0010, Q.IV.0011 and Q.IV.0012 attached hereto, accurately reflect the concentrations of PCBs

in the matrix from which the samples were collected at the time the samples were collected.

9323. The plaintiffs have no evidence to present that demonstrates that the information reported in documents bearing NM&F Bates numbers 1087-2364, 5398-6859 and documents Q.IV.0007, Q.IV.0008, Q.IV.0009, Q.IV.0010, Q.IV.0011 and Q.IV.0012 attached hereto, does not accurately reflect the presence or absence of PCBs in the water samples analyzed by Ceimic.

9324. The plaintiffs have no evidence to present that demonstrates that the information reported in documents bearing NM&F Bates numbers 1087-2364, 5398-6859 and documents Q.IV.0007, Q.IV.0008, Q.IV.0009, Q.IV.0010, Q.IV.0011 and Q.IV.0012 attached hereto, does not accurately reflect the concentrations of PCBs in the water samples analyzed by Ceimic.

9325. The plaintiffs have no evidence to present that demonstrates that the information reported in documents bearing NM&F Bates numbers 1087-2364, 5398-6859 and documents Q.IV.0007, Q.IV.0008, Q.IV.0009, Q.IV.0010, Q.IV.0011 and Q.IV.0012 attached hereto, does not accurately reflect the presence or absence of PCBs in the matrix from which the samples were collected at the time the samples were collected.

9326. The plaintiffs have no evidence to present that

demonstrates that the information reported in documents bearing NM&F Bates numbers 1087-2364, 5398-6859 and documents Q.IV.0007, Q.IV.0008, Q.IV.0009, Q.IV.0010, Q.IV.0011 and Q.IV.0012 attached hereto, does not accurately reflect the concentrations of PCBs in the matrix from which the samples were collected at the time the samples were collected.

9327. The results of the PCB and TSS analyses conducted by Ceimic are summarized on pages A-2 through A-13 (Appendix A1) of the ASA Transport Study Report.

9328. Appendix A1 is admissible in evidence.

9329. Appendix A1 of the ASA Transport Study Report is a business record, which was prepared or received and kept in the ordinary course of business; it was the ordinary course of business for ASA to prepare, keep and maintain such records; and the record was made or prepared at or near the time of a regularly conducted business activity of ASA by or from information transmitted by a person with knowledge of such activity.

9330. The data tables of Appendix A1 are described on pages A-2 and A-3.

9331. The analytical results of the PCB and TSS analyses

conducted by Ceimic are shown on pages A-7 through A-13 of Appendix A1.

9332. The information shown on pages A-7 through A-13 of Appendix A1 accurately reflects the samples collected by ASA and the analytical results reported by Ceimic.

9333. The plaintiffs have no evidence to present that demonstrates that the information shown on pages A-7 through A-13 of Appendix A1 does not accurately reflect the samples collected by ASA and the analytical results reported by Ceimic.

9334. The information reported on pages A-7 through A-13 of Appendix A1 accurately reflects the compositions of the water samples analyzed by Ceimic.

9335. The plaintiffs have no evidence to present that demonstrates that the information shown on pages A-7 through A-13 of Appendix A1 does not accurately reflect the compositions of the water samples analyzed by Ceimic.

9336. The information shown on pages A-7 through A-13 of Appendix A1 accurately represents the composition of the water from which the samples analyzed by Ceimic were taken.

9337. The plaintiffs have no evidence to present that

demonstrates that the information shown on pages A-7 through A-13 of Appendix A1 does not accurately reflect the composition of the water from which the samples analyzed by Ceimic were taken.

9338. The information shown on pages A-7 through A-13 of Appendix A1 accurately represents the composition of the water passing through the Coggeshall Street Bridge transect in New Bedford Harbor and the water at the upstream and downstream locations at the times sampled.

9339. The plaintiffs have no evidence to present that demonstrates that the information shown on pages A-7 through A-13 of Appendix A1 does not accurately represent the composition of the water passing through the Coggeshall Street Bridge transect in New Bedford Harbor and the water at the upstream and downstream locations at the times sampled.

9340. The quality assurance and quality control procedures adhered to during Ceimic's preparation and analysis of the samples received from ASA are accurately reflected in documents bearing NM&F Bates numbers 1087-2364, 5398-6859 and documents Q.IV.0007, Q.IV.0008, Q.IV.0009, Q.IV.0010, Q.IV.0011 and Q.IV.0012 attached hereto.

9341. The plaintiffs have no evidence to present that

demonstrates that the information shown in documents bearing NM&F Bates numbers 1087-2364, 5398-6859 and documents Q.IV.0007, Q.IV.0008, Q.IV.0009, Q.IV.0010, Q.IV.0011 and Q.IV.0012 attached hereto, does not accurately reflect the quality assurance and control procedures adhered to during Ceimic's preparation and analysis of the samples received from ASA.

9342. The results of the quality assurance and quality control procedures adhered to during Ceimic's preparation and analysis of the samples received from ASA indicate that the data reported by Ceimic is valid and reliable.

9343. The plaintiffs have no evidence to present that demonstrates that the results of the quality assurance and quality control procedures adhered to during Ceimic's preparation and analysis of the samples received from ASA indicate that the data reported by Ceimic is not valid and reliable.

9344. Upon completion of its analyses, Ceimic transmitted copies
of the documents bearing NM&F Bates numbers 1087-2364, 5398-6859 and documents Q.IV.0007, Q.IV.0008, Q.IV.0009, Q.IV.0010, Q.IV.0011 and Q.IV.0012 attached hereto, to ASA.

The Statistical/Computational Work

9345. Dr. Rines reviewed the data packs produced by Enseco and Ceimic and compiles from them a series of tables which show the PCB concentrations detected in the analyzed water samples.

9346. The data tables compiled by Dr. Rines are shown on pages A-4 through A-13 (Appendix A1) of the ASA Transport Study Report.

9347. The information shown on pages A-4 through A-15 represents
an accurate compilation of the analytical results produced by Enseco and Ceimic.

9348. Appendix A1 is admissible in evidence.

9349. Appendix A1 of the ASA Transport Study Report is a business record, which was prepared or received and kept in the ordinary course of business; it was the ordinary course of business for ASA to prepare, keep and maintain such records; and the record was made or prepared at or near the time of a regularly conducted business activity of ASA by or from information transmitted by a person with knowledge of such activity.

9350. Using the tables prepared by Dr. Rines, along with the

the values reported under "Net Seaward PCB Flux" were calculated using a constant of 70% to represent the portion of total PCBs present which consisted of Arocolor 1242.

9403. The information shown in Table 4.4 of the ASA Transport Study Report accurately reflects the data collected and the analysis performed by ASA in connection with the ASA Transport Study.

9404. The information shown in Table 4.4 of the ASA Transport Study Report represents reliable estimates of the net mass transport of PCBs through the Coggeshall Street Bridge transect on an annual basis.

9405. The arithmetic mean value of the estimated net mass transport seaward is an accurate estimate of the mean annual transport of PCBs through the Coggeshall Street Bridge transect on an annual basis.

<u>Final Report, A Field Study of the Circulation and Dispersion in New Bedford Harbor, Prepared by W.R. Geyer and W.D. Grant, Woods Hole Oceanographic Institution for Battelle Laboratories, Duxbury, Massachusetts</u>

9406. The accuracy of the information presented in Geyer, 198 , report cannot be evaluated in the absence of system calibration data.

9407. The multiplicity of instruments used to monitor currents, water temperature, salinity and pressure complicates intercomparisons and evaluations of data accuracy.

9408. The methods and procedures associated with these hydrographic surveys are not presented in the report nor is there any justification given for the selection of the study dates and the associated survey tracks.

9409. The conductivity and transmission data obtained during the current meter deployments were not presented in the report.

9410. No justification is presented for the times selected to conduct the drifter deployments therefore, the degree to which the conditions prevailing during these surveys are representative of typical summer conditions cannot be evaluated.

9411. There has been no effort to provide a spectral analysis of the time series current meter data and to establish associated cause and effect relationships.

9412. In the absence of such analysis it is not possible to determine whether the observations provide adequate "ground truth" for the numerical simulations being conducted by Battelle.

9413. The observations are extremely limited in duration and are largely confined to a mid-summer period. This 28 day period cannot provide a representative range of wind and storm associated tidal conditions expected to affect circulation within New Bedford Harbor.

9414. The basis for the estimates of volume exchange through the hurricane barrier is not made clear.

9415. In the absence of this information the accuracy of the estimate cannot be established.

9416. There is no basis presented for the statement that up to 50% of the water exiting in the harbor is returned on the subsequent flood tide.

9417. As a result quantitative estimates using this figure appear to be largely conjectural.

9418. Estimates of particulate residence time are based on such a range of simplifying assumptions that they cannot be

considered to be accurate or generally representative.

New Bedford Harbor Superfund Project Acushnet River Estuary Engineering Feasibility Study of Dredging and Dredged Material Disposal Alternatives, Report 2 - Sediment and Contaminant Hydraulic Transport Investigations by Allen M. Teeter, Technical Report EL-88-15, Department of The Army, Waterways Experiment Station, Vicksburg, Mississippi, December 1988

9419. Given the temporal variability characteristic of the majority of estuarine systems it is impossible to evaluate to accuracy the flux estimates presented in this report.

9420. There is no rationale presented for the spatial and temporal sampling intervals, the duration of the sampling effort, nor the number of surveys conducted.

9421. In order to provide an accurate estimate of flux measurements, the representativeness of the timing and frequency of samples must be documented.

9422. The three surveys encompassed a range of freshwater streamflow conditions (0.25-1.5 cu.m/sec).

9423. Tidal ranges however, were restricted to those near the mean value of 1.13m; neither spring nor NEAP ranges tidal were studied.

9424. Meteorological conditions, known to affect circulation within the harbor and estuary (Geyer and Grant, 1986), were also quite limited. Winds were from the south and southwest for two of the surveys and from the northeast for the third. All wind speeds were generally in the 16-32 km/hr range.

9425. The range of environmental conditions sampled during the three field surveys was extremely limited.

9426. Calibration of information for the current meters is not presented making evaluation of measurement accuracy impossible. Flow inaccuracies could from the measurements significantly affect flux estimates.

9427. Calculation of tidal fluxes require volume and not velocity weighted PCB and/or total suspended material (TSM) concentrations. Teeter (1988) did not analyze volume composited samples.

9428. Flow compositing of samples precludes the possibility of making any detailed error analysis of the flux estimates.

9429. The net water fluxes, summarized in Table 2 of the report, are substantial with magnitudes as large as 28% of the flood tide volume.

9430. The factors affecting this transport are not discussed.

9431. The net fluxes are much larger than those associated with long-term river flows and may be the result of some low frequency variations in sea level.

9432. The presence of such low frequency factors complicates sampling of the estuary and may be a primary cause for the significant variation in PCB flux observed during each of the surveys; this possibility is not discussed in the report.

9433. Most of the field data from the field program (currents, surface elevations, salinity, etc.) are not presented in the report making independent analysis impossible.

9434. The role of density stratification of the water column and its influence on PCB and TSM transport processes is never discussed.

9435. Density stratification may be of particular

importance within subsequent efforts to develop a numerical model of sediment and contaminant transport for use in the evaluation of potential effects associated with the proposed remedial action scheme including dredging and various confined disposal options.

9436. Teeter (1988) states on p. 25, para. 52 that "the results for the second survey were revised in 1988 after a re-examination of previous analyses." The meaning of this statement is not clear and cannot be discerned using the information provided.

9437. The elimination of tidal bias used in the report appears to make the assumption that flood and ebb tidal volume transports are the same and that the net long term water flux is seaward at the river discharge rate.

a. For this assumption to hold the estuary must be in near steady state over each tidal cycle.

b. There is no reason to believe that this is true.

c. No effort was made to justify the assumption which if wrong could lead to substantial errors in estimated net flux.

d. Average flux values are presented throughout the report. Given the large variability observed this

approach appears difficult to statistically justify.

e. There is no analysis of error presented in the report.

9438. Error analysis is considered to represent an essential component of any QA-QC effort.

9439. Given the noted deficiencies in sampling design little confidence can be placed in the PCB and suspended material flux estimates presented in this report.

9440. No effort was made to provide verification of the model results using field data from this or other studies.

9441. In the absence of such verification the results must be considered to be largely conjectural.

9442. The report presents the results of an application of a two-dimensional numerical model used to detail the circulation characteristics of the harbor and estuary.

9443. No effort was made to justify the use of a two-dimensional model.

9444. There was no effort made to include the effects of

wind stress on system circulation. Such effects are known to be substantive (Geyer and Grant, 1986).

9445. There was no consideration of possible far-field effects associated with variations in sea-level stand within Buzzards Bay on circulation within the harbor and estuary.

9446. Effects associated with variations in streamflow volume were not considered. No justification was provided for the selection of 0.85 cu-m/sec as the input streamflow.

9447. The hydrodynamic component of the model was combined with a sediment-transport element to evaluate the probability of sediment migration from the dredging site and the potential for some fraction of these materials to move south past the Coggeshall Street Bridge.

9448. The results of the escape analysis are limited due to the environmental conditions considered and most probably underestimate material losses associated with the dredging operations.

9449. Overall this report suffers due to insufficient consideration of the inherent variability of estuarine system adjoining New Bedford, Massachusetts.

Aerovox PCB Disposal Site, Acushnet River and New Bedford Harbor, MA., Tidal Cycle and PCB Mass Transport Study, January 10-12, 1983, Final Report - March 4, 1983, by the Environmental Response Team and the Technical Assistance Team, Edison, New Jersey

9450. This report summarizes the results of a series of field and laboratory investigations intended to evaluate the extent to which PCBs are dispersed from the upper harbor-estuary areas of New Bedford Harbor, Massachusetts.

9451. This investigation represents an effort to complement studies initiated by the EPA and the U.S. Coast Guard in August, 1982 (Interim Report PCBs in New Bedford, Mass, Harbor, dated December 18, 1982).

9452. Specifically, this investigation was conducted in order to more accurately assess water mass mixing patterns in New Bedford Harbor; to study PCB mass transport; to provide data detailing the effect of a major rainfall event on the dispersion of PCBs; and to provide some additional data that would permit determination of the extent to which the observations of the previous year (1982) were representative of transport mechanisms in New Bedford Harbor.

9453. The field survey was conducted by personnel from the joint USCG COTP-PROV and Emergency Response Team (ERT) on January 10-12, 1983.

9454. The field survey monitored water mass movements through the Coggeshall Street causeway for three complete tidal cycles (39 hours).

9455. Extreme meteorological conditions prevailed throughout the period of observation including significant rainfall and high southeasterly winds.

9456. The survey measured sea-level stand, water depths at the causeway, water temperature, conductivity and salinity dissolved oxygen, current speed and direction, light transmission, and suspended material concentrations.

9457. During the survey water samples were obtained for PCB analysis.

9458. In addition to the bridge sampling site, the survey included two additional stations, one located 1.4nm to the north of the bridge, and a second station at Nun #4 to the south of the bridge.

9459. The purpose of these secondary stations was to provide a synoptic view of the water mass characteristics within the upper harbor-estuary.

9460. The discussion of the sampling procedures used in this survey is extremely difficult to follow. The procedures appear overly complex and, by confusing personnel, likely to affect ultimate reliability.

9461. Kemmerer Water bottles were used to collect water samples during the surveys.

9462. Kemmerer water bottles are not commonly used for sampling marine waters because they are prone to corrosion, fouling, and/or failure.

9463. Calibration information is not provided for any of the measurement systems used in the study.

9464. A tide staff was used to estimate sea-level in the study.

9465. It is difficult to obtain high accuracy sea-level observations from a visual staff, particularly in the presence of a moderately high energy surface wave field.

9466. A sounding line was used in the study for measurements of water depth.

9467. It is difficult to get high accuracy measurements of water depth from a sounding line particularly in the presence of a moderately high energy surface wave field.

9468. Given the low accuracy of the observations of sea-level and water depth it is impossible to develop accurate estimates of volume flux through the Coggeshall Street causeway.

9469. Samples for PCB analysis were composited before laboratory analysis.

9470. Compositing makes it impossible to assess the relative importance of various sections of the water column within transport estimates.

9471. The ability to assess such characteristics is essential within estuarine systems characterized by measurable vertical density gradients.

9472. No effort was made to assess the intensity and/or characteristic recurrence interval of the storm that occurred during the sampling period.

a. In the absence of this information the extent to which the transport estimates are representative of conditions that might occur during a given year cannot be estimated.

9473. The methods used to assess suspended material concentrations are not clear.

9474. A plankton net was utilized to collect suspended material in the study.

9475. The character and quantity of the material trapped in a plankton net varies with time as the net accumulates material. What initially will pass through will in time be trapped due to accumulating residue.

9476. The deployment time of 2 hours represents a significant portion of a half tidal cycle and makes the data nearly useless in terms of mass transport.

9477. Figure 3 is not included in the report.

9478. The absence of a regular sampling frequency throughout the course of the survey effectively negates the utility of the 39 hour survey.

9479. The frequency and timing of sampling in this study can miss much of the variable conditions in current flow likely to be encountered during the study.

9480. The maximum velocities observed, 1.68 kts flood and 3.64 kts ebb are unrealistic for the system and are probably due to a measurement or computational error.

9481. No effort is made to check the representativeness of maximum estimated velocities using the combination of tidal elevation and water depth.

9482. The observed short-term current reversals were not adequately sampled in the survey.

9483. The "synoptic" surveys required two hours to complete.

9484. The measured flows, density structure and other physical and chemical measurements can be expected to change significantly over a two hour time.

9485. The surveys are not adequately synoptic for the variability in physical phenomena observed in the study.

9486. As a result plots of the longitudinal distributions

presented in the report have little meaning.

9487. There is no basis for the statement that elevated PCB concentrations in the near-surface waters are the result of entrainment of contaminated sediments from the exposed flats. These contaminants could just as well have entered via streamflows or street drainage.

9488. The statistical analysis presented is haphazard and shows little sensitivity to the dynamics of the system and their probable effect on PCB transport.

9489. Results from the study and conclusions based upon the statistical analysis are therefore inaccurate.

9490. Given the range of potential errors associated with this investigation, little confidence can be placed in the estimated flux of PCB/tidal cycle.

9491. The estimate of yearly flux makes the assumption that rainfall dominated the transport during the survey period. This has not been demonstrated.

9492. It is likely that wind stress and the associated wave field was as important during the study.

9493. Failure to take the effects of wind stress on the system into consideration renders the extrapolation worthless.

9494. The document attached as Q.IV.00014 is a true and accurate copy of the draft letter report by Yasuo Onishi entitled "Review on Aerovox PCB Disposal Site, Acushnet River and New Bedford Harbor, Massachusetts, Title [sic] Cycle and PCB Mass Transport Study, July 1985."

9495. Dr. Onishi is employed by the Battelle Pacific Northwest Laboratory at Richland, Washington.

9496. The review described in Attachment Q.IV.0014 was supported by the U.S. Environmental Protection Agency under a Related Services Agreement with the U.S. Department of Energy, Contract DE-AC06-76RLO 1830.

9497. Battelle Pacific Northwest Laboratory has been employed by the United States in connection with the remedial investigation and feasibility study of the New Bedford Harbor Superfund Site.

9498. The study described in Attachment Q.IV.00014 is a review of the 1983 Title Cycle and PCB Mass Transport Study by the Environmental Response Team and Technical Assistance Team from Edison, New Jersey ("the ERT Study").

9499. This review was prepared by Dr. Onishi at the request of the US EPA.

9500. This review is a public record setting forth the activities of the office or agency; or matters observed pursuant to duty imposed by law as to which matters there was a duty to report; or factual findings resulting from an investigation made pursuant to an authority granted by law.

9501. Attachment Q.IV.0014 is a business record which was prepared and received and kept in the ordinary course of business; it was in the ordinary course of business to prepare, keep and maintain such records; and the record was made at or near the time of a regularly conducted business activity by or from information transmitted by a person with knowledge of such activity.

9502. Attachment Q.IV.0014 is a business record of acts, events, conditions, opinions, or diagnoses, made at or near the time by, or from information transcribed by, a person with knowledge, kept in the course of a regularly conducted business activity, and it was the regular practice of that business activity to make the record.

9503. All of the statements in Attachment Q.IV.0014 are

admissions by a party opponent offered against a party and is: a plaintiff's own statement; or a statement of which a plaintiff has manifested an adoption or belief in its truth; or a statement by a person authorized by a plaintiff to make a statement concerning the subject; or a statement by a plaintiffs' agent or servant concerning a matter within the scope of the agency or employment made during the existence of the relationship.

9504. In his review, Dr. Onishi states that the field study estimates of tidal flow, sediment, and PCB fluxes by the Coggeshall Bridge (in Table 5 of the Report) raised some concern.

9505. The field study estimates of tidal flow, sediment, and PCB fluxes by the Coggeshall Bridge (in Table 5 of the Report) raised some concern.

9506. In his review, Dr. Onishi states that the ERT estimate of the cross-sectional area of the bridge is almost twice as much as Battelle's estimate based on Figure 2 in their report.

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9508. In his review, Dr. Onishi states that this discrepancy caused an average discharge of almost twice as much as Battelle's independently calculated discharge.

9509. This discrepancy caused an average discharge of almost twice as much as Battelle's independently calculated discharge.

9510. In his review, Dr. Onishi states that with the suspended sediment of PCB concentrations reported in ERT's Table 5, a PCB flux across the bridge is about half of ERT's estimate.

9511. With the suspended sediment of PCB concentrations reported in ERT's Table 5, PCB flux across the bridge is about half of ERT's estimate.

9512. In his review, Dr. Onishi notes that most suspended sediment, suspended-sediment-sorbed PCB, and dissolved PCB samples were taken only once during each ebb or flood tide in their study and that these values were assumed to be representative of the entire ebb or flood tide.

9513. Most suspended sediment, suspended-sediment-sorbed PCB, and dissolved PCB samples were taken only once during each ebb or flood tide in their study and that these values were

assumed to be representative of the entire ebb or flood tide.

9514. In his review, Dr. Onishi states that these samples were not taken at the same stages of the flood and ebb tide; thus, there is concern as to their representativeness over the entire ebb or flood tide.

9515. These samples were not taken at the same stages of the flood and ebb tide; thus, there is concern as to their representativeness over the entire ebb or flood tide.

9516. In his review, Dr. Onishi states that the estimated net downstream flux of PCB could therefore be biased because of the measurement scheme.

9517. The estimated net downstream flux of PCB could therefore be biased because of the measurement scheme.

9518. In his review, Dr. Onishi states that it would have been better if suspended sediment of PCB concentrations were measured at closer intervals over at least one entire tidal cycle to examine the representativeness of other discreet measurements of sediment and PCB, as was done for the velocity measurement.

9519. It would have been better if suspended sediment of

PCB concentrations were measured at closer intervals over at least one entire tidal cycle to examine the representativeness of other discreet measurements of sediment and PCB, as was done for the velocity measurement.

9520. In his review, Dr. Onishi states that in addition, it would have been better if ERT had measured PCB concentration in urban runoff water to confirm that PCB contributions from overland during and immediately after the storm were unimportant.

9521. In addition, it would have been better if ERT had measured PCB concentration in urban runoff water to confirm that PCB contributions from overland during and immediately after the storm were unimportant.

9522. In his review, Dr. Onishi states that direct extrapolation to obtain annual PCB migration (seaward) was also debatable.

9523. Direct extrapolation to obtain annual PCB migration (seaward) was also debatable.

9524. In his review, Dr. Onishi states that the direct extrapolation of this storm event may not therefore be appropriate in obtaining the annual net flux of PCB.

9525. The direct extrapolation of this storm event may therefore not be appropriate in obtaining the annual net flux of PCB.

9526. In his review, Dr. Onishi recommends conducting another field data collection with continuous measurements of suspended sediments and PCB concentrations.

9527. The ASA 1990 Transport Study represents just such a field data collection and measurement effort.

EPA PRE-OPERATIONAL MONITORING DATA

9528. In 1988, a report was released by Greg Tracey and Timothy Gleason entitled "New Bedford Harbor Pilot Study Pre-Operational Monitoring - Progress Report: Current Meter Studies at the Coggeshall St. Bridge During July 1987, a copy of which was produced as called Report C in the plaintiffs' requests for admissions ("Report C").

9529. In 1988, a report was released by Greg Tracey and Timothy Gleason entitled "New Bedford Harbor Pilot Study Pre-Operational Monitoring Progress Report: Results Of Physical

Measurements at the Coggeshall St. Bridge For The Second Pre-operational Sampling Program," a copy of which was called Report H in the plaintiffs' requests for admissions ("Report "H").

9530. In 1988, a report was released by Raymond Palmquist, Kathleen Schweitzer, Robert Bowen and Richard Pruell entitled "New Bedford Harbor Pilot Study Pre-Operational Monitoring Progress Report: Chemical Analysis Results Of Water Samples Collected During July 1987," a copy of which was called Report D in the plaintiffs' requests for admissions ("Report D").

9531. In 1988, a report was released by Raymond Palmquist, Kathleen Schweitzer, Robert Bowen and Richard Pruell entitled "New Bedford Harbor Pilot Study Pre-operational Monitoring Progress Report,. Chemical Analysis Results Of Water Samples Collected During September 1987, a copy of which was called Report E in the plaintiffs' requests for admissions ("Report E").

9532. Reports C, D, E and H were prepared at the request of EPA.

9533. EPA relied upon Reports C, D, E and H in fulfillment of its statutory and regulatory mandate to conduct a remedial investigation and feasibility study at the New Bedford Harbor Superfund site.

9534. EPA seeks to recover the costs of preparation of Reports C, D, E and H from AVX.

9535. Reports C, D, E and H are parts of the EPA Administrative Record and/or Sites file for the New Bedford Harbor Superfund site.

9536. Statements and conclusions in Reports C, D, E and H are admissions of the United States.

9537. For purposes of these RFAs only, the events and data set forth in EPA's pre-operational monitoring reports are accepted as true and accurate; otherwise AVX has no knowledge of them.

9538. The current meter studies and chemical analyses reported in Reports C, D, E and H were conducted prior to U.S. Army Corps of Engineers dike construction and pilot dredging study.

9539. During the current meter studies reported in Reports C and H, measurements were made of currents, temperature and salinity at hourly intervals at east and west stations located 14 m (east) and 12 m (west) from the respective shorelines at the Coggeshall Street Bridge. No data was collected from the

center of the channel under the Coggeshall Street bridge.

9540. During the July, 1987 current meter study reported in Report C, the vertical measurement stations were located at 0.6 m below the surface and at mid-depth.

9541. During the September, 1987 current meter study reported in Report H, the vertical measurement stations were located at 1.0 m above the bottom, 0.5 m below the surface and at mid-depth.

9542. During the July, 1987, current meter study reported in Report C, current, temperature and salinity were measured using a Niel Brown direct reading current meter.

9543. During the September, 1987, current meter study reported in Report H, current, temperature and salinity were measured using an InterOceans S-4 current meter.

9544. Neither Report C or Report H discloses that any calibration or intercalibration of the Niel Brown and InterOceans S-4 current meters used, respectively, in the July, 1987, and September, 1987, current meter studies was performed.

9545. The plaintiffs have not presented evidence that any calibration or intercalibration off the Niel Brown and

InterOceans S-4 current meters used, respectively, in the July, 1987, and September, 1987, current meter studies was performed.

9546. The current meter data reported in Report C and the current meter data reported in Report H are not directly comparable because the vertical measurement stations were not the same for both reports.

9547. The current meter data reported in Report C and the current meter data reported in Report H are not directly comparable because different current meter instruments were used to collect the data in each report and no calibration or intercalibration for those instruments was performed.

9548. In Reports C and H, sea surface elevation heights were measured relative to the Coggeshall Street Bridge and the Harbor bottom beneath the bridge, which is not in accordance with vertical reference systems normally used in estuarine and near shore physical oceanographic studies.

9549. In estuarine and near shore physical oceanographic studies, the vertical reference systems normally used are MSL (means sea level) and NGVD (national geodetic vertical datum).

9550. Neither Report C or H discloses what type of instrument was used to measure sea surface elevations during the

July, 1987 and September, 1987, current meter studies.

9551. A "weighted line" was used to measure sea surface elevations in the current meter studies.

9552. Measurement of sea surface elevations by a "weighted line" can introduce substantial error due to surface wave effects.

9553. Freshwater flow rates for the Acushnet River and meteorological data at the sampling site were not measured or recorded during either the July or September, 1987 current meter studies.

9554. Neither Report C or H discloses the numerical values for the data recorded during the July and September, 1987 current meter studies.

9555. The time references used in Reports C and H, given in the form of "high" or "low" tide plus some number of hours, is nonstandard and subject to error due to inaccurate determinations of high and low tides.

9556. The data reported in Report C show current speeds and
directions which display a flood and ebb tidal pattern with a

semi-diurnal period.

9557. The data reported in Report C show current speeds that vary little vertically with minor variations between the east and west stations.

9558. The data reported in Report C for salinity and temperature show significant variability both vertically and laterally, lacks any consistent tidally related pattern, and is highly complex.

9559. The data reported in Report H show current speeds and
directions which display a flood and ebb tidal pattern with a semi-diurnal period.

9560. The data reported in Report H show current speeds that vary little vertically with significant variations between the east and west stations.

9561. The data reported in Report H for salinity and temperature show temperature as generally uniform vertically and laterally, and incomplete salinity data.

9562. Reports C and H demonstrate that the hydrographic and current structure at the Coggeshall Street Bridge is highly

variable and complex.

9563. As reported in Reports D and E, seawater samples were collected on July 9 and 13, 1987, and September 24 and 28, 1987, at four stations: the upper estuary ("station 111"); the Coggeshall Street Bridge ("station 211"); just south of the Route 6 Bridge ("station 301"); and just inside the hurricane barrier ("station 411").

9564. As reported in Reports D and E, the seawater samples were collected at 1 hour intervals over the flood and ebb tide and composited based on the local water velocity to yield mean flood and ebb tide samples, although most of the sample collection locations (vertical and horizontal) are not reported.

9565. At station 2, hourly water samples were reportedly filtered and composites made of the dissolved and particulate phases for both ebb and flood tides.

9566. As reported in Reports D and E, collected seawater samples (composited and dissolved/particulate) were analyzed for PCBs.

9567. During the September 24, 1987 survey, samples were reportedly collected at east and west stations at surface, mid-depth and bottom three hours after low and high water to

evaluate spatial variability.

9568. During the September 28, 1987 survey, whole water samples were reportedly collected hourly to evaluate temporal variability.

9569. As reported in Reports D and E, Aroclors 1242 and 1254
dominate the reported PCB congeners and their sum is a reasonable representation of the total PCBs present.

9570. As reported in Reports D and E, PCBs occur in both particulate and dissolved phases.

9571. As reported in Report D, the flood composited total PCB concentration was 0.516 ug/l compared to 0.677 ug/l for the ebb composited sample at station 2, which, if accurate, demonstrates a net landward (into the upper estuary) transport of PCBs.

9572. As reported in Report D, the differences between the total PCB concentrations derived by summing the dissolved and particulate concentrations versus using a whole water analysis based on the July 13, 1987 survey can be as large as 0.206 ug/l. Such a difference is larger than the difference between the ebb and flood composited total PCB concentrations.

9573. The uncertainty in the analysis of the sum of dissolved and particulate fractions versus whole water samples may be sufficiently large to mask the difference between the ebb and flood composited PCB concentrations. Such uncertainty can substantially alter the magnitude and even the direction of the calculated net total PCB transport.

9574. As reported in Report E, the differences between the total PCB concentrations derived by summing the dissolved and particulate concentrations versus using a whole water analysis based on the September 24, 1987 survey can be as large as 0.167 ug/l, and based on the September 28, 1987, survey as large as 0.127 ug/l.

9575. Such differences are less that than the uncertainty (0.206 ug/l) in the estimate of total PCBs based on dissolved plus particulate versus analysis of whole water from the July 13, 1987 survey. If this uncertainty in the mean flood/ebb PCB concentrations is taken into account, the net PCB transport may either be landward or seaward for either or both of the September, 1987 surveys.

9576. As reported in Report E, estimates of total PCB concentrations on September 24, 1987, at high tide plus three hours based on the mean of six samples give a value of 0.608

ug/l.

9577. As reported in Report E, the composited versus summed estimates of total PCB concentrations for flood and ebb tide for the September 28, 1987 survey are not directly comparable since the former uses a flow proportioned sampling scheme while the latter simply averages the five hourly samples.

a. For these two measures to be comparable, the simple averaging procedures require constant current throughout the tidal cycle.

9578. As reported in Report E, the standard deviations for the September 28, 1987 survey for the mean ebb and flood PCB values based on averaging the individual hourly samples are 0.219 ug/l for ebb and 0.264 ug/l for flood.

a. These standard deviations are approximately twice as large as the net difference between the ebb and flood values for that day.

9579. Consistency dictates that the average of whole water PCB concentrations of individual hourly samples for each portion of the tidal cycle should be compared to the corresponding whole water composite PCB concentrations.

a. Such a comparison was not done in this study.

9580. As reported in Reports D and E, the compositing technique used is based on proportioning the sample volume based on the locally measured flow rates or velocities divided by the sum of the flow rates at all sampling locations.

9581. The primary factor of interest in estimating the flux of PCBs at the Coggeshall Street Bridge is the volume weighted concentration for each portion (flood or ebb) of the tidal cycle.

9582. The difference between the volume weighted concentrations times the average (flood and ebb) tidal volume minus the river flow times the mean (flood and ebb) PCB concentration gives the net tidally corrected transport.

9583. As reported in Reports D and E, data on the volume weighted PCB concentrations were not collected during the July and September 1987 surveys.

9584. As reported in Reports D and E, uncertainties in estimating total PCB concentrations are normally between 0.05 and 0.2 ug/l, which are typically between 10% and 50% of the total PCB concentration.

9585. As reported in Reports D and E, the maximum uncertainties in total PCB concentrations due to spatial averaging, temporal averaging, and whole water versus particulate and dissolved analysis are equivalent to or larger than the mean differences between the ebb and flood composited samples for the four surveys.

9586. Assuming that the difference between the mean ebb and flood composited PCB concentrations provides an estimate of the net transport rate and direction and taking into account the uncertainties due to spatial averaging, temporal averaging, and whole water versus particulate and dissolved analysis, the net PCB transport at the Coggeshall Street Bridge may either be into or out of the upper estuary for any of the four surveys.

9587. In 1988, a report was released by Greg Tracey and Timothy Gleason entitled "New Bedford Harbor Pilot Study Pre-Operational Monitoring - Progress Report: Suspended Solids Measurements in New Bedford Harbor" a copy of which was called "Report I" in the plaintiffs' requests for admissions ("Report I").

9588. Report I was prepared at the request of EPA.

9589. EPA relied upon Report I in fulfillment of its statutory and regulatory mandate to conduct a remedial

investigation and feasibility study at the New Bedford Harbor Superfund site.

9590. EPA seeks to recover the costs of preparation of Report I from AVX Corporation.

9591. Report I is part of the EPA Administrative Record and/or Sites file for the New Bedford Harbor Superfund site.

9592. Statements and conclusions in Report I are admissions of the United States.

9593. Statements and conclusions in Report I are admissible into evidence.

9594. The total suspended solids ("TSS") analyses reported in Report I were conducted prior to U.S. Army Corps of Engineers dike construction and pilot dredging study.

9595. Report I does not disclose the actual water depths from which the water samples were collected for TSS analyses.

9596. Report I does not disclose during which tide of the day the water samples were collected.

9597. Report I does not disclose the physical positions of

the "east" and "west" locations at station 2 (Coggeshall Street Bridge) from which samples were collected.

9598. Report I indicates that for stations 1, 3, and 4, equal volume water samples taken from three depths were composited into an hourly sample.

9599. Report I indicates that for station 2, three depth samples were flow composited into hourly samples.

9600. None of the water samples reported in Report I were volume flux composited, based on local volume flux, which renders the data in Report I unusable for making accurate estimates of net flux at any station.

9601. The sample compositing procedures used for the samples reported in Report I do not provide any information on the vertical structure in the distribution of suspended solids over a tidal cycle.

9602. For the July 8 and 9, 1987, surveys reported in Report I, three samples yielded large suspended solids concentrations, which were not considered representative of other samples and were denoted as "outliers."

a. No "outliers" analysis was conducted to justify this conclusion.

b. For the July, 1987 surveys reported in Report I, there is no consistent trend of suspended solids concentration with tidal phase.

c. For the July, 1987 surveys reported in Report I, the samples collected from stations 2 and 3 show higher tidally averaged suspended solids concentrations than stations 1 and 4, but no explanation for this difference is given.

d. For the July, 1987 surveys reported in Report I, the mean ebb suspended solids concentrations were usually lower than the mean flood values, and the standard deviations of the mean flood or ebb values were typically larger than the difference between the mean flood and mean ebb values.

e. For the July, 1987 surveys reported in Report I, it is not possible to determine or infer net suspended sediment transport direction or rate because the suspended sediment concentration data was not weighted by the volume flux.

f. For the September 24, 1987 survey reported in Report I, one sample yielded an extremely large value of suspended solids concentration and was considered an "outlier."

g. No "outliers" analysis was conducted to justify this conclusion.

9603. For the September, 1987 surveys reported in Report I, there was no consistent trend in suspended solids concentrations by station or tidal phase.

9604. For the September, 1987 surveys reported in Report I, the mean ebb suspended solids concentrations showed no consistent trend. At station 2, the trends were opposite on the two survey days. The standard deviations of the mean flood or ebb values were typically larger than the difference between the mean flood and mean ebb values.

9605. Based on the September, 1987 surveys reported in Report I, net suspended sediment transport could be landward, neutral or seaward.

9606. For the September 24, 1987 survey reported in Report I, vertical and horizontal suspended solids concentrations were made at mid-flood and mid-ebb stages of the tide. This data

shows little spatial structure with deviations from the crosssectionally average mean (7.2 to 8.0 mg/l) of less than 2.3 mg/l.

9607. For the September 24, 1987 survey reported in Report I, the hourly composited sample at station 2 at time H+3 has a suspended solids concentration of 6.6 mg/l and a value of 5.8 mg/l at time L+3. These values compare to values of 7.7 +/- 1.0 mg/l (standard deviation) at time H+3 and 9.0 +/- 1.3 mg/l at time L+3 when the six samples from station 2 are averaged together. If the currents are uniform at station 2, the composited and vertically/laterally averaged samples should be the same.

9608. For the September 24, 1987 survey reported in Report I, the differences between the cross-sectionally averaged and the composited values are 0.6 mg/l at time H+3 and 2.2 mg/l at time L+3 and 10-27.5% of the mean value, respectively. These difference indicate the importance of flow compositing versus simple averaging of suspended solids data.

9609. Estimates of the net transport of suspended solids at a particular station require flux volume composited concentrations estimates. Use of other estimates may introduce substantial errors into any flux estimates.

ASA ESTIMATES OF PCB TRANSPORT THROUGH COGGESHALL BRIDGE TRANSECT BASED ON EPA PRE-OPERATIONAL MONITORING DATA

9610. Applied Science Associates, Inc. ("ASA") is an environmental consulting firm which conducted an analysis of PCB transport in New Bedford Harbor using the EPA pre-operational data.

9611. An estimate of net PCB transport between the Upper and Lower estuary of Coggeshall Street Bridge (CSB) can be made using the results from the New Bedford Harbor Pilot Pre-Operational Monitoring Study of currents and water chemistry conducted by EPA (EPA 1988).

9612. Such an analysis was conducted on behalf of AVX by ASA.

9613. Pre-operational data were collected by EPA (1988) for both currents and PCB concentrations on July 9 and 13, 1987 and September 24 and 28, 1987.

9614. The purpose of these measurements was to provide data to the Corps of Engineers to allow estimates to be made

of the flux of dissolved and particulate phase PCBs out of the upper estuary prior to the construction or a dike and the pilot dredging study.

9615. The data collection methodology and results are presented in Tracey and Gleason (1988 a,b) (Reports C and H in plaintiffs' RFAs) for the current measurements and Palmquist et al (1988 a,b) (Reports D and E in plaintiffs' RFAs) for the chemical analyses for the July and September surveys.

9616. The net PCB and sediment transports through the CSB transect were estimated using the EPA data and the flux estimation methodology presented in the ASA transport study (ASA, 1990).

9617. This technique determines the flood and ebb transports of PCBs and suspended sediments by integrating the instantaneous volume weighted transports. The difference between the two transports represents the net transport over a tidal cycle.

9618. The resulting net flux estimates were corrected for tidal effects using the procedure given by Teeter (1988) (Report A in plaintiffs' RFAs.)

Some assumptions and notes of caution in interpreting the data in this analysis include the following:

9619. a. The current data reported in Tracey and Gleason (1988 a,b) (Reports C and H) are presented only in the form of graphs. The scale of the graphs make them very difficult to read. Estimated errors in reading are + 7 cm/sec. One value, averaged over the vertical for the east and west sampling stations, is used.

9620. b. The EPA sea surface elevation data uses a non-standard vertical reference system (the Coggeshall Street Bridge support beams) rather than the normal NGVD or MSL benchmark. The MSL height was established by taking half the difference between the highest and lowest elevations observed and adding the mean low water depth.

9621. c. When current data were missing, values measured prior to and after the missing data were linearly interpolated in time (e.g., missing data at time L + 2, Figure 16, p. 20, 13 July 1988, Report D).

9622. d. Total PCBs were calculated by adding the

particulated and dissolved fractions.

9623. Table 1 shows the calculated water volume fluxes (ebb, flood, and net) and volume weighted PCB transports (flood; ebb; net; nev; tidal corrected) for the four pre-operational surveys.

9624. a. The net PCB transport based on the EPA pre-operational data are 346 gm/tidal cycle, 50 gm/tidal cycle, 313 gm/tidal cycle and 130 gm/tidal cycle for the July 9, 13 and September 24, 28, 1987 surveys, respectively. The transport direction are seaward, except for the July 9, 1987 survey which gives landward transport. The tide corrected fluxes for the four surveys are 104, 72, 118 and 108 gm/tidal cycle. The directions remain the same as for the uncorrected values.

9625. The water volume transport for the four surveys display some usual behavior.

9626. a. The net transport is of the same order of magnitude as either the flood or ebb transport for the July 9, 1987 and September 24, 1987 suryeys. The net transports are in opposite directions; landward for the July 9 survey and seaward for the

Table 1 Water volumes and PCB mass transport at Coggeshall Street Bridge based on the EPA pre-operational survey data (July, September 1987)

Date	Tidal Range (m)	Water Volume ($10^{-6}m^3$) Flood	Ebb	Net*	PCB Mass Transport (gm/tidal cycle) Flood	Ebb	Net	Net (Tide Corrected)
July 9	1.4	0.847	0.442	0.405	574	228	346	104
July 13	1.3	0.544	0.510	0.034	323	373	-50	-72
Sept 24	1.2	0.500	0.919	-0.419	189	502	-313	-118
Sept 28	1.0	0.829	0.877	-0.048	324	454	-130	-108

*Negative indicates seaward transport

24 September survey.

b. These net transports are extremely large and far surpass that which could be explained by Acushnet River flow. In the July 9, 1987 survey, they are also in the opposite direction from the presumed river flow direction (down estuary).

9627. c. These transports are substantially larger than observed in any prior PCB transport study at Coggeshall Street Bridge.

9628. d. These large net transports are not likely real but probably due to the lack of careful referencing for the tidal range and inadequate sampling during the field program.

9629. The net PCB fluxes are seaward for the July 13 and September 24 and 28, 1987 sampling dates but landward for July 9, 1987.

9630. This is the first reported observation of landward PCB transport at CSB.

9631. Table 2 shows the total composited PCB concentrations measured during the EPA pre-operational surveys (July

Table 2 Total composited PCB concentrations measured during EPA pre-operational surveys (July, September 1987)

Date	Mean PCB (total) concentration (ppb) Flood	Ebb
July 9, 1987	0.677	0.516
July 13, 1987	0.594	0.731
Sept 24, 1987	0.379	0.546
Sept 28, 1987	0.391	0.518

9, 13 and September 24, 28, 1987).

9632. Table 2 shows that the mean total PCB concentration on flood exceeds that on ebb for the July 9, 1987 survey.

9633. a. This difference in flood and ebb PCB concentrations and the net landward water flux are primarily responsible for the net landward PCB flux observed.

9634. Table 3 shows the net water volume and PCB mass transport at Coggeshall St. Bridge based on the EPA pre-operational surveys (July 9, 13 and September 24, 28, 1987).

9635. a. The net PCB transport based on the EPA pre-operational data using the tidal prism to estimate the flux are 87, 69, 77 and 49 gm/tidal cycle for the July 9, 13 and September 24, 28, 1987 surveys, respectively.

9636. The estimates in Table 3 use tidal prism volume, calculated by multiplying the tidal range by the surface area of the estuary north of Coggeshall St. Bridge to determine the flood and ebb volume fluxes. In this technique the volume fluxes exactly balance and

Table 3 Water volume and PCB mass transport at Coggeshall Street Bridge based on the EPA pre-operational survey data (July, September 1987)

Date	Tidal Range (m)	Water Volume ($10^{-6}m^3$) Flood	Ebb	Net*	PCB Mass Transport (gm/tidal cycle) Flood	Ebb	Net	Net (Tide Corrected)
July 9	1.4	0.539	0.539	0	365	278	87	87
July 13	1.3	0.500	0.500	0	297	366	-69	-69
Sept 24	1.2	0.462	0.462	0	175	252	-77	-77
Sept 28	1.0	0.385	0.385	0	150	199	-49	-49

*Negative indicates seaward transport

there is no net water transport.

9637. This method is similar to that employed by Otis (1988) in analyzing PCB transports at Coggeshall St. Bridge, as set forth in a Letter Report from Mark J. Otis, U.S. Army Corps of Engineers to Frank Ciavattieri, EPA. (October 19, 1988), Attachment Q.IV.0015 to these RFAs.

9638. Comparing the two different techniques to compute tidal (flood/ebb) volumes (Tables 1 and 3) it is noted that the transport directions remain the same; however the magnitudes can differ by 50% or more (September 28, 1987 survey).

9639. Table 4 shows estimates of these suspended sediment transports using current data to estimate the ebb and flood tidal volumes for the each of the four surveys.

9640. a. The net total suspended solids transport are 4690, 496, 3550, and 266 kg/tidal cycle for the July 9, 13 and September 24, 28, 1987 surveys, respectively.

9641. Landward transports of suspended sediment are observed on July 9 and September 28 and seaward transport on the

Table 4 Water volume and total suspended solids transport at Coggeshall Street Bridge based on EPA pre-operational survey data (July, September 1987)

Date	Tidal Range (m)	Water Volume ($10^{-6}m^3$) Flood	Ebb	Net*	TSS Transport (kg) Flood	Ebb	Net*
July 9	1.4	0.847	0.442	0.405	8147	-3457	4690
July 13	1.3	0.544	0.510	-0.034	3935	-4431	-496
Sept 24	1.2	0.500	0.919	-0.419	3682	-7232	-3550
Sept 28	1.0	0.829	0.877	-0.048	5920	-5654	266

*Negative indicates seaward transport

other two sampling days.

9642. a. The magnitude of suspended sediment transport (maximums) are typical of those observed by Teeter (1988) (Report A in plaintiffs' RFAs).

9643. b. Teeter (1988) never observed seaward transport.

9644. Table 5 shows the summary of observations for net PCB flux through the Coggeshall St. Bridge transect.

9645. a. Data from Teeter (1988) (Report A), the EPA (1983) Emergency Response Team Study, Otis' Letter (1988), Attachment Q.IV.0015, the ASA Transport Study, and the present analysis using the EPA pre-operational data are included.

9646. b. All PCB net flux estimates are tide corrected using Teeter's (1988) (Report A) method and are based on integrating the instantaneous fluxes to determine the volume transport.

9647. c. Data in the table include the number of tidal cycles sampled, and the range and average net PCB transport for each study.

Table 5 Summary of observations of PCB flux through the Coggeshall Street Bridge transect.

Study	Number of Data Sets	PCB Flux (kg/tidal cycle) Range	Average
Otis Letter (1988)	6	0.12 to 0.58	0.377
EPA/ERT (1983)	3	0.82 to 0.99	0.906
Teeter (1988)	3	0.07 to 2.36	1.55
ASA (1990)	9	0.02 to 1.208	0.417
EPA Data (1987)	4	-0.1 to 0.118	0.0485 0.0993*

Notes:
All estimates are tide corrected using Teeter's (1988) method.
Negative indicates landward flux in this table.
*If the one landward flux case is not included in the average.

9648. d. The net, tide corrected, seaward (except as noted) PCB transport range and average are 120 to 580 gm/tidal cycle (range) and 377 gm/tidal cycle (average) from Otis, Attachment Q.IV.0015, 820-990 gm/tidal cycle and 906 gm/tidal cycle from EPA, Emergency Response Team Study (1983); 70 to 2360 gm/tidal cycle and 1550 gm/tidal cycle from Teeter (1988) (Report A); 20 to 1208 gm/tidal cycle and 417 gm/tidal cycle for the ASA transport study (ASA 1990) and 100 (landward) to 118 gm/tidal cycle and 48.5 gm/tidal cycle from the present analysis of the EPA pre-operational data.

9649. In comparison to other studies the net PCB transport estimates based on the EPA pre-operational data (July 9, 13, and September 24, 28, 1987) are typically at the low end of those previously obtained. The highest transport estimates based on the EPA data are lower than the minimum observed in Otis (1988) or EPA (1983).

9650. Net PCB flux estimates at Coggeshall St. Bridge, based on the EPA pre-operational data (July 9, 13 and September 24, 28, 1987), show substantially lower average transport rates than any previous study for the area.

9651. a. They are a factor of approximately 8 to 30 times less than previous estimates.

9652. b. They are less than Teeter's (1988) estimate by a factor of 32.

Long-Term Fate of PCB Contamination in the New Bedford Harbor, Massachusetts, System, M.C. Richmond, L.F. Hibler, T.E. Michener, M.L. Kemner, D.S. Trent, and Y. Onishi paper presented at ASCE Meeting on Estuarine and Coastal Modeling, November 1989, Newport, Rhode Island.

9653. Attachment Q.IV.0016 is a true and accurate copy of a report entitled "Long-Term Fate of PCB Contamination in the New Bedford Harbor, Massachusetts, System" and is genuine.

9654. Attachment Q.IV.0016 is a business record.

9655. This report details the results of a three dimensional hydrodynamic and sediment contaminant transport model developed by Battelle to evaluate the transport and fate of PCBs in New Bedford Harbor.

applications.

f. The calculations used to derive Equation 25 provide reliable and accurate results.

g. The calculations used to derive Equation 25 are suitable for the use intended in Attachment Q.IX.0003.

h. The calculations used to derive Equation 25 have in part been relied upon by plaintiffs' experts in their assessment of the New Bedford Harbor Superfund Site.

i. The calculations used to derive Equation 23 have in part been relied upon by plaintiffs' experts in their assessment of the New Bedford Harbor Superfund Site.

10098. Dr. Thibodeaux was employed by the United States Army Corps of Engineers study chemodynamic processes in New Bedford Harbor.

10099. In addition to review of PCB sediment profiles developed from samples collected at Station FX and DR, Dr. Thibodeaux also reviewed thin layer sediment sampling program data generated by Balsam during March and April, 1990.

10100. Dr. Thibodeaux reviewed the 1990 supplemental PCB thin

layer sediment profile data developed for sample stations designated as STL-1, STL-2, STL-3 and STL-4.

10101. Attached as Attachment Q.IV.0017 is a true and accurate copy of a report entitled "New Bedford Harbor Supplemental Thin Layer PCB Sediment Sampling Program Data Report." Attachment Q.IX.0017 is a business record, which was prepared and received and kept in the ordinary course of business; it was in the ordinary course of business to prepare, keep and maintain such records; and the record was made at or near the time of a regularly conducted business activity by or from information transmitted by such a person with knowledge of such activity.

10102. Attached as Attachment Q.IV.0017 is a true and accurate copy of a report entitled "New Bedford Harbor Supplemental Thin Layer PCB Sediment Sampling Program Data Report.

10103. The locations of the four stations sampled during the March 1990 Supplemental Thin Layer Sediment Sampling Program are shown in Figure 1 of Attachment Q.IV.0017.

10104. PCB thin layer analytical data for sampling Stations STL-1, STL-2, STL-3 and STL-4 are presented in Tables 1, 2, 3 and 4, respectively, of Attachment Q.IV.0017.

10105. Based on review of the PCB analytical data contained in Tables 1, 2, 3 and 4 of Attachment Q.IV.0017, Dr. Thibodeaux concluded that the PCB profiles are very similar in nature to the profiles observed at Station FX of the initial 1988 thin layer sediment sampling program.

10106. Conclusions reached during Dr. Thibodeaux's initial analysis of thin layer sediment sampling data were consistent with the observed results from the Supplemental Thin Layer Sediment Sampling Program.

10107. Each of the four stations sampled during the March 1990 Supplemental Thin Layer Sediment Sampling Program were different in nature with respect to estuary hydrodynamics and/or reported PCB concentrations.

10108. Sampling from the four Stations during the March 1990 Supplemental Thin Layer Sediment Sampling Program provide a more extensive database to conclusively describe PCB transport mechanisms within New Bedford Harbor.

10109. The PCB analytical data contained in Tables 1, 2, 3 and 4 of Attachment Q.IV.0017 show PCB profiles very similar in nature to the profiles observed at station FX of the initial 1988 thin layer sampling program.

10110. Due to the varying nature of the hydrodynamic and contaminant levels present at Supplemental Thin Layer Sediment Sampling Stations STL-1, STL-2, STL-3 and STL-4, the Supplemental Thin Layer Sediment Sampling Program, in combination with the prior thin layer sediment sampling program, provide an adequate database for analysis of PCB flux mechanisms within the New Bedford Harbor Upper Estuary.

10111. In each of the four stations sampled during the Supplemental Thin Layer Sediment Sampling Program, classic "diffusion tales" were observed in the lower portion of each sample.

10112. The results of the Supplemental Thin Layer Sediment Sampling Program with respect to the observance of classic "diffusion tales" in the low portion of the samples are consistent with prior findings by Dr. Thibodeaux.

10113. The presence of "diffusion tales" in each of the four Supplemental Thin Layer Sediment Sampling Program station data sets indicates that diffusion is a principal PCB transport mechanism within New Bedford Harbor sediments.

10114. Table 5 of Attachment Q.IV.0017 presents QA/QC analytical data collected in support of the Supplemental Thin Layer Sediment Sampling Program.

10115. This table presents results of duplicate samples, trip blank samples, field blank samples, and equipment blank samples.

10116. The results of the QA/QC sampling data provided in Table 5 indicate that these PCB analytical data are reliable.

10117. The consistent findings between the initial 1988 thin layer sediment sampling program and the Supplemental Thin Layer Sediment Sampling Program corroborates the analytical modeling preformed by Dr. Thibodeaux with respect to the effectiveness of capping as a remedial approach for New Bedford Harbor.

Bench Scale Simulation of Capping Effectiveness

10118. Dr. Thibodeaux has performed a bench scale laboratory experiment which was conducted to simulate sediment bed capping in the Upper Estuary.

10119. The results of this experiment will be set forth in a paper that is in preparation entitled "The Efficiency of Capping Contaminated Bed Sediments in situ--1. Lab-Scale Experiments of Diffusion/Adsorption in the Capping Layer,"

X-Q, Wang, University Petroleum, Beijing, China; L.J. Thibodeaux, Kalliat T. Valsaraj and D. D. Reible, Louisiana State University, Baton Rouge, Louisiana, 70803.

10120. Results of this experiment are set forth in a paper that is in preparation entitled "The Efficiency of Capping Contaminated Bed Sediments in situ--1. Lab-Scale Experiments of Diffusion/Adsorption in the Capping Layer, 'IX-Q, Wang, University Petroleum, Beijing, China; L.J. Thibodeaux, Kalliat T. Valsaraj and D. D. Reible, Louisiana State University, Baton Rouge, Louisiana, 70803.

10121. The work was performed at L.S.U. and directed by Dr. Thibodeaux.

10122. This laboratory study was performed to observe the transport of the hydrophobic organic compound 2,4,6 trichlorophenol (TCP) through a capping layer placed over a contaminated sediment inoculated with TCP.

10123. A Capping Simulator Cell (CSC) was designed to simulate a submerged cap over contaminated sediment.

10124. Figure 2 (Attachment Q.IV.0018) accurately shows details of the CSC.

10125. The CSC is a closed-cell vessel which allows control over environmental and ambient conditions.

10126. The CSC was designed so that continuous and uniform thin sediment caps can be constructed over contaminated sediments without mixing the clean and contaminated sediments.

10127. Inlet and outlet reservoirs were designed as part of the CSC to minimize potential turbulence associated with inflow and outflow.

10128. The CSC was designed such that TCP transport through all paths could be evaluated.

10129. In normal operation, the bottom chamber of the CSC was filled with a sample of the contaminated sediment (slurry).

10130. The top chamber was then placed on and attached by screw bolts.

10131. The sediment was then leveled and a wet capping sediment was carefully spread over it and leveled to the desired depth.

10132. For simulation studies, a continuous flow of water at 5 to 75 ml/h was created by a peristaltic pump moved over the surface of the sediment.

10133. The outflow was collected and analyzed for its TCP content.

10134. Four types of capping sediments were utilized as capping material during this experiment.

10135. The capping sediments used were obtained from:

A. The LSU University Lake

B. The Tao River in China

C. A Baton Rouge, LA quartz sand source

D. A New Bedford, MA Tilcon Quarry sand sample obtained by Balsam, referred to as Balsam sediment.

10136. The University Lake sediment was collected under the direction of Dr. L. J. Thibodeaux.

10137. The Tao River sediment was collected under the direction of Dr. X-Q Wang.

10138. The quartz sand sediment was collected under the direction of Dr. L. J. Thibodeaux.

10139. The Balsam sediment was collected under the direction of Mr. L. C. Sarapas.

10140. TCP analyses of CSC outflow were performed in the LSU laboratories.

10141. These TCP analyses were conducted by GC methods.

10142. Quality Control measures were undertaken by LSU staff during these TCP analyses to assure the validity of these data.

10143. The LSU TCP analyses are valid and reliable.

10144. Table (Attachment Q.IV.0018) accurately describes the characteristics of the sediments used in the study.

10145. The Kp values in the last column are measured values.

10146. Water pH was less than or equal to 4.0 at all times; TCO was the neutral species.

10147. A batch of contaminated sediment was prepared using TCP as the chemical species.

10148. Antibiotics were added to eliminate bioactivity in the

sediment.

10149. The source of the contaminant bed sediment was University Lake on the L.S.U. Campus, Baton Rouge, Louisiana.

10150. One of the first experiments was with an uncapped contaminated sediment.

10151. Figure 6 (Attachment Q.IV.0018) accurately shows laboratory TCP flux data and the model simulation (solid line). This curve clearly displays the usual falling curve molecular diffusion transport process from a finite source.

10152. Figures 8 and 9 (Attachment Q.IV.0018) show the laboratory TCP flux and model simulation results for capping TCP contaminated bed sediment with very thin layers (6 mm for quartz sand and 7 mm for three other sediments) of sediments from Tao River, Balsam (Tilcon quarry), a local quartz sand source and University Lake.

10153. Initially, the flux of TCP through the clean cap material is 0.0 mg/CM4/s.

10154. Quantities of TCP then move from the contaminated underlayer into the clean cap material where adsorption of TCP takes place.

10155. Eventually, breakthrough occurs and TCP appears in the outflow.

10156. The flux rate increased with time, went through a maximum, and then decreased slowly thereafter.

10157. Table 2 (Attachment Q.IV.0018) summarizes the TCP breakthrough times.

10158. In general, as the organic matter content of the sediment increases, so does breakthrough time.

10159. This was expected based upon the theory of retarded diffusion for hydrophobic compounds.

10160. Effective diffusion coefficients were calculated by Dr. Thibodeaux based on the results of the CSC experiment.

10161. The calculated coefficients for the four capping materials tested are presented in Table 3 of (Attachment Q.IV.0018).

10162. The calculated diffusion coefficients are consistent with the breakthrough times reported in Table 2 (Attachment Q.IV.0018).

10163. The results of this CSC experiment are consistent with the modeling of cap effectiveness performed by Dr. Thibodeaux for the New Bedford Harbor site, and supports these modeling results.

Further Modeling of PCB Fluxes

10164. The deposition rate for sediment in the Upper Estuary ranges from approximately .5 of a centimeter to 4 centimeters per year.

10165. The deposition rate in the Upper Estuary of New Bedford Harbor ranges from .3 to 4 centimeters per year.

10166. The deposition rate of sediment in the Upper Estuary of New Bedford Harbor ranges from .2 to 4 centimeters per year.

10167. The deposition of new sediment over the contaminated sediment bed in the Upper Estuary of New Bedford Harbor will retard flux of PCBs from the contaminated sediment.

10168. Since January 1973 approximately 8 to 68 centimeters of sediment have been deposited over the contaminated sediment

bed in the Upper Estuary of New Bedford Harbor.

10169. Since January 1973 approximately 5 to 68 centimeters of sediment would have deposited on the contaminated sediment bed in Upper New Bedford Harbor.

10170. The deposition of 8 to 68 centimeters of sediment in the Upper Estuary of New Bedford Harbor would have substantially reduced the flux of PCB from the contaminated sediment bed.

10171. The deposition of 5 to 68 centimeters of sediment in the Upper Estuary of New Bedford Harbor would have substantially reduced the flux of PCB from the contaminated sediment bed.

10172. If one were to estimate the reduction of flux from the contaminated sediment bed resulting from deposition of new sediment, one could use a simple numerical model similar to that developed by Thibodeaux and Reible as Attachment.

10173. Attachment Q.IV.0022 is a business record.

10174. Given assumptions of PCB distribution similar to that found at Balsam's site FX (Attachment Q.IV.0022 such a model would predict a substantial decrease in flux from the sediment bed due to sediment deposition since January 1973 as compared to what is presently being released from the sediment bed.

10175. The results of such a model are a reasonable approximation of the physical chemical dynamics of PCB flux from the Upper Estuary sediment bed.