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March 9, 2007

Ms. Christine Williams
U.S. Environmental Protection Agency, Region I
1 Congress Street Suite 1100 (HBT)
Boston, MA 02114-2023

SUBJECT: RESPONSES TO FORENSICS STUDY COMMENTS FROM EPA REGION I CORRESPONDENCE DATED DECEMBER 14, 2007, DRAFT PHASE III QUALITY ASSURANCE PROJECT PLAN FOR INSTALLATION RESTORATION (IR) PROGRAM SITE 16 FORMER NAVAL CONSTRUCTION BATTALION CENTER (NCBC) DAVISVILLE, RI

Dear Ms. Williams:

The Navy's responses to the forensics study comments provided by U.S. EPA Region I in correspondence dated December 14, 2007 are enclosed. Four copies of the response-to-comments (RTC) document are forwarded to U.S. EPA Region I, and one copy of the RTC document is forwarded to RIDEM. As indicated recently, the Navy is proposing to collect additional forensics investigation samples in the Site 16 area to further evaluate the potential contribution of Site 16 source areas to the polycyclic aromatic hydrocarbon (PAH) contamination in the Allen Harbor sediments. The details of the additional forensics evaluations will be incorporated into the next version of the Phase III Quality Assurance Project Plan (QAPP) for Site 16.

If you have any questions, please do not hesitate to contact the Remedial Project Manager, Mr. Curt Frye, at 215-897-4914.

Sincerely,

David Barney
BRAC Environmental Coordinator
By direction of BRAC PMO

Enclosures:

1. Response to EPA Comments Dated 14 December 2006, Forensics Related Issues Concerning Allen Harbor Marina and IR Site 16, Former NCBC Davisville, North Kingstown, Rhode Island

Copy to:

Mr. Curt Frye, NAVFAC Midlant (1 copy)
Mr. Brian Balukonis, RIDEM (1 copy)
Mr. Rich Gottlieb, RIDEM (1 copy)
Dr. Ken Finkelstein, NOAA (1 copy)
Ms. Kathleen Campbell, CDW (2 copies)
Mr. Christopher Modisette, RI RCD (1 copy)
Mr. Steven King, Quonset Development Corporation (1 copy)
Mr. Jon Reiner, Town of North Kingston (1 copy)
Ms. Lee Ann Sinagoga, TtNUS Pittsburgh (1 copy)
Mr. Steve Vetere, TtNUS Boston (1 copy)
Ms. Maryellen Iorio, USACE (1 copy)

RESPONSE TO EPA COMMENTS DATED 14 DECEMBER 2006
FORENSIC RELATED ISSUES CONCERNING ALLEN HARBOR MARINA AND IR SITE 16
FORMER NCBC DAVISVILLE
NORTH KINGSTOWN, RHODE ISLAND

BACKGROUND

The Navy held a meeting with EPA and RIDEM on 08 December 2006 at the QDC office in North Kingstown, RI to discuss forensic issues related to the Allen Harbor Marine sediments and IR Site 16. As part of the Screening Level Ecological Risk Assessment (SLERA), which was published by the Navy in 2004, the Navy performed a forensics investigation of the Allen Harbor sediments. Based on this investigation, the Navy concluded that the PAHs detected in the sediments were not likely site related. To date, EPA and RIDEM have not concurred with the Navy's position.

The purpose of the meeting on 08 December 2006 was for the Navy to further explain and support its position to the regulators, enabling a path towards consensus. Following the meeting, EPA submitted comments by letter dated 14 December 2006 and identified aspects of the investigation that it believed would improve the conclusive nature of the study. EPA's comments and Navy's responses are summarized below. Please note that the below EPA comments are not verbatim – rather, they are a summary of each EPA comment, created by the Navy, in order to make the comments and responses more readable and to focus on what the Navy perceived to be the main issues presented by the EPA comment. For the full text of EPA comments, please refer to the EPA's letter of 14 December 2006. Additionally, the comments have been numbered by the Navy to allow a more orderly sequence of comment/response.

EPA General Comment 27a:

EPA believes that the PAH concentration in Allen Harbor should be more uniform if contributions from the dock pilings were the primary PAH source.

Navy response to EPA General Comment 27a:

The PAH concentrations in Allen Harbor are consistent with contributions from three candidate sources that are not associated with Site 16. First, the deposition of fine particulates from Narragansett Bay is expected to begin near the narrow inlet of Allen Harbor and increase with distance away from the Narragansett Bay towards the inner reach of Allen Harbor. The deposition of fines is expected to be lower near the inlet of Allen Harbor and greater in the Inner Harbor as a result of hydrodynamic processes. The settling of fine particulates in Allen Harbor is significant for this study, because the fines contain higher proportions of PAHs than larger particles. The preferential deposition of fines in the Inner Harbor verses the Outer Harbor should create subtle PAH gradients throughout Allen Harbor based on background conditions alone (Forensic Report Figure 9). Consequently, a range of PAH concentrations that are generally lower near the inlet of the Narragansett Bay and higher in the Inner Harbor is consistent with the conceptual site model presented in the SLERA.

Second, localized areas of higher PAH concentrations are expected around marina docks constructed from creosote treated wood (Forensic Report Figure 9). Creosote is a tar product that is often refined based on standards developed by the wood treating industry. Like the creosote leaching studies identified by EPA, creosote leachate and abraded solids from these structures will migrate into the surrounding environment. Due to the high levels of PAHs in creosote, even small amounts of this material can cause elevated PAH concentrations in sediment samples. The complex and variable nature of this migration may not be consistent at every piling location. Furthermore, the composition of each piling is not necessarily identical as these structures have been built and replaced at varying times. For this reason, localized areas of elevated PAHs associated with creosote are expected to be heterogeneous in concentration and composition.

Third, localized areas of higher PAH concentrations are expected near storm sewer outfalls (SLERA Appendix B Figure 9). The storm sewers collect abraded pavement, roadway sealer, vehicular soot, vehicular fuels,

motor oil drippings, and other materials that are known to contain a wide variety of hydrocarbons and PAHs. The variable rates of roadway abrasion, storm water events, and seasonal changes in roadway use (e.g., heavy vehicular traffic in boating season and sanding in winter) will likely introduce variability in the concentration and composition of hydrocarbons conveyed to the Allen Harbor sediments by the storm sewer system. Therefore, some degree of chemical difference is expected between samples collected in the storm sewers and the Allen Harbor sediments. If we assume a normal sedimentation rate of 1 to 4 cm/yr in Allen Harbor, samples collected from sediments several inches thick will contain material deposited over many seasons, if not years. Therefore, sediments near the outfall represent time averaged contributions from the storm sewer and sediments collected within the storm sewer are snapshots of the material flowing through the storm sewer at one specific time. The PAH concentration and compositions are not expected to match perfectly. Rather, they are used together to demonstrate the contribution and variability of roadway materials accumulating in Allen Harbor sediments. Collectively, these samples establish that the storm sewers convey hydrocarbons and PAHs to Allen Harbor sediments. These hydrocarbons mix with and are buried by ambient sediments over time. Additional variability is introduced through this mixing process.

In summary, the PAH concentration gradients are not expected to be perfectly uniform in Allen Harbor. The variation in the settling rate of fine particles supplemented with localized influences of marina structures and roadway runoff sufficiently explain the observed range of PAHs (2 to 28 mg/kg of EPAPAHs) in Allen Harbor. The spatial distribution of the past samples is adequate for associating elevated levels of PAHs with marina structures and storm sewer outfalls. The contribution of PAHs from Site 16 was not evident in the form of a PAH concentration gradient and the lack of compositional similarity among Source Area soil and Allen Harbor sediment samples.

EPA General Comment 27b:

EPA believes that the PAH contributions from the storm drain in the southeast corner of Allen Harbor may include runoff contributions from Site 16. The data presented in the SLERA do not define the areas that are drained by the storm sewer system, some of which might include Site 16.

Navy response to EPA General Comment 27b:

The forensic analysis demonstrates that the hydrocarbons in the Site 16 samples associated with the creosote dip tank operation (Source Areas 1 and 2) and fire fighter training area (Source Area 3) were different than the sediment collected from the storm sewer (Source Area 4) and southeast out fall area in Allen Harbor (AH-49). The distinct source signatures of samples from the creosote and fire fighter training areas were not observed in the storm sewer and Allen Harbor samples; therefore, the difference in compositional features demonstrates that Site 16 was not a significant source of PAHs in Allen Harbor.

In addition, the hydrocarbons from a second roadway runoff area (AH-28) exhibited elevated PAHs (compare 25 mg/kg EPAPAHs in AH-28 with 28 mg/kg EPAPAHs in AH-49). Importantly, the sediment in this outfall area possessed no potential influence from Site 16. In other words, elevated PAHs and hydrocarbons were evident in two areas along Allens Harbor Road regardless of potential influence from Site 16. Therefore, the dominant source of PAHs in Allen Harbor is primarily attributed to the surrounding roads and local land use.

In summary, the likelihood that Site 16 significantly increased PAHs in the surface sediments of the southeast corner of Allen Harbor was unlikely based on two lines of evidence: 1) the compositional differences between the creosote and fire fighter training areas verses Allen Harbor sediments and 2) the similar composition of sediments collected from multiple Allen Harbor sediment locations that received roadway runoff.

Despite these arguments in favor of the conceptual site model presented in the SLERA, Navy will investigate and map the storm sewer system as part of its planned activities in 2007. The details of this supplemental investigation will be included in a work plan under separate cover.

EPA General Comment 27c:

EPA believes that the PAH gradients demonstrated in the SLERA report are too sparse to develop a persuasive picture of the gradient near the southern dock.

Navy response to EPA General Comment 27c:

The sampling intensity was adequate for developing a site model, risk assessment, and forensic analysis of Allen Harbor. In total, more than 20 sediment samples were collected for the SLERA in the Inner Harbor alone. These samples were located with an emphasis on demonstrating the presence of significant concentration gradients radiating from the Seep Areas, Site 16 shoreline, and storm water outfalls. Navy specifically adopted EPA recommendations concerning the collection of two additional non-random samples along transects from the Seep and Storm Sewers when drafting the SLERA work plan (Navy 2003, RTC-EPA Comment 2). Furthermore, EPA stated that, "The random sampling of sediments provides generally good coverage of the three sections in the harbor." (Navy 2003, RTC-EPA Comment 11). Navy perceives a significant incongruity in the decision by EPA to render a criticism at this time about inadequate sampling resolution when the data generated fail to implicate the Site 16 with PAH contributions to Allen Harbor. The data were generated as part of a well reasoned and reviewed work plan. The past data require no additional work.

Despite the adequacy of the previous SLERA investigation, Navy will collect a limited number of additional sediment samples between the Site 16 shoreline and the southern dock to further demonstrate variability in these transects. This work will be included as part of Navy's planned activities in 2007. The details will be included in a work plan under separate cover.

EPA General Comment 27d:

EPA is troubled by the inconsistency of elevated PAHs next to selected dock structures. It questions why some samples collected near marina structures would have elevated PAHs (AH-29 EPAPAH = 24 mg/kg and AH-35 EPAPAH = 22 mg/kg) while others are not particularly elevated (AH-17 EPAPAH = 6.88 mg/kg and AH-23 EPAPAH = 11.9 mg/kg).

Navy response to EPA General Comment 27d:

Some variability in the concentration and composition of sediments around the marina pilings is expected for several reasons. First, the observed PAH concentrations in sediments around the marina pilings require a very large dilution. Recognizing that creosote can contain upwards of 100,000 mg/kg of EPAPAHs, the dilution factor necessary to reach the observed PAH concentrations in Allen Harbor sediments would be three to four orders of magnitude. In other words, the elevated concentrations of PAHs observed near the marina pilings likely reflect the presence of very small fragments of marina pilings mixed at a ratio greater than 1:1000 with ambient sediment. The presence of two or three small fragments in the same mixture will account for the range of concentrations observed around the marina structures.

Second, the pilings are not likely preserved with the same material. The variable nature of the treated wood is common to most dock structures that have experienced repairs or expansions over time. Some marina structures may be treated with creosote alone; some with mixtures of creosote and petroleum; and some with mixtures that contain no creosote at all. Therefore, sediments collected around marina structures treated with creosote will have more PAHs than those treated with creosote blends or no creosote at all.

Third, the age of the marina structures vary. The rate of particle abrasion from older or more weathered pilings will likely be higher than more recently treated structures. The older structures (more splintered and brittle) will be more prone to abrasion. Similarly, the species of wood used to make the marina structures will offer different rates of degradation.

In summary, the release of PAHs from marina structures into proximal sediments should be variable, not uniform. This variability is caused by high dilution rates, changes in the preservative formulation, different

product age, and inconsistent species of wood. As stated previously, the findings presented in the SLERA are consistent with the observed data.

EPA General Comment 27e:

EPA observed that a strong correlation exists between one groundwater sample collected from a temporary monitoring well (03 28-GW-07S) in 1998 and sediment from Seep 16-01. It contends that this compositional similarity is inconsistent with forensic evidence that demonstrate an incomplete pathway between the Source Areas, Seep 16-01, and Allen Harbor sediments.

Navy response to EPA General Comment 27e:

EPA is correct to point out that the observed strong correlation between 03 28-GW-07S and the Seep 16-01 appears incongruous with the Navy's position. However, the Navy believes the observed correlation between 03 28-GW-07S and Seep 16-01 is an anomaly. The Navy previously discussed the reasons for this conclusion. First, Navy noted that the PAHs detected in 03 28-GW-07S were generally measured below conservative screening levels for risk and are not considered hazardous. Second, Navy pointed out that groundwater results from proximal monitoring wells yielded non-detects that supported the discontinuous pathway from the Site 16 Source Areas (creosote and fire fighter training) to Allen Harbor. Third, sample 03 28-GW-07S pathway was situated near Building E107 and an underground storage tank (UST) area. Navy believes that low levels of fuel may have caused the anomalous PAH measurements. Fourth, sample 03 28-GW-07S was collected from a temporary monitoring well that likely contained groundwater whose composition was predominantly influenced by resuspended and otherwise immobile particulate phase hydrocarbons.

Navy recognizes that the correlation coefficient between 03 28-GW-07S and SEEP16-01 is good (R^2 between 0.80 around 0.85). However, Navy also recognizes that the correlation coefficient is likewise very poor when compared to Site 16 Source Area soils, Reference Area sediments, and Allen Harbor sediments (Table 1 – these R^2 values were all less than 0.3). Therefore, the composition of 03 28-GW-07S may resemble SEEP16-01, but these PAHs are not from the creosote or fire fighter training areas and they generate no recognizable impact on Allen Harbor sediments. The notion that sample 03 28-GW-07S demonstrates a potential pathway from the Site 16 Source Areas to Allen Harbor is erroneous.

Despite the above, the Navy will collect additional soil and groundwater samples in the vicinity of sample 03 28-GW-07S to confirm that hydrocarbon migration is not occurring in this area of the site. A particular emphasis will be placed on evaluating potential residues from the UST area formerly located near Building 107. The details will be included in a work plan under separate cover.

Table 1. Statistical comparison of 03 28-GW-07S to proximal groundwater, seep, soils, and sediments.

Sample	Matrix	Description	Correlation Coefficient (R^2)
28-GW07	Groundwater	Temporary Monitoring Well Near Seep	1.000
SEEP16-01	Surface Water	Seep	0.853
SEEP16-01D	Surface Water	Seep	0.805
MW16-03S	Groundwater	Upgradient of 28-GW07	non-detect
MW16-05S	Groundwater	Upgradient of 28-GW07	non-detect
S1-1	Soil	Creosote Area	0.275
S1-2	Soil	Creosote Area	0.298
S2-1	Soil	Creosote Area	0.051
S2-2	Soil	Creosote Area	0.079
S3-1	Soil	Fire Training	0.099
S3-2	Soil	Fire Training	0.143
S4-1	Sediment	Storm Sewer	0.088
R1-1	Sediment	Reference Area	0.143
R1-2	Sediment	Reference Area	0.220
R1-4	Sediment	Reference Area	0.230
R2-1	Sediment	Reference Area	0.244
R2-3	Sediment	Reference Area	0.228
R2-5	Sediment	Reference Area	0.205
R3-1	Sediment	Reference Area	0.184
R3-2	Sediment	Reference Area	0.172
R3-4	Sediment	Reference Area	0.185
AH03	Sediment	Outer Harbor	0.246
AH06	Sediment	Outer Harbor	0.203
AH08	Sediment	Outer Harbor	0.210
AH11	Sediment	Outer Harbor	0.169
AH17	Sediment	Middle Harbor	0.184
AH23	Sediment	Middle Harbor	0.174
AH26	Sediment	Middle Harbor	0.095
AH26D	Sediment	Middle Harbor	0.099
AH28	Sediment	Middle Harbor	0.090
AH29	Sediment	Middle Harbor	0.220
AH32	Sediment	Inner Harbor	0.130
AH33	Sediment	Inner Harbor	0.134
AH35	Sediment	Inner Harbor	0.086
AH40	Sediment	Inner Harbor	0.070
AH42	Sediment	Inner Harbor	0.082
AH45	Sediment	Inner Harbor	0.154
AH47	Sediment	Inner Harbor	0.100
AH49	Sediment	Inner Harbor	0.059
AH51	Sediment	Outer Harbor	0.141

These correlation coefficients were calculated using the PAHs detected in 03 28-GW-07S (naphthalene, 2-methylnaphthalene, acenaphthene, fluorene, anthracene, phenanthrene, fluoranthene, and pyrene) after normalizing each concentration to the total concentration of these 8 PAH analytes in each sample.

Comments on Appendix B, Final Report,
Environmental Forensic Investigation, Site 16

EFI Comment 1a

EPA is concerned that environmental weathering could alter the PAH composition of hydrocarbon migrating from Site 16 to Allen Harbor; especially with respect to ratios used in the forensic investigation to identify refined tar products (i.e., the ratio of anthracene to phenanthrene - A0/P0). EPA emphasized that the conditions under which environmental weathering occurs is different on land than in sediment.

Navy response to EFI Comment 1a

Navy explained the effects of environmental weathering previously. The term environmental weathering refers primarily to the collective effects of volatilization, dissolution, and biodegradation. Researchers have established that 2- and 3-ring PAHs are more susceptible to environmental weathering than 4- to 6-ring PAHs. The molecular changes associated with abiotic weathering (e.g., volatilization and dissolution) will affect isomers, like A0 and P0, in approximately equal measure. In other words, these isomers will be altered at similar rates and the ratio of A0/P0 will not change significantly. The molecular changes associated with biodegradation can result in the preferential reduction of selected hydrocarbons. For example, many species of microbes sequentially degrade:

1. normal linear alkanes (e.g., n-C_{17} and n-C_{18}),
2. isoprenoids (e.g., pristine and phytane),
3. parent aromatic hydrocarbons (e.g., phenanthrene and anthracene), and
4. alkylated aromatic hydrocarbons (e.g., methylphenanthrenes).

This sequential biodegradation is largely governed enzymes known as mono- and di-oxygenases that add one or two oxygen atoms, respectively, to the hydrocarbon molecule. Once oxygenated, the compound can be more readily metabolized. Aromatic hydrocarbons are more difficult to initially oxygenate than aliphatic hydrocarbons, because of the high degree of molecular stability offered by the benzene ring structure. Many of the enzymes capable of oxygenating aromatic compounds exhibit broad specificity within each class of hydrocarbon compounds and are not isomer specific for parent PAHs. For example, dioxygenases capable of degrading aromatic hydrocarbons are also capable of degrading heterocyclic aromatics, saturated rings, and linear alkenes. The evolutionary rationale for broad specificity within hydrocarbon classes is an interesting topic, but beyond the scope of this discussion. What is important about the biodegradation process is that hydrocarbon degrading bacteria generally specialize in classes of compounds (e.g., normal alkanes, isoprenoids, parent PAHs, and alkylated PAHs). Within a class of hydrocarbons, lighter molecular weight compounds are degraded before heavier constituents. When the class of hydrocarbons is reduced (but rarely eliminated entirely), a different population(s) of bacteria will begin to degrade the next class of more bioresistant hydrocarbons. The rate of biodegradation is a function of terminal electron acceptors, nutrients, microbial species, water, temperature, hydrocarbon types, and lack of biocides. The rate will be higher in oxygen containing and lower in saline environments.

The bottom line is that diagnostic compounds such as A0 and P0 are expected to degrade in the environment. The biotic and abiotic processes of degradation are expected to reduce both compounds at approximately equal rates. The available literature provided in the SLERA and Navy's initial response to comments supports this conclusion. At present, the only known process for generating a high A0/P0 ratio is through specialized industrial refining. Published accounts of anthracene enrichment are complemented by numerous environmental investigations at tar refineries and wood treating plants in which creosote residues in surficial tar deposits and subsurface soils forensically match PAH enriched sediments in proximal waterways. Despite long residence time in terrestrial and sediment environments, the A0/P0 ratio consistently identified fugitive creosote. Collectively, these lines of evidence support the use of the A0/P0 ratio as presented in the SLERA report. If EPA possesses any specific evidence to refute the use of this ratio as presented, it is requested that the EPA provide this information to Navy before April 2, 2007.

EFI Comment 1b

EPA requests a more extensive discussion about the variability in the A0/P0 ratio among Source Area samples.

Navy response to EFI Comment 1b

The forensics report and December 2006 presentation provide the multiple lines of evidence used to differentiate the Source Area samples from the pyrogenic PAHs observed in Allen Harbor in detail. Navy acknowledges that the A0/P0 ratio varies among the Source Area samples. Source Area samples with low A0/P0 ratios (e.g., Source 2-1) are distinguished from Allen Harbor sediments based on separate lines of evidence. Source 2-1 contained weathered middle distillate that is likely kerosene. Kerosene was not observed in Allen Harbor sediments. Source 2-2 also contained weathered middle distillate that is likely biodegraded diesel fuel. The PAHs in Allen Harbor (mostly pyrogenic 4- to 6-ring PAHs) are clearly not derived from a plume of biodegraded diesel (petrogenic 2- to 3-ring PAHs). Source samples 3-1 and 3-2 contain residual petroleum with biomarker patterns that do not match the Allen Harbor sediments. The only Source Area samples for which the A0/P0 is important are the samples with creosote. Source 1-1 and 1-2 possess high A0/P0 ratios (1.5 to 2). None of the Allen Harbor sediments along the Site 16 shoreline exhibit this characteristic feature; therefore, the migration pathway is incomplete.

EFI Comment 1c

EPA requests a more extensive discussion about the analytical uncertainty of diagnostic PAH compounds. EPA is concerned because the concentrations of PAH in some of the duplicates vary by a factor of 2.

Navy response to EFI Comment 1c

The assessment of variability in the PAH results is centered on duplicate measurements of the same parameter. Table 2 summarizes the duplicate measurements among the two batches of samples collected from Allen Harbor that were measured for PAHs. The relative percent difference (RPD) is calculated for each set of duplicate results that are associated with the A0/P0 ratio. The performance standard for the RPD is less than 30% as stated in the work plan. The primary corrective action for RPDs greater than 30% is a review of the data for evidence of matrix heterogeneity.

A comparison of the laboratory control (LCS) samples demonstrates variability within the analytical method in the absence of variability associated with the matrix. In this case, the measured amount of A0, P0, and P0d10 (the surrogate) yielded RPDs of 20% which satisfied the 30% performance criteria. The proportional nature of this shift did not affect the A0/P0 ratio (RPD = 1%).

The laboratory duplicates consist of aliquots of the field sample withdrawn from the same sample container. One laboratory duplicate was created as part of the batch QC for each sample delivery group. The duplicate from the first batch of samples (i.e., AH-26 and AH-26 Duplicate) demonstrate the variability of the analytical method plus the variability of this particular field sample matrix. These data demonstrate a consistent RPD among PAH analytes (A0 = 10% RPD and P0 = 11% RPD) and the associated surrogate (P0d10 = 8% RPD) that satisfied the performance criteria. Again, the laboratory and matrix precision did not alter the A0/P0 ratio (RPD = 0%).

The second batch of samples was associated with the duplicate set including Core 1-Bottom and Core 1-Bottom Duplicate. In this case, the precision of the A0 and P0 measurements exceeded the performance criteria (RPD A0 = 116% and P0 = 41%) and prompted a review of the data. These results did affect the A0/P0 ratio (RPD = 85%). This review of the data indicated numerous source signature differences between the sample and its laboratory duplicate. The surrogate RPD was 7% which indicated that the analytical method performed well, but the matrix heterogeneity was high. In practical terms, the first sample was very clean (EPAPAHs = 2.8 mg/kg) and the second sample contained a few small fragments of pyrogenic material not present in the first sample (EPAPAHs = 12.5 mg/kg). In summary, this sample simply contained heterogeneous sources of PAHs.

Three sets of blind field duplicates were also associated with the PAH samples. In this case, the sample was homogenized in the field and split samples were submitted to the laboratory in separate sample containers with distinct field identities (i.e., DUP 01, DUP 03, and DUP 07). The exact associations of the "DUP" and field samples were not revealed until after the data were reported and independently validated.

The first two blind duplicate sets (AH-06 & DUP03 and AH-11 & DUP01) satisfied the performance criteria. The laboratory precision (P0d10 RPD = 1% to 3%) was about 13% better than field matrix precision (A0 and P0 RPD = 12% to 18%). The A0/P0 source signature for these samples was not distorted by the different degrees of laboratory and matrix variability. In summary, the RPD differences in these samples indicated that a few extra fragments of pyrogenic PAH material were present in one of the samples, but the origin of this material was likely the same based on the consistent A0/P0 ratio. The third blind duplicate set (AH-33 & DUP07) also exhibited better laboratory precision (P0d10 RPD = 20%) than the matrix precision (A0 RPD = 38% and P0 = 43%). The collective difference in measured PAH concentrations exceeded performance criteria. However, the difference was consistent and did not affect the source signature (A0/P0 = 5%). Again, this finding demonstrates the likely presence of a few extra fragments of pyrogenic PAH material in one of the samples, but the origin of this material was likely the same based on the consistent A0/P0 ratio.

Table 2. Duplicate measurements among Allen Harbor sediment samples.

Sample ID	Sample Type	Batch	Relative Percent Difference (RPD)			
			A0 %	P0 %	A0/P0 %	P0d10 %
BE162LCS-P	LCS	S04-0117MS	20%	20%	1%	20%
BE165LCS-P	LCS	S04-0118MS				
AH-26	Sample	S04-0117MS	10%	11%	0%	8%
AH-26	Lab Duplicate	S04-0117MS				
Core 1-Bot	Sample	S04-0118MS	116%	41%	85%	7%
Core 1-Bot	Lab Duplicate	S04-0118MS				
AH-06	Sample	S04-0117MS	17%	12%	5%	3%
DUP 03	Blind Duplicate	S04-0117MS				
AH-11	Sample	S04-0118MS	12%	18%	6%	1%
DUP 01	Blind Duplicate	S04-0118MS				
AH-33	Sample	S04-0118MS	38%	43%	5%	20%
DUP 07	Blind Duplicate	S04-0118MS				

A0 Anthracene
P0 Phenanthrene
P0d10 Phenanthrene-d10 (Surrogate)

$$RPD = \frac{|\text{Difference}|}{\text{Average}} * 100$$

In summary, this study experienced some degree of matrix heterogeneity and laboratory variability. However, the source signatures of diagnostic PAH ratios, like A0/P0, were unaffected.

EFI Comment 2a

EPA requested clarification as to how regional background, marina, and storm sewer releases can be recognized.

Navy response to EFI Comment 2a

The primary forensic objective of Navy was the determination of Site 16 contributions to Allen Harbor. None were observed.

Based on the available data, Allen Harbor sediments are compositionally most similar to the Reference Areas (SLERA Appendix B Figure 11a for PAHs and Table 6 for heavy petroleum). As discussed previously, the absolute hydrocarbon concentrations in Allen Harbor are higher than the Reference Areas, but the difference

is attributed to the preferential deposition of fine grain particles in Allen Harbor. See Navy response to EPA General Comment 27a for more detailed discussion of fine particles. Except where noted below, the Narragansett Bay is a likely and significant source of EPAPAHs below about 15 mg/kg in Allen Harbor.

Localized influences of residual petroleum from roadway runoff are evident at AH-28 and AH-49 (SLERA Appendix B Table 6 Triterpane Pattern E). The somewhat elevated concentrations of PAHs at these locations more closely resemble regional background (SLERA Appendix B Figure 11a), perhaps the result of concentrating terrestrial runoff in the storm sewer system. Localized influences of creosote from marina structures are evident in samples AH-03 and AH-29 (SLERA Appendix B Figure 11a). The full extent of these contributions in Allen Harbor is unknown, but likely significant in sediments with more than 15 mg/kg EPAPAHs.

EFI Comment 2b

EPA stated that the number and distribution of forensic samples is not sufficient to demonstrate unequivocally that the docks are the source of PAHs in harbor sediments.

Navy response to EFI Comment 2b

The primary forensic objective of Navy was the determination of Site 16 contributions to Allen Harbor. The objective has never been to unequivocally reconcile the full magnitude of non-Site 16 sources of PAHs in Allen Harbor. The data were used to construct a conceptual site model to reconcile the available data in accordance with interrelationships that are more likely than not correct. EPA's expressed interest in an unequivocal source apportionment for non-Site 16 sources is well beyond the scope of Navy obligations. (Please note that, if the contaminants in Allen Harbor <u>were</u> determined to be site related, then, per Navy policy, a Watershed Contaminated Source Document [WCSD] would in fact be required. The purpose of this document would be to identify all of the potential sources of contamination to the harbor, site related and non-site related, in order to determine the extent of the Navy's responsibility, as well as the estimated effectiveness of any potential remedy dealing only with the site related contribution. For a copy of the Navy policy: see *http://enviro.nfesc.navy.mil/erb/erb_a/regs_and_policy/don_policy_sediment.pdf*).

Despite the absence of a requirement that Navy reconcile the impact of storm sewer effluent in Allen Harbor, it will collect several additional samples of roadway materials to further evaluate the types of hydrocarbons present in storm sewer drainage area. An emphasis will be placed on collecting samples of new and old paving materials. The details of this supplemental investigation will be included in a work plan under separate cover.

EFI Comment 3

EPA expressed an interest in incorporating examples of weathered creosotes with different formulations into the report.

Navy response to EFI Comment 3

Navy is planning to collect a limited number of additional soil samples from the creosote treating area on Site 16. It is also planning to collect several samples from the marina pilings themselves. Collectively, these will serve as the primary basis for demonstrating a more broad range of creosote formulations associated with potential impacts to Allen Harbor sediments. Sediment samples will be collected near the pilings sampled previously. The details of this additional work will be included in a work plan under separate cover.

EFI Comment 4a

EPA expressed a need to further explore and delineate the storm sewer system.

Navy response to EFI Comment 4a

Navy intends to further explore and delineate the storm sewer system. The details of this additional work will be included in a work plan under separate cover.

EFI Comment 4b

EPA noted a high correlation between the groundwater sample 03 28-GW-07S and SEEP 16-01. It expressed a need to further investigate the source of SEEP 16-01.

Navy response to EFI Comment 4b

Navy contends that the PAH contribution of SEEP 16-01 is not associated with the PAHs in the creosote treating area, fire fighter training area, or Allen Harbor sediments (see Navy response to EPA General Comment 27e). However, Navy intends to further explore the soil and groundwater constituents at and upgradient of SEEP 16-01 with an emphasis on potential residues from a nearby former UST area and former septic tank area.

EFI Comment 5a

EPA believes the data are inconclusive with respect to Navy's assertion that the PAH concentrations in Allen Harbor are homogeneous. EPA is also not convinced that the dock piling and storm sewers are the "most likely" sources of PAHs in Allen Harbor.

Navy response to EFI Comment 5a

In general, Navy believes that the sediments within Allen Harbor are relatively homogeneous. The PAHs fall within a low and narrow concentration range (EPAPAHs from 2 to 28 mg/kg). Most sediment throughout the Inner, Middle, and Outer Harbor contain ∑EPAPAHs below 15 mg/kg with slight elevations near the marina pilings and storm sewer outfalls. Most Allen Harbor sediments are dominated by plant waxes mixed with heavy residual petroleum and low levels of PAHs. These are the same hydrocarbon features observed in the Reference Area sediments. With the exception of samples near the marina pilings and storm sewer outfalls, the sediment samples in the Inner, Middle, and Outer Harbors possess very similar chemical fingerprints. It is on the basis of these findings that Navy describes the Allen Harbor sediments as homogeneous.

The origins of PAHs in Allen Harbor are mixed. Against the background hydrocarbon features described above, the most significant source of PAHs in Allen Harbor is most likely the marina pilings and storm sewer effluent. Samples of these features will be collected as part of Navy sampling activities in 2007. The details of this additional work will be included in a work plan under separate cover.

EFI Comment 5b

EPA adopted language for associating AH-35 with Seep 16-01 from the comments column in Table 2-3 which describe this location as "gradational from seep."

Navy response to EFI Comment 5b

Navy has clarified that sample location AH-35 is best described as "proximal to piling." All parties agree. No further action is required.

EFI Comment 6

No further action is required.

EFI Comment 7

EPA questions the use of A0/P0 to identify PAH impacts from Site 16 to Allen Harbor.

Navy response to EFI Comment 7

The A0/P0 ratio is only used to help determine that Site 16 creosote did not impact Allen Harbor sediments. Its use was appropriate. See Navy response to EFI Comment 1b for further details on the multiple lines of evidence approach used to demonstrate the absence of impacts from other Site 16 Source Areas.

Navy Response to EPA Recommendations

As presented at our meeting in December, Navy is planning to conduct addition work at Allen Harbor in accordance with the tasks summarized in this section. This additional work is complex and beyond the scope of this document. The details of this supplemental investigation will be included in a work plan under separate cover. If these data support the conceptual site model proposed in the SLERA report, regulatory concurrence with the results is anticipated.