TETRA TECH NUS, INC.
55 Jonspin Road • Wilmington, MA 01887-1020
Tel 978.658.7899 • Fax 978.658.7870 • www.tetratech.com

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Project Number N7397

March 28, 2001

James Shafer, Remedial Project Manager
U.S Department of the Navy
Naval Facilities Engineering Command
Northern Division
10 Industrial Highway
Code 1823, Mail Stop 82
Lester, Pennsylvania 19113-2090

Subject: Response to Comments on the
Proposed Sediment PRG Development for the Old Fire Fighting Training Area
Comments Dated February 7, 2001

Dear Mr. Shafer:

Enclosed you will find a response package to comments received from USEPA on the *Proposed Sediment PRG Development (January, 2001).* This response package includes a response to comments provided by the EPA (Attachment A), a revision to the approach proposed by the Navy in accordance with the comments and responses (Attachment B) and a summary table of calculated PRGs and a map showing potential action areas based on these PRGs (Attachment C).

You will note that PRGs provided in Attachment C were calculated using ingestion of shellfish, sediment exposure to humans wading in the intertidal area, and ecological receptors. Backup tables and a text summary of the development of these PRGs are currently being completed and will be provided to reviewers as soon as they are available.

Very truly yours,

Stephen S. Parker
Project Manager

SSP/rp

Enclosure

c: M. Griffin, NSN (4 w/encl.)
K. Keckler, USEPA (3 w/encl.)
P. Kulpa, RIDEM (4 w/encl.)
J Stump, Gannett Fleming (2 w/encl.)
K. Finkelstien, NOAA (1 w/encl.)
D. Egan, TAG (1 w/encl.)
J. Trepanowski/G. Glenn, TtNUS (1 w/encl.)
File N7397-3.2 (w/o encl.)

bc: G. Tracey, SAIC (2 w/encl)
J. Quinn, URI (2 w/encl)
File N7397-8.0 (1 w/encl.)

ATTACHMENT A
Response to Comments on the Proposed PRG Development Approach
Comments Provided by the EPA, February 7, 2001

<u>Page</u> <u>Comment</u>

p.2, No.1 The discussion in the first and second paragraphs on this page presents the rationale for disqualification of the development of sediment PRGs for human ingestion of shellfish. The Navy suggestion for disqualification is because of the considerable uncertainty associated with the risk analysis for the subsistence fisherman including the absence of subsistence fishing in the area. While it appears unlikely that no subsistence fishing occurs in the area, recreational fishing does occur and commercial lobster pots have been identified. Therefore, PRGs need to be developed based on human consumption of shellfish.

PRGs could then be evaluated as they were at McAllister Point (Appendix D, TetraTech NUS, February 1999). At McAllister Point, PRGs for human shellfish consumers were developed and then the use of the PRGs as cleanup values was evaluated as a risk management task. Sediment PRGs were also developed based on human consumption of shellfish at Derecktor shipyard (Appendix B, TetraTech NUS, July 1999) and implementation of the PRGs as cleanup levels was evaluated on a chemical by chemical basis.

Response: *The Navy concurs with the EPA, and PRGs will be calculated for recreational ingestion of shellfish. The Navy believes that this recreational exposure is an appropriate and conservative estimate of any human exposure to shellfish that may occur at the site. These PRGs will be calculated for contaminants that provide elevated risk in the risk assessment: those that exceed or approach a 1E-6 cancer risk, or a hazard index of 1.0. Since ingestion of lobster provided the highest risk, this exposure endpoint will be used. In concert with the approach used for McAllister Point, contaminant specific PRGs will be calculated to a concentration targeting 1E-6 cancer risk or a hazard index of 1.0. Since there are fewer than 10 carcinogenic COCs, this will assure that the aggregate risk for all contaminants will be 1E-5 or lower. The concentration of arsenic in the shellfish tissue will be adjusted to account for the presence of arsenic in its organic form. These PRGs will be applied to scope remedial activities for the marine sediments (OFF-1 through OFF-21) investigated at Coasters Harbor.*

p.2, No. 3 The presentation clarity of the aquatic pathway PRG process has improved from that used for McAllister Point. The presentation of step 3 could be improved further by only using two bullets to identify the definitions of toxicity; the first bullet for the amphipod and the second bullet for the sea urchin.

Response: *The Navy concurs. The bullet formatting was lost during electronic transfer of the documents. The intention was that there should only be two primary bullets (the first one and the third one). The remaining three bullets should be indented and under the primary bullets. This correction is reflected in Attachment B.*

p.3, No. 8 The equation presented to calculate the PRG as dry weight sediment is presented differently than the equation used for McAllister Point, but it is essentially the same equation. However, the equation would be more appropriately expressed if it specifies that the TEV is multiplied by the sediment to porewater chemical ratio. Please see third equation below.

- McAllister Point equation for organic PRGs
  PRG = TEV x Koc x foc, where:
  foc = site average % TOC / 100
  Koc = organic partitioning constant
  TEV = toxicity effects value

- Navy proposed equation for OFFTA PRGs
  PRG = Cs x TEV / PW, where:
  TEV = toxicity effects value (ug/L)
  Cs = chemical concentration in the sediment (ug/kg)
  PW = pore water concentration for the chemical (ug/L)

The Navy proposed equation would be more appropriately expressed as PRG = TEV x Cs / PW, where:
Cs = sediment chemical concentration (ug/kg)
PW = porewater chemical concentration (ug/L). Directly measured for metals and calculated through equilibrium partitioning for organic chemicals.
TEV = toxicity effects value (ug/L).

This equation expression specifies that the TEV is multiplied by the sediment to pore water chemical ratio.

Response: *The Navy concurs that the equation cited for McAllister Point is essentially the same equation as the one proposed for OFFTA, however, it can only be used for the organic constituents. At McAllister Point, the PRGs for metals were calculated as pore water concentrations, in part, because of the metal debris as fragments within the sediment at the site. The equation proposed for OFFTA can be used for metals and organics (see also Attachment B). However, it should be noted that the equation, while mathematically the same as the one proposed by EPA, should be PRG = Cs x TEV/PW. This is because of the assumption that the Cs/PRG ratio should be equal to the PW/TEV ratio.*

ATTACHMENT B

Approach for Development of Preliminary Remediation Goals (PRGs) for Shoreline and Marine Sediment at the Old Firefighting Training Area (OFFTA)

Revision 1: March 20001

INTRODUCTION

The Navy is mandated to develop Risk Based PRGs to direct remedial actions at sites under the Installation Restoration Program. A proposed approach was provided to the regulatory agencies in January, 2001. Based on comments received from the USEPA and NOAA, that proposed approach has been revised as described within this summary.

At the OFFTA site, actionable risk was estimated and calculated in the Remedial Investigation report and supporting documents for sediment under the following receptor scenarios:

1. Human lifetime resident exposure to shoreline sediment
2. Subsistence-Level shellfish collection from the offshore sediment area
3. Ecological risk associated with the nearshore and offshore sediment

To establish cleanup goals for these three receptor scenarios, PRGs will be developed for each scenario separately, as necessary and applied to the exposure areas described below. Where PRGs overlap, the more conservative will apply. For the purposes of this PRG approach and for the FS, the following clarifications are made:

<u>Shoreline Sediment</u> – Area along the mid-tide line (Sampling Stations SSD-333 through SSD-337). Samples were collected and used for human health risk (shoreline wading scenario) only. Data available includes bulk chemistry.

<u>Near Shore Marine Sediment</u> – Area along the low-tide line (Sampling Stations OFF-1 through OFF-7). Data available includes bulk sediment chemistry, some shellfish, and porewater. Samples were collected for ecological risk, but shellfish data was also used for human health risk evaluation under shellfish ingestion scenarios.

<u>Offshore Marine Sediment</u> – Area beyond the low tide line (Sampling stations SD-08 through SD-21). Data available includes bulk sediment chemistry, fish, shellfish, benthic diversity, elutriate, toxicity, and porewater. Samples were collected for ecological risk, but shellfish data was also used for human health risk evaluation under shellfish ingestion scenarios.

1. Sediment PRGS Based on Human Lifetime Resident Exposure to Shoreline Sediment

Evaluation of risks presented in the OFFTA RI for shoreline sediment indicates that cancer risks exceeded 1E-5, and noncancer risks did not exceed an HI of 1 for any target organ.

PRGs are back-calculated from the target risk for the lifetime resident exposure to sediment for contaminants that exceed a contaminant specific risk of 1E-6 in the RI Report. These include arsenic, benzo(a)pyrene, benz(a)anthracene, benzo(b)flouranthene, and dibenz(a,h)anthracene. PRGs are developed for site specific contaminants targeted to the 1E-6 risk level to ensure total cancer risks are less than RIDEM criteria of 1E-5 The risk-based PRG for arsenic is compared to the agreed on background arsenic level (6.2 mg/kg) to assure that the final PRG is not below background.

2. Sediment PRGs Based on Subsistence-Level Shellfish Collection from the Offshore Area

Evaluation of risks presented in the OFFTA RI for shellfish ingestion indicates that cancer risks in lobster exceeded 1E-5 for arsenic for recreational fishermen and for subsistence fishermen and PCBs, benzo(a)pyrene and benzo(b)fluoranthene for only the subsistence fishermen. Subsistence fishing is typically evaluated as a matter of course in the human health risk assessment process. However, the risk assessment uncertainties explain that the subsistence fisherman scenario does not exist at the site and is unlikely in the foreseeable future. Although the study area is within an area closed to shellfishing, EPA reports that some amount of lobster collection may occur in Coasters Harbor. Based on the presence of recreational fishing and commercial lobster pots, there is a need to address this risk endpoint.

In order to address the risk associated with shellfish collections from this area, PRGs are developed for shellfish ingestion. Contaminants that were predicted in the remedial investigation report to provide a cancer risk of 1E-6 and/or a HQ of 1.0 under the subsistence fishing/ingestion of lobster scenario are selected as COCs. The risk assessment notes that arsenic dominates the risk under the shellfish ingestion scenarios. This is likely because arsenic risks from shellfish are based on EPAs slope factor, accepted for inorganic forms of arsenic in the environment. However, arsenic in seafood exists in an organic state known as arsenobetaine. Approximately 80 to 90 percent of the arsenic in seafood is not toxic (USFDA 1993). To adjust for this overestimate, the equation for target arsenic concentrations in the shellfish tissue includes a 10 percent adjustment factor before sediment PRG calculation.

The target tissue concentrations are back-calculated using the equations and ingestion rates for recreational exposure to tissue concentrations presented in the Remedial Investigation Report. These tissue concentrations are then converted to sediment concentrations using average BSAFs from co-located shellfish/sediment sampling stations to yield an estimate of the TOC-normalized sediment COC concentration. The shellfish tissue COC concentration corresponding to a target cancer risk of 1E-6 and/or HQ of 1.0 is divided by the average BSAF, and the resulting values are adopted as the human-health based PRG for offshore sediment. Since there are fewer than ten COCs, this approach ensures that the aggregate cancer risk from all COCs combined will not exceed 1E-5.

Conversion of tissue PRGs to sediment PRGs at McAllister LF were performed using BAF (metals) and BSAF (organics). The approach for OFFTA Newport will be the same, and calculations for sediment/ tissue PRG conversions are described below:

For metals, the BAF = median across all sampling locations of the ratio:

- (Tissue Conc. at location / Sediment Conc. at location)

For organics, the BSAF = median across all sampling locations of the ratio:

- (Tissue Conc. (dry wt.) at location / Lipid Conc. at location) / (Sediment Conc. at location / TOC Conc. at location)

Note that sediment data are in dry weight units and tissue data are in dry weight units for the BSAF and BAF values to be meaningful. This requires that the tissue TEV be converted to a dry weight value as follows:

- tissue TEV (dry wt.) = tissue TEV (wet wt.) * 100 / (average % moisture of tissue samples)

The HH sediment PRG is then calculated as follows:

- HH sediment PRG for metals = tissue TEV (dry wt.) / BAF

- HH sediment PRG for organics = [average TOC conc * tissue TEV (dry wt.) / average tissue lipid conc.] / [BSAF]

3. Sediment PRGS Based On Ecological Risk

Evaluation of the risks presented in the ecological risk assessment for the OFFTA site indicate that high potential for risk to ecological receptors is present at one near shore sediment station (exposure and effects relationships identified) and that an intermediate potential for risk to ecological receptors is present at eight other stations (exposure and/or effects measured). These risks are likely present due primarily to PAHs, and to a lessor degree, metals in sediment. However, the metals in the sediment are unlikely to be toxic, based on the AVS-SEM data presented later in this section.

The following steps are used in the PRG process to calculate the Ecological Risk Based PRGs:

Step 1: Identify the water quality screening value (WQSV) that will be used for comparison to the pore water concentrations

- USEPA Water Quality Criteria
- Other USEPA chronic values
- Convert sediment screening values (i.e., ER-L) to a WQSV using equilibrium partitioning

Step 2: Determine the pore water concentrations for the sediment samples

- Measured concentrations for metals, corrected for AVS-SEM (described on Page B-4)
- Predicted concentrations for organics (calculated using equilibrium partitioning)

Step 3: Classify the toxicity test samples as toxic or non-toxic

- Amphipod toxicity test
  - * Statistically significant reduction in survival versus the control and less than 80% of the mean control survival
- Sea urchin toxicity test on pore water

* Statistically significant reduction in normal development versus the control
* EC50 less than approximately 70% pore water concentration

Step 4: Group the samples as toxic or non-toxic for each receptor. Do not include the reference stations in these groupings.

- Calculate the 95% Upper Confidence Limit (UCL) of the pore water concentrations for each group of samples (toxic and non-toxic) using the correct data distribution (normal vs. log normal)
- Default to the maximum concentration if there are less than 10 samples in a group

Step 5: Summarize the results of the toxic and non-toxic samples

- Compare the 95% UCL (or maximum) pore water concentrations of the non-toxic samples for each receptor to the WQSV
- If the non-toxic pore water concentration exceeds the WQSV the value is considered the No Observed Effects Concentration (NOEC) for that receptor
- If the non-toxic pore water concentration is less than the WQSV then the NOEC defaults to the WQSV
- Compare the NOEC to the 95% UCL (or maximum) pore water concentrations of the toxic samples; do this for both receptors.
- If the toxic pore water concentration exceeds the NOEC, then the chemical is retained for PRG development for that receptor
- If the toxic pore water concentration is less than the NOEC, then the chemical is not retained for PRG development for that receptor
- Select the lower of the two NOECs (that were retained for PRG development) between the two receptors as the Aquatic NOEC

Purpose: The outcome of this step is to obtain the 95% UCL pore water concentration that is associated with a non-toxic sample.

Step 6: Compare the Aquatic NOEC (in Step 5) to the Reference Station pore water concentration (RSV)

- If the Aquatic NOEC is greater than the RSV then the NOEC becomes the Toxicity Effect Value (TEV)
- If the Aquatic NOEC is less than the RSV then the RSV becomes the TEV

Purpose: This step is done to ensure that the PRGs will not be below the reference concentrations.

Step 7: Divide the pore water concentrations by the TEVs at each station (except the reference stations) to get the TEV-Hazard Quotient (TEV-HQ)

- The chemical with the highest TEV-HQ for a station is the limiting Chemical of Concern (COC) for that station
- The list of limiting COCs across all of the stations are the limiting COCs for the site
- Note that the same chemical may be a limiting COC at more than one station

Purpose: This step is done to limit the number of chemicals for which PRGs are developed to the chemicals that are causing the highest risk at each station.

Step 8: Calculate and develop the sediment baseline PRG

- The sediment PRGs are calculated using the following equation at each station and then averaging the values across all of the stations for the final PRG:

$$PRG = Cs * (TEV)/(PW)$$

Where:

TEV	=	Toxicity Effects Value (ug/L)
Cs	=	Chemical concentration in the sediment (ug/kg)
PW	=	Pore water concentration for the chemical (ug/L)

- The PRGs may be adjusted based on the constituents and their spatial distribution to focus the remedial actions on the locations that have the highest risks.

Purpose: To develop a sediment-based PRG that could be used across the site and to minimize unnecessary habitat disruption in lower risk areas.

Role of AVS and SEM in PRG Development for Metals in Sediment

USEPA has developed Draft Sediment Guidelines for six metals [Draft Equilibrium Partitioning Sediment Guidelines (ESGs) for the Protection of Benthic Organisms: Metal Mixtures (Cadmium, Copper, Lead, Nickel, Silver, and Zinc), 2000]. The USEPA document establishes two sets of guidelines for evaluating sediment. The first guideline is based on Acid Volatile Sulfide (AVS) and Simultaneously Extracted Metal (SEM) data, and the second guideline is based on a comparison of dissolved metals concentrations in the pore water to water quality criteria. The USEPA document indicates that either of the two guidelines may be used for evaluating sediment. This discussion focuses on the SEM-AVS guideline.

The basis premise of the SEM-AVS guideline is that if there is more AVS than SEM (on a molar basis) in a sample, than the AVS will bind the six metals and they will not be toxic (USEPA, 2000). The following equation is used to represent this process:

$$\sum \text{SEM-AVS} \leq 1.0 = \text{non-toxic sediment from the SEM metals}$$

The SEM-AVS guideline also can be normalized to the fraction of organic carbon in the sediment (f_{oc}) by dividing the SEM-AVS value by the f_{oc} (USEPA, 2000). Based on the normalized guideline, toxicity is not likely to occur when the concentration is <130 $\mu mol/g_{oc}$, toxicity is likely when the concentrations is >3,000 $\mu mol/g_{oc}$, and toxicity is uncertain when the concentration is between 130 and 3,000 $\mu mol/g_{oc}$. Note that the organic carbon normalization does not appear to work for silver (USEPA, 2000).

Table 1 summarizes the SEM-AVS results (normalized and un-normalized) for each station. Two of the twenty-three stations had SEM-AVS values that were slightly greater than 1.0 (1.23 at Station OFF-1 and 1.51 at Station OFF-3). With two exceptions, the remaining stations had SEM-AVS values that were well below 1.0. Only one of the stations (OFF-4 - 168 $\mu mol/g_{oc}$) had a normalized SEM-AVS value that was slightly greater than 130 $\mu mol/g_{oc}$. Finally, note that although silver was not included in the SEM analysis, when AVS is present, any silver in the sediment is not of toxicological concern and none should occur in the interstitial water (USEPA, 2000).

Table 2 presents the sediment concentrations for the metals that are included in the SEM analysis. As is observed from this table, the stations that had the overall highest concentrations of the metals [i.e., OFF-2 (zinc) OFF-7 (lead), OFF-13 (copper, lead, zinc), and OFF-14 (copper, lead, zinc)] had SEM-AVS values that were less than 1.0. In fact, Stations OFF-7, OFF-13, and OFF-18 had the lowest SEM-AVS values of -37, -13, and -36, respectively.

For the OFFTA site, PRGs are not calculated for the six SEM metals (cadmium, copper, lead, nickel, silver, and zinc) because none of these metals are expected to cause toxicity at most of the stations. The only station with a normalized·SEM-AVS value greater that the non-toxic level was Station OFF-4, and the pore water and sediment was not toxic at this station. Therefore, PRGs for these metals are not necessary.

TABLE 1

SEM-AVS RESULTS
OLD FIRE FIGHTING TRAINING AREA
NAVAL STATION NEWPORT, NEWPORT RHODE ISLAND

Sample Location	SEM-AVS (umol/g)	TOC (%)	TOC Normalized SEM-AVS[2] (umol/g_{oc})
OFF-1	1.23[1]	1.8	68
OFF-2	0.79[1]	1.1	72
OFF-3	0.49	0.9	54
OFF-4	1.51[1]	0.9	168
OFF-5	-22	1	-2222
OFF-6	-25	1.8	-1387
OFF-7	-37	1.9	-1969
OFF-8	-4.7	1.3	-360
OFF-9	-3.6	1.2	-304
OFF-10	-6.4	1.1	-581
OFF-11	-12	1.1	-1104
OFF-12	-23	2.5	-923
OFF-13	-47	4	-1168
OFF-14	-8.4	2	-420
OFF-15	-5.6	1.2	-466
OFF-16	-22	2.6	-849
OFF-17	-13	2.6	-490
OFF-18	-36	4	-904
OFF-19	-16	2.9	-546
OFF-20	-28	2.3	-1213
OFF-21	-12	2.3	-504
OFF-22	-1.4	1.3	-110
OFF-23	-31	2.7	-1142

Notes:
SEM - Simultaneous Extracted Metals
AVS - Acid Volatile Sulfide
[1] - AVS was not detected in these samples
[2] - This value is calculated using the following equation: SEM-AVS/(TOC/100)

TABLE 2

METALS RESULTS
OLD FIRE FIGHTING TRAINING AREA
NAVAL STATION NEWPORT, NEWPORT RHODE ISLAND

Sample Location	Cadmium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Nickel (mg/kg)	Silver (mg/kg)	Zinc (mg/kg)
OFF-1	0.31	58	131	34	0.46 J	156
OFF-2	0.14	24	90	26	0.065 UJ	315
OFF-3	0.18	12	60	22	0.065 UJ	50 U
OFF-4	0.06	31	96	20	0.065 UJ	106
OFF-5	0.23	17	139	19	0.065 UJ	40 U
OFF-6	0.15	11	47	19	0.065 UJ	53 U
OFF-7	0.29	33	294	28	0.18 J	156
OFF-8	0.19	11	38	16	0.17 J	47 U
OFF-9	0.11	6.9	25	18	0.065 UJ	40 U
OFF-10	0.15	10	27	13	0.065 UJ	27 U
OFF-11	0.22	9.1	39	5.5 U	0.17 J	28 U
OFF-12	0.53	37	114	21	0.48 J	147
OFF-13	0.80	81	202	30	1.06 J	263
OFF-14	0.12	19	45	16	0.23 J	48 U
OFF-15	0.18	12	33	14	0.19 J	37 U
OFF-16	0.36	24	61	18	0.44 J	51 U
OFF-17	0.38	26	71	19	0.4 J	126
OFF-18	0.69	84	190	28	1.08 J	248
OFF-19	0.21	30	56	24	0.18 J	166
OFF-20	0.25	19	41	21	0.19 J	109
OFF-21	0.39	23	46	27	0.16 J	144
OFF-22	0.19	18	22	21	0.065 UJ	39 U
OFF-23	0.43	45	74	43	0.27 J	306

ATTACHMENT C
Summary of PRGs and Preliminary Action Areas
Shoreline and Marine Sediment at the Old Firefighting Training Area

PRELIMINARY REMEDIATION GOALS (PRGs)
MARINE AND SHORELINE SEDIMENT
OLD FIREFIGHTING TRAINING AREA (OFFTA)
NAVAL STATION NEWPORT
NEWPORT, RHODE ISLAND

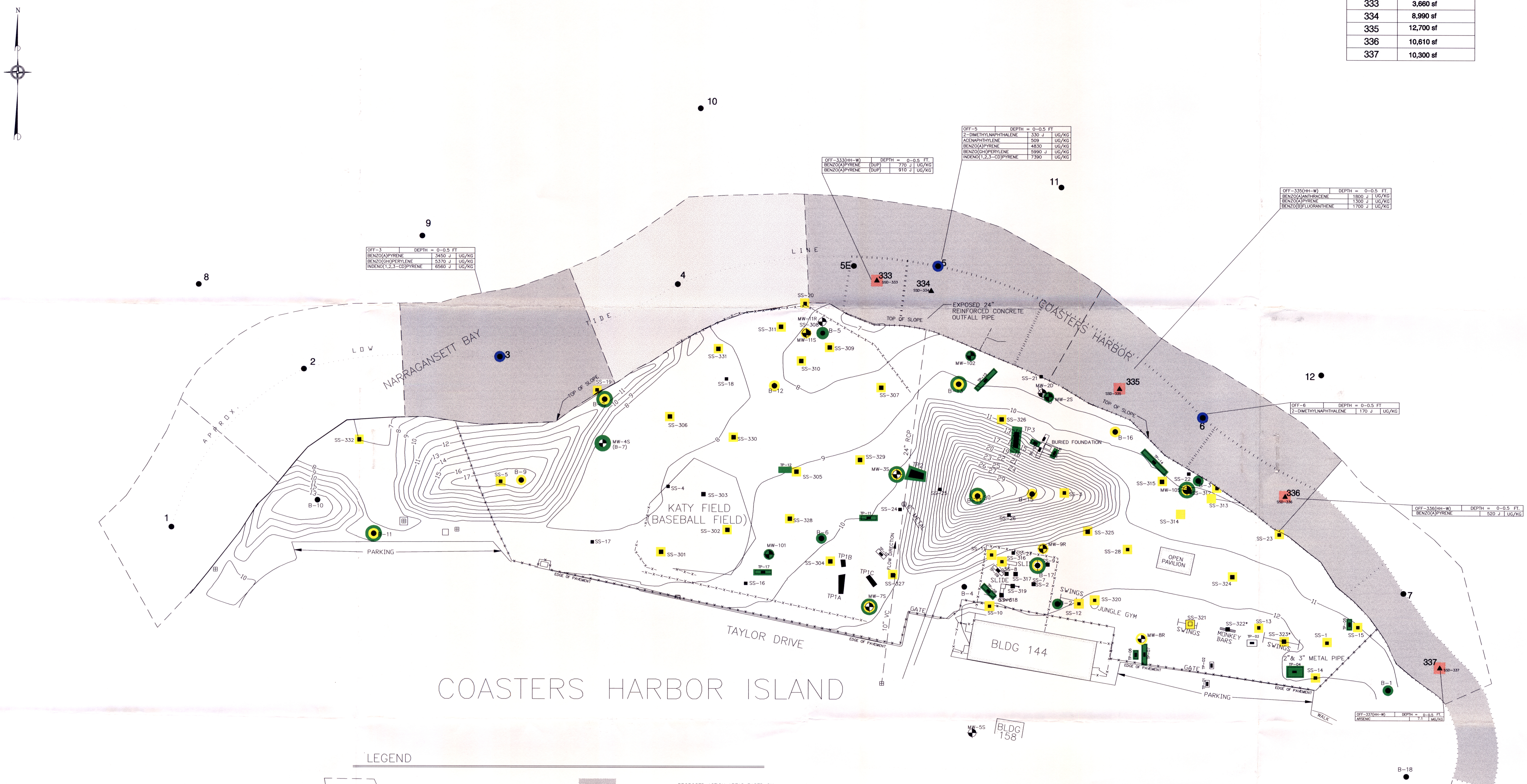
Contaminant	Ecological PRGs	Human Health Wading PRGs	Recreational Lobster Ingestion	*ERLs (4)*	*ERMs (4)*
Polyaromatic Hydrocarbons (ug/kg)					
2-Methylnaphthalene	135			*70*	*670*
Acenaphthylene	502			*44*	*640*
Benz(a)anthracene		1338	34270	*261*	*1600*
Benzo(a)pyrene	2929	134	9360	*430*	*1600*
Benzo(b)fluoranthene		1338	51296		
Dibenz(a,h)anthracene		134	6742	*63.4*	*260*
Benzo(g,h,I)perylene	3518				
Indeno(1,2,3-cd)pyrene	4266		72519		
PCB/Pesticides					
Total PCB Congeners			175	*22.7*	*180*
Metals (mg/kg)					
Arsenic**		6 2**	82	*8.2*	*70*
Copper	30 8 (2)			*34*	*270*
Cadmium			10	*1.2*	*9.6*
Chromium			3708	*81*	*370*
Lead	93 (2)			*46.7*	*218*
Mercury			2 3	*0.15*	*0.71*
Silver	0 4 (2)			*1*	*3.7*
Zinc	149 (2)			*150*	*410*
STATION EXCEEDANCES	**OFF-3,5,6**	**SSD-333 through 336 (3)**	**NONE**		

Note: All Human health PRGs are based on an exposure specific risk of 1E-6.

Human health wading PRGs are calculated from and applicable to Stations SSD-333 through 337
Lobster Ingestion PRGs only compared to Marine sediment stations (OFF-1 through OFF-21)
Ecological PRGs only compared to marine sediment stations (OFF-1 Through OFF-21)
** arsenic PRG for human health is based on HHRA and background assessment
(1) - Subsistence lobster ingestion PRGs not to be used.
(2) - Ecological PRGs for metals are eliminated based on low AVS-SEM values indicating no toxicity from metals - see text
(3) - No data is available for the intertidal area west of SSD-333: This area is covered with boulders and concrete slabs
(4) - ERL and ERM values are depicted for comparison only ERLs and ERMs are not to be used as cleanup values

INNER TIDAL AREA NO.	LOW-TIDE AREA
333	3,660 sf
334	8,990 sf
335	12,700 sf
336	10,610 sf
337	10,300 sf

AREA NO.	AREA
1	19,430 sf
2	25,110 sf
3	24,980 sf
4	27,440 sf
5	33,460 sf
6	27,940 sf
7	22,900 sf



LEGEND

BOUNDARY OF OFFSHORE STATION AREAS	PROPOSED ACTION AREAS BASED ON PRG EXCEEDENCES
BOUNDARY OF INNER TIDAL AREAS	POSSIBLE ADDITIONAL ACTION AREA
CATCH BASIN	OFFSHORE SEDIMENT SAMPLE WHERE ECOLOGICAL PRG EXCEEDED
FENCE	
EXISTING CONTOUR	
SS-28 SURFACE SOIL SAMPLE LOCATIONS	OFFSHORE SEDIMENT SAMPLE WHERE HUMAN HEALTH WADING PRG EXCEEDED
B-16 SOIL BORING LOCATION WHERE SURFACE SOIL SAMPLE WAS COLLECTED	SURFACE SOIL SAMPLE LOCATION WHERE CRITERIA* EXCEEDED
MW-6S MONITORING WELL LOCATION WHERE SURFACE SOIL SAMPLE WAS COLLECTED	SUBSURFACE SOIL SAMPLE LOCATION WHERE CRITERIA* EXCEEDED
SSD-333 SHORELINE SEDIMENT SAMPLE LOCATIONS	SURFACE & SUBSURFACE SOIL SAMPLE LOCATION WHERE CRITERIA* EXCEEDED
STORM SEWER	
TP-10 TEST PIT LOCATION WHERE SUBSURFACE SOIL SAMPLE(S) WERE COLLECTED (B&RE, 6/97)	
TP1C TEST PIT LOCATION WHERE SUBSURFACE SOIL SAMPLE(S) WERE COLLECTED (TRC, 1/94)	

* RIDEM RESIDENTIAL DIRECT EXPOSURE CRITERIA EXCEPT FOR ARSENIC (PROPOSED 6.2 MG/KG BACKGROUND LEVEL WAS USED)

SELECT CONTAMINANTS INCLUDE ARSENIC, LEAD, BENZO(A)PYRENE, AND TPH
SEE TABLES 1 AND 2 FOR A COMPLETE LIST OF CONTAMINANTS EXCEEDING CRITERIA.

DEPTH OF SAMPLING
TEST SAMPLE LOCATION IDENTIFIER

OFF-3	DEPTH = 0-0.5 FT	
INDENO(1,2,3-CD)PYRENE	6560 J	UG/KG

CONTAMINANT TESTED
SAMPLE RESULTS

TYPICAL CONTAMINANT LEVEL BOX
J INDICATES THAT QUANTITATION IS APPROXIMATE
U INDICATES CONTAMINANT NOT DETECTED AT DETECTION LEVEL SPECIFIED

TAGS WITH GRAY BACKGROUNDS HAVE OTHER CONTAMINANTS THAT EXCEED THE CRITERIA.

TAGS WITH WHITE BACKGROUNDS LIST ALL CONTAMINANTS THAT EXCEED THE CRITERIA.

GRAPHIC SCALE

50′ 0′ 50′ 100′

SCALE: 1"= 50'

NOTES AND REFERENCES:

1. DRAWING COMPILED FROM A DRAWING ENTITLED "BASE MAP OLD FIRE FIGHTING TRAINING AREA NETC, NEWPORT, RHODE ISLAND, JULY 1997, PROJ. NO. 7578 CTO: 288, BY BROWN & ROOT ENVIRONMENTAL, SOURCE: BASE PLAN BY GUERRIERE & HALNON, INC., DATED NOVEMBER 10, 1997, AND THE ADDITION OF FIELD MEASURED FEATURES, BY LOUIS FEDERICI AND ASSOCIATES 3/16/99, PRESENTED ON A DRAWING ENTITLED "KADY FIELD, TOPOGRAPHIC, SOIL SAMPLE LOCATION, AND SITE SURVEY AT THE OLD FIRE FIGHTING TRAINING AREA, NAVAL STATION NEWPORT IN NEWPORT, RHODE ISLAND FOR TETRA TECH NUS, INC., LOUIS FEDERICI & ASSOCIATES, 3/16/99, DWG NO. 990205-01.

2. HORIZONTAL DATUM BASE ON THE RI STATE PLANE COORDINATE SYSTEM NAD 1927. VERTICAL DATUM BASED ON NAVEL BASE MEAN LOW WATER.

3. ALL LOCATIONS ARE TO BE CONSIDERED APPROXIMATE.

4. PLAN NOT TO BE USED FOR DESIGN.

DRAWN BY: D.W.M / R.G.D.	TITLE: OFFSHORE SEDIMENT ACTION AREAS AND SOIL SAMPLE EXCEEDENCE LOCATIONS OLD FIRE FIGHTING TRAINING AREA SITE, COASTERS HARBOR ISLAND NAVAL STATION NEWPORT, RHODE ISLAND		
PREPARED BY: C. WOODS			
CHECKED BY: J. FORRELLI			
	SOURCE: BASE PLAN: SEE NOTES.		
	SCALE: 1"=50'	DATE: MARCH 26, 2001	PROJ. NO: 5278
PROJECT MANAGER: J. FORRELLI			
PROGRAM MANAGER: J. TREPANOWSKI	DRAWING NO: 2	ACFILE NAME: DWG\5278\0533\NEAR_SHORE.DWG	REV: 0

TETRA TECH NUS, INC.
55 JONSPIN ROAD
WILMINGTON, MASSACHUSETTS 01887
(978)658-7899