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13 February 2001

Mr. Steve Parker
TetraTech NUS
55 Jonspin Rd.
Wilmington, MA 01887-1020

Dear Mr. Parker,

Enclosed please find the revised OFFTA ERA tables, figures and text pages based on the recalculated sea urchin pore water performance control values using the Appendix K LIS values. The values in Appendix K were compared to the original laboratory bench sheets and found to be correct. As we discussed, the IC₁₀ value reported for LIS sediment in Appendix L was incorrect; the recalculated IC₁₀ is 54.4%, which is up from the erroneous 16.1% value that was used in normalizing the toxicity data reported in Table 5.2-1.

With respect to this parameter, it is noted that only Stations 1 and 5 had higher toxicity than the reference area (Station 23). Still, by applying the same conservative evaluation criteria, as before, the effect of the recalculation is that three stations (Stations OFF-3, OFF-10, and OFF-12) are reclassified from low to intermediate risk as a result of the change (Table 6.6-3).

Thus, errata pages are included as follows:

1. Section 1 pp. 1-7 and 1-8 with accompanying Table 1.6-1 and Figure 1.6-1;
2. Section 5.2.2, p. 5-57 with accompanying Table 5.2-1 and Figures 5.2-3 and 5.2-4;
3. Section 6.6.2.1, p. 6-48 and accompanying Table 6.6-2;
4. Section 6.6.3, pp. 6-53 and 6-54 and accompanying Table 6.6-3;
5. Appendix L, Tox-Calc results for sea urchin pore water sample LIS.

The text pages have been formatted to provide one-to-one replacements for original pages as printed in the Final ERA Document. These pages should cover all changes needed to the document to correct this error.

If you or any should have questions regarding these materials, please feel free to contact me directly at the number below or by email to gtracey@saic.com.

Sincerely,

A handwritten signature in black ink that reads "Gregory A. Tracey". The signature is fluid and cursive.

Gregory A. Tracey, Ph.D.
Senior Scientist.

Final

**OLD FIRE FIGHTING TRAINING AREA MARINE
ECOLOGICAL RISK ASSESSMENT REPORT:
TECHNICAL REPORT AND APPENDICES A-D**

**NAVAL STATION NEWPORT
NEWPORT, RHODE ISLAND**

Prepared For:
Department of the Navy, Northern Division
Naval Facilities Engineering Command
10 Industrial Highway, Mail Stop No. 82
Lester, Pennsylvania 19113

Prepared By:
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Contract Task Order No. 269
April 2000

effects throughout the remainder of the study area. Baseline effects were assigned to Station OFF-09. No stations were ranked as high adverse effects.

Tissue Residue Effects. Possible impacts of contaminants residues in target species were assessed separately through comparison of body burdens with Tissue Screening Concentration (TSC) and Critical Body Residue (CBR) benchmarks.

Tissue Residue Adverse Effects Rankings. Four stations were assigned low adverse effects due primarily to elevated copper residues in lobster. The remaining stations were characterized as baseline effects given only minimal exceedences of TSC benchmarks.

1.6.3. Synthesis of Exposure and Effects Weights of Evidence

The summary of exposure-based and effects-based weights of evidence and characterization of risk for the OFFTA Marine Ecological Risk Assessment is presented in Table 1.6-1 and discussed by risk category, below.

High Risk Probability Stations. In the present investigation, only Station OFF-05 is categorized as a high risk station, given both high exposure and high effects rankings. In addition, exposure-response relationships were observed between measured toxicity and CoC concentrations in sediment, porewater and elutriates.

Intermediate Risk Probability Stations. Stations which demonstrated intermediate risks include Stations OFF-02, OFF-3, OFF-04, OFF-06, OFF-09, OFF-10, OFF-12, OFF-13, OFF-15, OFF-17, OFF-18, OFF-21 and reference Station OFF-23. Multiple exposure- or effects-based weights of evidence were observed in the data, resulting in an intermediate Exposure and/or Effects ranking. However, quantitative exposure-response relationships were found to be lacking.

Low Risk Probability Stations. A low risk probability was indicated for the remainder of Coasters Harbor stations not included in the high or intermediate risk categories. The stations included OFFTA Stations OFF-01, OFF-07, OFF-08, OFF-11, OFF-14, OFF-16, OFF-19, OFF-20. Also included in this category is reference station OFF-22. Minimal impacts are suggested by the majority of exposure and effects-based weights of evidence, and no exposure response relationships were evident.

Baseline Risk Probability Stations. Baseline risk was not assigned for any of the OFFTA stations. The lack of baseline conditions throughout the study area is attributed to the number of potential non-site CoC sources including the Newport Waste Water Treatment Plant outfall as numerous industrial activities occurring in Newport Harbor.

1.6.4. Uncertainty in Risk Estimation

The conclusions drawn in this assessment are based on an extensive database of sediment chemistry, biological indicators, and toxicity evaluations, with broad spatial and temporal coverage. The present study provides multiple weights of evidence for assessment of impacts in the vicinity of Coasters Harbor, hence there would appear a high probability of accurately concluding the occurrence of risk is expected. The present study was conducted under a comprehensive Work/Quality Assurance Plan, and data validation has been performed and found to meet the study requirements. Potential errors in the study design and protocols were minimized through peer review and evaluation. Data collection activities were reasonably complete. Thus, it is concluded that the overall uncertainty with regard to the accuracy of risk estimations has been satisfactorily minimized.

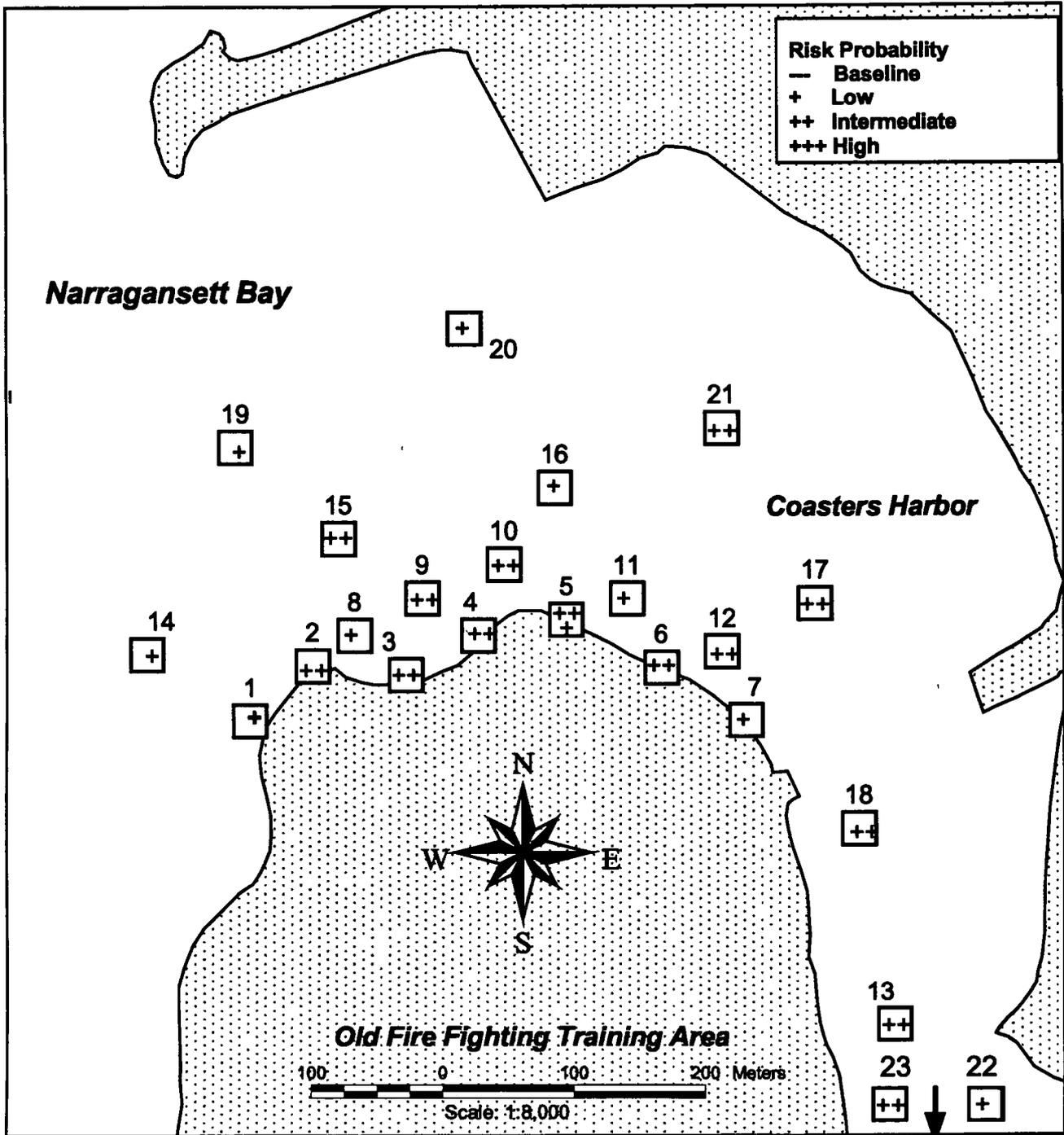


Figure 1.6-1. Risk characterization summary for the Old Fire Fighting Training Area Ecological Risk Assessment

Table 1.6-1. Summary of Exposure and Effects-based Weights of Evidence and Characterization of Risk for the OFFTA ERA Investigation.

WEIGHT OF EVIDENCE SUMMARY									
Station	CHEMICAL EXPOSURE INDICATORS				BIOLOGICAL EFFECTS INDICATORS				RISK PROBABILITY
	Bedded Sediment ¹	Resuspended Sediment ²	Bioconcentration ³	Exposure Ranking ⁷	Sediment Toxicity ⁴	Field Effects ⁵	Tissue Residue Effects ⁶	Effects Ranking ⁷	Overall Ranking ⁸
OFF-01	+	+	++	L	++	+	-	L	Low
OFF-02	+++	++	++	H	++	+	-	L	Intermediate
OFF-03	+++	+	+	I	+	+	-	L	Intermediate
OFF-04	++	+++	++	H	-	+	-	B	Intermediate
OFF-05	+++	++	++	H	+++	++	-	H	High
OFF-06	+++	+	++	H	-	+	-	B	Intermediate
OFF-07	++	+	++	I	-	+	-	B	Low
OFF-08	++	+	+	L	-	+	-	B	Low
OFF-09	++	++	NA	I	++	-	-	L	Intermediate
OFF-10	++	+	++	I	+	+	-	L	Intermediate
OFF-11	++	+	++	I	-	+	-	B	Low
OFF-12	++	++	+	I	++	+	-	L	Intermediate
OFF-13	++	++	+	I	++	+	+	L	Intermediate
OFF-14	+	++	+	L	-	+	-	B	Low
OFF-15	++	+	++	I	++	+	+	L	Intermediate
OFF-16	++	+	+	L	-	+	-	B	Low
OFF-17	++	++	+	I	-	+	+	L	Intermediate
OFF-18	++	++	+	I	++	+	-	L	Intermediate
OFF-19	+	+	+	L	++	+	+	L	Low
OFF-20	+	++	+	L	++	+	-	L	Low
OFF-21	++	+	++	I	+	+	-	L	Intermediate
OFF-22	++	++	NA	I	-	+	-	B	Low
OFF-23	+	++	NA	I	++	+	-	L	Intermediate

1- Bedded Sediment Exposure Ranking based on sediment and porewater Hazard Quotients, see Table 6 6-1

2- Resuspended Sediment Ranking based on Elutriate Hazard Quotients see Table 6 6-1

3- Bioconcentration Ranking based on Tissue Concentration Ratios for mussels, clams, lobster and cunner, see Table 6 6-1

4- Sediment Toxicity Risk Ranking based on sediment and porewater toxicity tests see Table 6 6-2

5- Field Effects Ranking Based on results of Condition Index, Benthic Community Structure, Hematopoietic neoplasia, cytochrome P450, and avian predator exposures, see Table 6 6-2

6- Tissue-based Risk Ranking Based on risks of CoCs in tissues to aquatic receptors, see Table 6 6-2

7- Overall Exposure/Effects (E/E) Ranking based on indicators ("-" = Baseline, "+" = Low, "++" = Intermediate, "+++ " = High, see also Section 6 6)

Baseline (B) = Low (+) E/E ranking observed for only one indicator,

or baseline E/E ranking observed for all indicators,

Low (L) = Intermediate (++) E/E ranking observed for only one indicator with no greater than low (+) E/E ranking observed for other indicators,

or high (+++) E/E ranking observed for only one indicator with no greater than baseline (-) E/E ranking observed for other indicators,

or low (+) E/E ranking observed for all indicators

Intermediate (I) = High (+++) E/E ranking observed for only one indicator with no greater than low (+) E/E ranking observed for other indicators,

or intermediate (++) E/E ranking observed for two or more indicators

High (H) = High (+++) E/E ranking observed for one indicator with intermediate (++) or greater E/E ranking observed for other indicators

E/E Rankings for stations for which two or fewer WoE observations were available are equal to the highest WoE ranking

NA = Ranking not available

8- Overall Risk Ranking based on E/E WoE summaries (see also Section 6 6)

Baseline = No greater than Baseline (B) ranking for both E/E WoE summaries,

Low = No greater than Low (L) ranking for both E/E WoE summaries,

or Intermediate (I) ranking for one WoE summary and no greater than Baseline (B) ranking for the other WoE summary,

Intermediate = Intermediate (I) ranking for both E/E WoE summaries,

or High (H) ranking for one WoE summary and no greater than Low (L) ranking for the other WoE summary,

High = High (+++) E/E ranking observed for one WoE summary with greater than intermediate (++) E/E ranking observed for the other WoE summary.

sediment. The resulting IC values represent a point estimate of the porewater concentration that caused a given percent reduction in normal development of the sea urchin relative to the control.

Results. Results of the porewater assay are presented in Table 5.2-1 and shown graphically in Figure 5.2-3. IC_{10} values decrease as toxicity of the sample increases. Thus, $IC_{10} = 2.4\%$ at Station OFF-5, represents the most toxic sample because the lowest concentration of porewater induced a response (in 10% of the organisms). The response observed at nine stations (OFF-1, 2, 9, 12, 13, 15, 18, 19 and Reference location 23) are interpreted as moderately toxic samples. Two additional stations (OFF-3, 10) had low toxicity. Finally, $IC_{10}s > 80\%$ were observed at the remaining stations, indicated slight or no toxicity (*i.e.*, a porewater concentration of 80% or greater was not sufficiently high enough to induce even a 10% reduction in normal development). The spatial pattern of IC_{10} values indicated the highest toxicity station was nearest the site.

Relationships between unionized ammonia concentrations and larval development are shown graphically in Figure 5.2-4. NOEC and LOEC unionized ammonia values are 0.037 and 0.090 mg/L, respectively (Carr *et al.*, 1996). This would suggest that ammonia may be a contributing factor to the observed toxic response. The potential role of other CoCs and the observed response will be evaluated in Section 6.4.

5.2.3. Sediment Elutriate Evaluations.

Toxicity testing of elutriates is a common technique used particularly by the U.S. Army Corps of Engineers to determine the potential impact of dissolved and suspended contaminants on water column organisms.

Background. The acute toxicity of elutriates prepared from OFFTA sediments was assessed in order to evaluate the bioavailability and biological effects of contaminants to benthic and water column organisms during resuspension events. This

Table 5.2-1. Summary of toxicity test results using *Ampelisca* survival and *Arbacia* larval development for the Old Fire Fighting Training Area Marine Ecological Risk Assessment.

A. Bedded Sediment Toxicity

Sample ID ¹	10-Day Solid-Phase Amphipod Survival Test <i>Ampelisca abdita</i>			48-hr Porewater Larval Development Test <i>Arbacia punctulata</i>			Effects Ranking ⁵
	Un-Ionized Ammonia (mg/L)	Survival		Un-Ionized Ammonia (mg/L)	Porewater Conc.		
		Mean ²	Flag ⁴		IC ₁₀ ³	Flag ⁴	
OFF-01	0.403	95.0	-	0.403	20.6	++	++
OFF-02	0.321	87.0	-	0.321	24.7	++	++
OFF-03	0.336	92.0	-	0.336	58.4	+	+
OFF-04	0.204	90.0	-	0.204	> 100.0	-	-
OFF-05	0.751	72.0	+	0.751	2.4	+++	+++
OFF-06	0.347	94.0	-	0.347	81.1	-	-
OFF-07	0.240	94.0	-	0.240	93.1	-	-
OFF-08	0.039	101.3	-	0.039	79.1	-	-
OFF-09	0.231	95.0	-	0.231	19.8	++	++
OFF-10	0.138	101.0	-	0.138	58.1	+	+
OFF-11	0.104	101.0	-	0.104	> 100.0	-	-
OFF-12	0.157	100.0	-	0.157	25.8	++	++
OFF-13	0.362	99.0	-	0.362	25.7	++	++
OFF-14	0.051	98.8	-	0.051	100.0	-	-
OFF-15	0.097	97.5	-	0.097	32.6	++	++
OFF-16	0.075	97.0	-	0.075	> 100.0	-	-
OFF-17	0.048	98.0	-	0.048	> 100.0	-	-
OFF-18	0.344	96.0	-	0.344	25.8	++	++
OFF-19	0.062	97.5	-	0.062	30.5	++	++
OFF-20	0.089	100.0	-	0.089	98.8	-	-
OFF-21	0.052	97.5	-	0.052	98.7	-	-
OFF-22	0.295	90.0	-	0.295	93.7	-	-
OFF-23	0.183	95.0	-	0.183	25.0	++	++

Notes:

- 1 - OFF - Old Fire Fighting Training Area; OFF-22 and OFF-23 are reference stations.
- 2 - Percent *Ampelisca* survival in bulk sediment sample. Data normalized to the control.
- 3 - IC₁₀ - Inhibition Concentration described as a percent of the performance control porewater concentration which would cause a 10% reduction in normal larval development. Refer to section 5.2.3. of the text for explanation of calculations of the estimated value. Values are measured as % full-strength test mixture (undiluted porewater or elutriate concentration) (1:4 sediment/water mixture for elutriate).

4 - Toxicity Flag Codes:

Ampelisca survival: - = no effect; * = statistically < control; *+ = statistically < control and 60-80% of control; *++ = statistically < control and < 60% control; *+++ = statistically < control and < 20% control.

Arbacia normal larval development: - = not toxic.

- + = 70% or less porewater concentration causes 10% abnormal development;
 - ++ = 50% or less porewater concentration causes 10% abnormal development;
 - +++ = 10% or less porewater concentration causes 10% abnormal development.
- ND = No data.

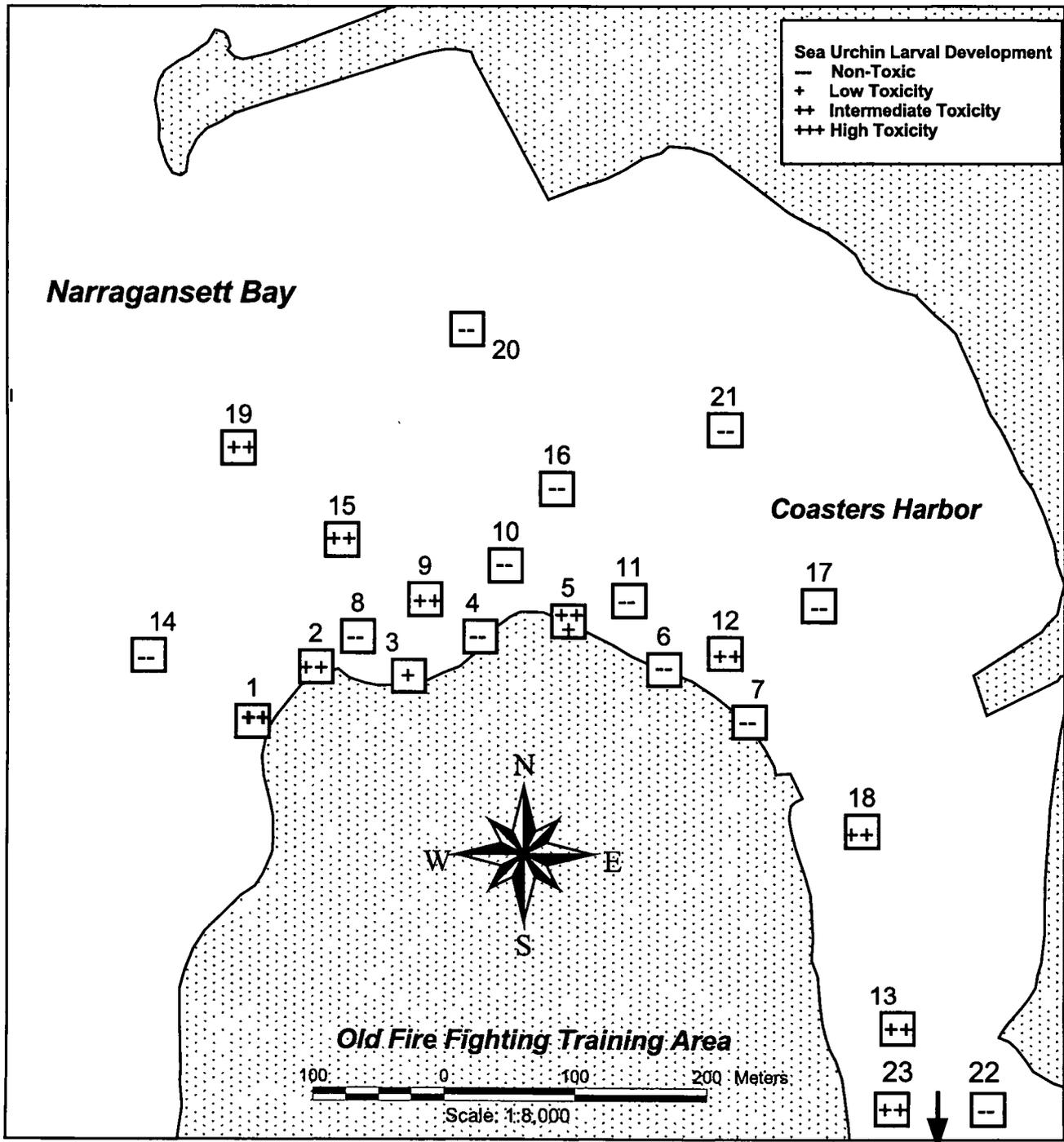


Figure 5.2-3. Spatial distribution of sea urchin (*Arbacia punctulata*) porewater toxicity for sediments collected in the Old Fire Fighting Training Area. See Table 5.2-1 for measured toxicity values.

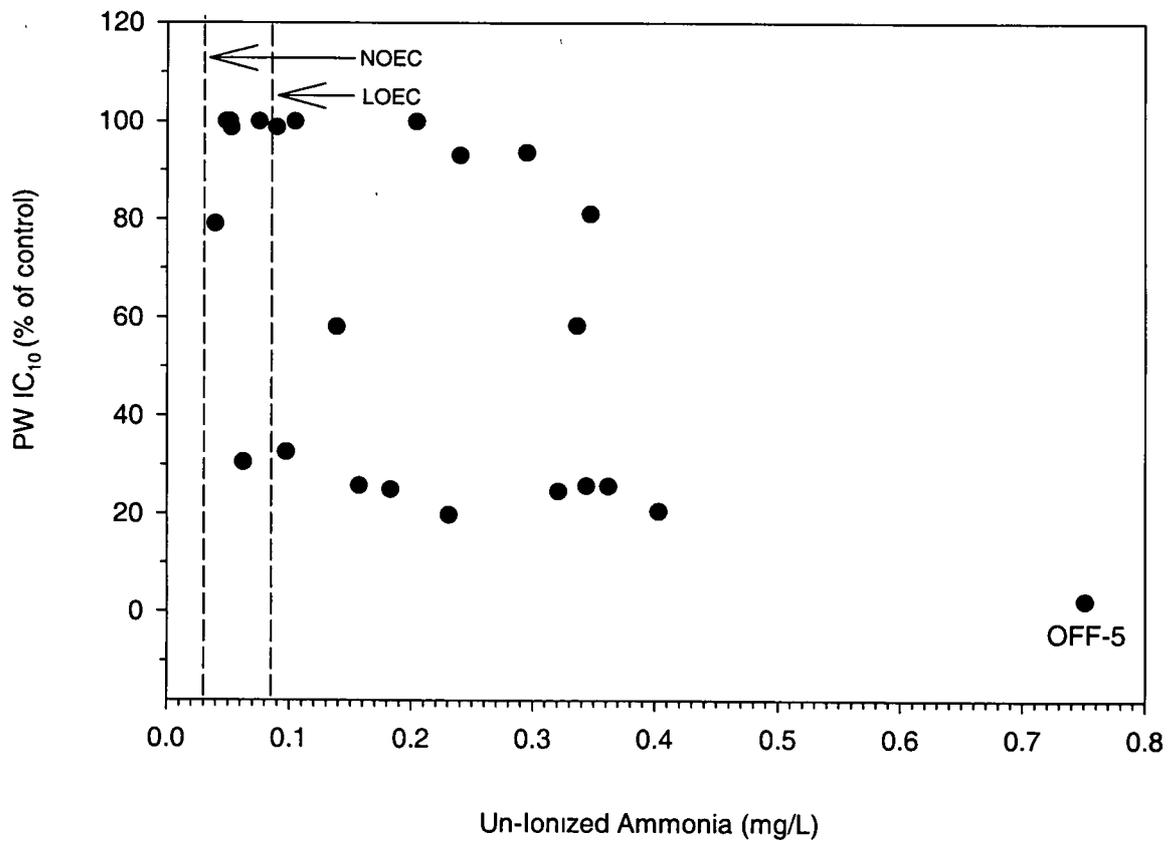


Figure 5.2-4. PW IC₁₀ (Porewater Concentration causing 10% inhibition in normal sea urchin larval development) vs. un-ionized ammonia in porewater from sediments collected from the Old Fire Fighting Training Area (OFFTA). The vertical dashed lines indicate the No Observable Effects Concentration (NOEC) and the Lowest Observable Effects Concentration (LOEC) for un-ionized ammonia (0.037 and 0.09 mg/L, respectively) as proposed by Carr et al., (in press).

bioassays with the amphipod, *Ampelisca*, and sea urchin, *Arbacia*, as well as elutriate bioassays with *Arbacia*, are used to assess possible impacts from in-place and resuspended sediments, respectively.

Bedded sediment results indicated high toxicity only at Station OFF-05 (Table 6.6-2) but also moderate toxicity at nine additional locations due to moderate porewater toxicity to sea urchin larval development. For resuspended sediments, moderate elutriate toxicity was evident mainly at three additional stations (OFF-09, 18, 20) as well as the reference location OFF-23.

Sediment Toxicity Effects Ranking. The overall station-specific sediment toxicity ranking is summarized in Table 6.6-2. At Station OFF-05, and to a lesser extent, OFF-1, 2, 9, 12, 13, 15, 18, 19, 20, and reference Station 23, there is generally moderate probability that bedded sediment CoCs (either in bulk or porewater) are causing toxic effects in field populations. For the majority of these stations, however, the observation of effects in one toxicity category without confirmation in the other toxicity category warrants caution that the intermediate overall adverse effects ranking may be overly conservative. This is supported by the fact that stations showing good agreement (OFF-9, 18, and 23) are relatively removed from the OFFTA site and many closer stations do not show similar effects.

6.6.2.2. Field Effects.

Field effects parameters, summarized in Table 6.6-2 include benthic community structure, bivalve condition indices, hematopoietic neoplasia, cytochrome P450 activity and avian predator effects.

Benthic community structure. From analyses of benthic community metrics discussed in Section 6.5.1, only low probabilities of adverse effect were apparent at Stations OFF-01, OFF-05, OFF-06, OFF-11 and OFF-14 (Table 6.6-2). Note that because the effects ranking is based on comparisons against reference locations, (a

A *High* ranking is assigned in cases where a high E/E ranking was observed for one WoE summary with greater than an intermediate E/E ranking observed for the other WoE summary.

These types of ranking schemes are intended only as a qualitative tool to provide definition and uniformity for the description of risks as discussed in the following section. The ranking approach is based on best professional judgement, since the "true" ecological risk of, for example, benchmark exceedence or observed toxicity, is not presently known. It is not intended to place rigorous boundaries on actions that risk managers may take with respect to the results of the study. Hence, the risk manager is encouraged to keep in mind the nature of the risk ranking approach when evaluating the general outcome of the risk assessment.

The summary of exposure-based and effects-based weights of evidence and characterization of risk for the OFFTA Marine Ecological Risk Assessment is presented in Table 6.6-3 and discussed by risk category, below.

High Risk Probability Stations. In the present investigation, only Station OFF-05 is categorized as a high risk station, given both high exposure and high effects rankings. In addition, exposure-response relationships were observed between measured toxicity and CoC concentrations in sediment, porewater and elutriates.

Intermediate Risk Probability Stations. Stations which demonstrate intermediate risks include Stations OFF-02, OFF-03, OFF-04, OFF-06, OFF-09, OFF-10, OFF-12, OFF-13, OFF-15, OFF-17, OFF-18, OFF-21, and reference Station OFF-23. Multiple exposure- or effects-based weights of evidence were observed in the data, resulting in an intermediate Exposure and/or Effects ranking. However, quantitative exposure-response relationships were found to be lacking.

Low Risk Probability Stations. A low risk probability was indicated for the remainder of Coasters Harbor stations not included in the high or intermediate risk categories. The stations included OFFTA Stations OFF-01, OFF-07, OFF-08, OFF-11, OFF-14, OFF-16, OFF-19, OFF-20 and reference station OFF-22. Minimal impacts are suggested by the majority of exposure and effects-based weights of evidence, and no exposure response relationships were evident.

Baseline Risk Probability Stations. Baseline risk was not assigned for any of the OFFTA stations. The lack of baseline conditions throughout the study area is attributed to the number of potential non-site CoC sources including the Newport Waste Water Treatment Plant outfall as numerous industrial activities occurring in Newport Harbor.

6.7. Risk Uncertainty

Uncertainty Factors Related to Weights of Evidence (WoE). The weight of evidence in this assessment is dependent upon analyses of exposure and effects data, and their integration into risk characterization determinations. The purpose of the uncertainty analysis is to identify the potential uncertainty sources as well as their possible relationship to the true degree of adverse exposure or effects as inferred from field measurements and laboratory tests used to support the individual WoE. Depending on the nature of the test endpoint or its method of interpretation, the uncertainty may tend to either over- or underestimate the true degree of adverse impacts (e.g., “false positive” and “false negative” results, respectively).

For the present investigation, lists of potential uncertainties believed to be important for exposure and effects measurement endpoints are summarized in Table 6.7-1 and Table 6.7-2, respectively, and are discussed in the following sections.

Table 6.6-2. Summary of Effects-based Weights of Evidence for the OFFTA ERA Investigation.

Station	Sediment Toxicity ¹			Field Effect Indicators ²						Tissue Residue Effects ³					
	Bedded Sediment	Resuspended Sediment	Effects Ranking ⁵	Benthic Community Structure ^{2A}	Bivalve Condition Index ^{2B}	Hematopoietic neoplasia ^{2C}	Cytochrome P450 ^{2D}	Avian Predator ⁴	Effects Ranking ⁵	Cunner	Deployed Mussels	Indigenous Mussels	Lobster	Mercenaria	Pitar
OFF-01	++	.	++	+	.	.	+	+
OFF-02	++	.	++	.	.	.	+	+
OFF-03	+	.	+	.	.	.	+	+
OFF-04	+	+
OFF-05	+++	.	+++	+	.	.	++	+	++
OFF-06	.	.	.	+	.	.	+	+
OFF-07	+	+
OFF-08	+
OFF-09	++	++	++
OFF-10	+	.	+	+
OFF-11	.	.	.	+	.	.	.	+
OFF-12	++	.	++	.	.	.	+	+
OFF-13	++	+	++	.	.	.	+	+	.	.	.	+	.	.	+
OFF-14	.	.	.	+	.	.	.	+
OFF-15	++	.	++	+	.	.	.	+	.	.	+
OFF-16	+	+
OFF-17	+	+	.	.	.	+	.	.	+
OFF-18	++	++	++	.	.	.	+	+	+
OFF-19	++	.	++	.	.	.	+	+	.	.	.	+	.	.	+
OFF-20	.	++	++	.	.	.	+	+
OFF-21	.	+	+	+
OFF-22	+
OFF-23	++	++	++	.	.	.	+	+

Effects rankings for stations for which only one indicator observation was available are equal to the indicator observation ranking.

1- Reduced survival or development in bioassay species exposed to sediments, sediment porewaters, or sediment elutriates.

See Table 5.2-1 for test-specific ranks.

2- Reduced fitness in field species exposed to sediments, sediment porewaters, or sediment elutriates.

2A - see Tables 5.3-1 and 5.3-2.

2B - see Figures 5.3-8.

2C - see Appendix B-2-3.

2D - see Section 6.5 text and Figure 6.5-8.

3- Assessment of possible adverse effects due to CoCs in target species tissues; see Table 6.2-6.

4 - Toxicity Reference Value Hazard Quotient (TRV-HQ); see Table 6.3-4.

5 - Effects Ranking: "+++" = higher effect (+++) observed for one or more endpoints;

"++" = intermediate (++) effect observed for one or more endpoints; "+" = low (+) effect observed for one or more endpoints;

"-" = no effect observed for all endpoints. See text in Section 6.6.

Table 6.6-3. Summary of Exposure and Effects-based Weights of Evidence and Characterization of Risk for the OFFTA ERA Investigation.

WEIGHT OF EVIDENCE SUMMARY									
Station	CHEMICAL EXPOSURE INDICATORS				BIOLOGICAL EFFECTS INDICATORS				RISK PROBABILITY
	Bedded Sediment ¹	Resuspended Sediment ²	Bioconcentration ³	Exposure Ranking ⁷	Sediment Toxicity ⁴	Field Effects ⁵	Tissue Residue Effects ⁶	Effects Ranking ⁷	Overall Ranking ⁸
OFF-01	+	+	++	L	++	+	-	L	Low
OFF-02	+++	++	++	H	++	+	-	L	Intermediate
OFF-03	+++	+	+	I	+	+	-	L	Intermediate
OFF-04	++	+++	++	H	-	+	-	B	Intermediate
OFF-05	+++	++	++	H	+++	++	-	H	High
OFF-06	+++	+	++	H	-	+	-	B	Intermediate
OFF-07	++	+	++	I	-	+	-	B	Low
OFF-08	++	+	+	L	-	+	-	B	Low
OFF-09	++	++	NA	I	++	-	-	L	Intermediate
OFF-10	++	+	++	I	+	+	-	L	Intermediate
OFF-11	++	+	++	I	-	+	-	B	Low
OFF-12	++	++	+	I	++	+	-	L	Intermediate
OFF-13	++	++	+	I	++	+	+	L	Intermediate
OFF-14	+	++	+	L	-	+	-	B	Low
OFF-15	++	+	++	I	++	+	+	L	Intermediate
OFF-16	++	+	+	L	-	+	-	B	Low
OFF-17	++	++	+	I	-	+	+	L	Intermediate
OFF-18	++	++	+	I	++	+	-	L	Intermediate
OFF-19	+	+	+	L	++	+	+	L	Low
OFF-20	+	++	+	L	++	+	-	L	Low
OFF-21	++	+	++	I	+	+	-	L	Intermediate
OFF-22	++	++	NA	I	-	+	-	B	Low
OFF-23	+	++	NA	I	++	+	-	L	Intermediate

1- Bedded Sediment Exposure Ranking based on sediment and porewater Hazard Quotients, see Table 6 6-1

2- Resuspended Sediment Ranking based on Elutriate Hazard Quotients see Table 6 6-1.

3- Bioconcentration Ranking based on Tissue Concentration Ratios for mussels, clams, lobster and cunner, see Table 6 6-1

4- Sediment Toxicity Risk Ranking based on sediment and porewater toxicity tests see Table 6 6-2

5- Field Effects Ranking Based on results of Condition Index, Benthic Community Structure, Hematopoietic neoplasia, cytochrome P450, and avian predator exposures, see Table 6 6-2

6- Tissue-based Risk Ranking Based on risks of CoCs in tissues to aquatic receptors, see Table 6 6-2

7- Overall Exposure/Effects (E/E) Ranking based on indicators ("-" = Baseline, "+" = Low, "++" = Intermediate, "+++ " = High, see also Section 6 6)

Baseline (B) = Low (+) E/E ranking observed for only one indicator,

or baseline E/E ranking observed for all indicators,

Low (L) = Intermediate (++) E/E ranking observed for only one indicator with no greater than low (+) E/E ranking observed for other indicators,

or high (+++) E/E ranking observed for only one indicator with no greater than baseline (-) E/E ranking observed for other indicators,

or low (+) E/E ranking observed for all indicators

Intermediate (I) = High (+++) E/E ranking observed for only one indicator with no greater than low (+) E/E ranking observed for other indicators,

or intermediate (++) E/E ranking observed for two or more indicators

High (H) = High (+++) E/E ranking observed for one indicator with intermediate (++) or greater E/E ranking observed for other indicators

E/E Rankings for stations for which two or fewer WoE observations were available are equal to the highest WoE ranking

NA = Ranking not available

8- Overall Risk Ranking based on E/E WoE summaries (see also Section 6 6)

Baseline = No greater than Baseline (B) ranking for both E/E WoE summaries,

Low = No greater than Low (L) ranking for both E/E WoE summaries,

or intermediate (I) ranking for one WoE summary and no greater than Baseline (B) ranking for the other WoE summary,

Intermediate = Intermediate (I) ranking for both E/E WoE summaries,

or High (H) ranking for one WoE summary and no greater than Low (L) ranking for the other WoE summary,

High = High (+++) E/E ranking observed for one WoE summary with greater than intermediate (++) E/E ranking observed for the other WoE summary

Bivalve Larval Survival and Development Test-Proportion Normal

Start Date:	Test ID: LIS	Sample ID:	OFTA
End Date:	Lab ID: NSW	Sample Type:	PORE WATER
Sample Date:	Protocol: PTI 94-PTI Echinoderm/Bival Test Species:		AP-Arbacia punctulata
Comments:	SEA URCHIN		

Conc-%	1	2	3
B-Control	0.7800	0.8100	0.8400
10	0.7600	0.8400	0.8400
50	0.7400	0.8000	0.8400
100	0.1100	0.0500	0.0800

Conc-%	Mean	N-Mean	Transform: Arcsin Square Root					Isotonic	
			Mean	Min	Max	CV%	N	Mean	N-Mean
B-Control	0.8100	1.0000	1.1205	1.0826	1.1593	3.422	3	0.8117	1.0000
10	0.8133	1.0041	1.1258	1.0588	1.1593	5.152	3	0.8117	1.0000
50	0.7933	0.9794	1.1007	1.0357	1.1593	5.635	3	0.7933	0.9774
100	0.0800	0.0988	0.2834	0.2255	0.3381	19.880	3	0.0800	0.0986

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.89605	0.805	-0.3561	-1.432
Bartlett's Test indicates equal variances (p = 0.94)	0.40542	11.3449		

Linear Interpolation (200 Resamples)

P Int	%	SD	95% CL(Exp)		Skew
IC01	27.709	18.083	0.000	75.701	0.4479
IC05	51.560	9.029	0.000	54.188	-2.5961
IC10	54.404	1.476	46.738	56.962	-1.0625
IC15	57.249	1.322	50.370	59.736	-0.6767
IC20	60.093	1.238	53.938	62.511	-0.6595
IC25	62.938	1.158	57.299	65.320	-0.6344
IC40	71.472	0.953	66.467	73.888	-0.4920
IC50	77.161	0.859	72.970	79.689	-0.3359
IC60	82.850	0.812	78.688	85.755	-0.1698
IC75	91.384	0.849	87.581	94.844	-0.0221
IC80	94.229	0.888	90.245	98.121	-0.0003
IC85	97.074	0.937	93.110	101.280	0.0161
IC90	99.918				
IC95	>100				
IC99	>100				

