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U.S. DEPARTMENT OF COMMERCE
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National Ocean Service
Office of Ocean Resource Conservation and Assessment
Hazardous Materials Response and Assessment Division
c/o EPA Office of Site Remediation and Restoration (HIO)
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Mr. Mark Evans
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Dear Kymberlee/Mark:

Thank-you for the Draft Evaluation of Chemical and Toxicological Data for Goss Cove – Naval Submarine Base, Gorton, Connecticut, prepared for Northern Division Naval Facilities Engineering Command (NAVFAC) by Science Application International Corporation, Narragansett, RI, 22 December 1998. The sampling program was designed to characterized sediments in the middle, depositional portion of the Cove. Ten stations from Goss Cove (Figure 1.2-1 of the document) were sampled for chemical and toxicological analysis. Surface grab samples (0-15 cm depth) were taken at all ten stations. Additionally, cores were collected at 5 of 10 stations for characterization of vertical contaminants of concern (CoC) distribution. Maximum CoCs are found in Table 1.

Toxicity analyses included the evaluation of bulk sediments, sediment porewater, and chemically fractionated porewater. Bulk sediment tests were conducted using the marine amphipod *Leptocheirus plumulosus.* Sediment pore water toxicity tests used *L. plumulosus* and the inland silverside *Menidia beryllina* . Toxicity Identification Evaluation (TIE) was conducted on the pore water from all sediments using *L. plumulosus* and *M. beryllina.* The TIE was a four-tier approach with untreated porewater tests, C18 treatment, EDTA chelation, Aeration/*Ulva* treatment.

COMMENTS:

Porewater and Sediment Chemistry
Trace elements and organics were analyzed at the site, many of which exceeded screening guidelines (Table 1). The maximum porewater concentration of cadmium, lead, mercury, nickel, silver, and zinc exceeded the AWQC. All the porewater samples had mercury concentrations that were 100 times greater than the criterion. All trace element concentrations from surface sediments except for arsenic, chromium, and selenium had maximum concentrations that exceeded the ER-L. Cadmium, mercury, and silver exceeded the ER-L by ten times in all surface sediment samples taken at the site. Maximum trace elements concentrations in sediment cores, except for arsenic, chromium, selenium, and zinc, exceeded the ER-L. Despite the exceedences of the ER-L, the sediment

concentrations infrequently were greater than the ER-M. Mercury, which may have other sources, and silver were the only metals considerably above the ER-M

From the samples taken from Goss Cove, many maximum concentrations of organics exceeded the guidelines. All porewater concentrations that exceeded the guidelines were actually non-detect concentrations that were given the estimated value of one-half method detection limit (MDL). The exception to this is total congener PCB and toxaphene, whose MDL value was the estimated value used in place of the non-detect denotation. In Table A-3.1a toxaphene concentration was reported as 500 ug/L. According to the footnote information, this value was one-half the MDL. However, the MDL for porewater was reported as 500 ug/L in the appendix. This contradiction was not explained in the text. The concentrations for chlordane, DDT, and DDE in surface sediment exceeded the ER-L guidelines in all samples. The maximum concentration for total congener PCBs was 0.682 mg/kg in the surface sediment. Chlordane, DDT, and DDE maximum concentrations in sediment cores exceeded the guidelines in samples collected from GC-4 and GC-8. The total maximum concentration for total PCB congeners was 0.193 mg/kg in the sediment core. All other maximum values that exceeded the guidelines in the surface sediment and sediment core were non-detected values but reported as one-half the MDL. Similar to the inorganic sediment chemistry, exceedences are recognized but there are no clear hotspots

In both this study and the 1996 Phase II Remedial Investigation, SEM/AVS and toxicity tests were measured on the same sediment samples. In both cases, the SEM/AVS was less than one, indicating that factors other than the presence of cadmium, copper, nickel, lead, or zinc were responsible for the observed adverse effect. Even with the low SEM/AVS ratio there still is a question concerning the inorganic sediment concentrations in the cove. Natural resources potentially could be at risk if the AVS decreases in the future from adjustments in the circulation from opening the cove to estuarine flow. Oxidation of the trace elements to higher valence form will result if the oxygen level increases near the sediment-water interface. Therefore, the opening of the cove could potentially cause for the high concentrations of trace elements found in the sediments to become more bioavailable. This issue is again discussed, below.

As discussed above, one-half the MDL is used as the concentration for many of the non-detect CoCs. In many cases the MDL exceeded the guidelines, which is a concern, because the high MDLs may have not detected many contaminants. The derivation of the MDL would have been useful for the evaluation of the data.

Bulk Sediment and Pore Water Toxicity

There were varied results in the bulk sediment and porewater toxicity tests. In the bulk sediment toxicity, *L. plumulosus* had >94.4% greater toxicity (Table 2). But it is confusing why there was greater than 100% survival in two of the bulk sediment results. The reason for this abnormality was not mentioned in the text. In the porewater toxicity test, *L. plumulosus* also showed high survival rates (Table 2). These results differ with the 1996 Phase II Remedial Investigation where sediment toxicity studies, conducted on *Ampelisca* and *L. plumulosus* toxicity tests, revealed the sediment was toxic to both animals. The contradiction could be due to three reasons. First, there could have been reduced toxicity at Goss Cove since 1996. Second, the toxicity test could have been carried out differently in 1996 and 1998 studies. The 1996 review did not contain specific information about the *L. plumulosus* toxicity test. Third, this document under review suggests that QA/QC on the 1996 study was poorly done. Unlike the 1998

L. plumulosus toxicity test results, the *M. beryllina* pore toxicity test had a low survival rate in the porewater (Table 2).

The TIE results of *L. plumulosus* are reported in Table 3.2-2 of the document. The document concluded the TIE fractionation tests were inconclusive with respect to the relative role of CoCs versus ammonia/sulfides as potential sources of risk to Goss Cove species. However, the document found that the lack of *L. plumulosus* toxicity suggests that CoCs in Goss Cove sediments/porewater are not likely to be adversely affecting the infaunal community.

The TIE results for *M. beryllina* (Table 3.2-3) demonstrated the removal of organics and metals from the sample did not improve survival. However, the largest the change with the toxicity results came with addition of the Ulva. The implication of these results, according to the document, is that toxicity of *M. beryllina* is due to high concentrations of ammonia found in the sediment and not the CoC's.

In the review of the analysis of the TIE results, there were two areas of confusion. When comparing the results, there was no evidence of any statistical methodology employed to data analysis. It appears the question of difference was answered subjectively. Statistical analysis would have aided in this process. The second area of confusion with analysis came from classifications of "high", "intermediate", "low", and "non-toxic" that were given to specific concentrations of porewater causing 50% reduction test response. A rationale for the given ranges would have been useful in evaluating the data.

SUMMARY

Based on the information provided, the toxicity observed in Goss Cove is due to the elevated concentrations of ammonia. The elevated ammonia concentrations are due to the anoxic conditions found at the site. The opening of Goss Cove would allow for the potential reduction of ammonia, thereby reducing the potential toxicity to benthic organisms. The current toxicological concern at Goss Cove appears to be the elevated concentrations of ammonia caused by the anoxic conditions. The opening of Goss Cove to the Thames River would allow for oxygenated water to enter the system and potentially reduce the ammonia concentrations therefore decreasing toxicity. However, the opening of the Cove might result in the trace element becoming more bioavailable through a potential oxidation of the sediments. Nevertheless, by opening the cove we eliminate a proven cause of toxicity and risk only a potential toxic response from decreasing the AVS concentration.

Please let me know if you have any questions

Sincerely,

Kenneth Finkelstein, Ph.D.

cc: Patti Tyler (EPA)
Tim Prior (USF&WS)

Table 1. Maximum concentration of contaminants of concern at Gross Cove.

	Water (µg/l)			Sediment (mg/kg)			
	MDL	Pore Water	AWQC a	MDL	Surface Sediment	Sediment Core	
Trace Elements							
Cadmium	0.2	70.10	9.3	0.5	12.38	14.97	1
Copper	0.05	0.25 f	2.4	0.5	89.10	59.45	3
Lead	0.1	83.30	8.1	0.5	215	78.37	4
Mercury	0.05	17.20	0.025 d	0.1	2.44	1.49	0
Nickel	0.50	222	8.2	1.0	54.39	99.03	2
Silver	0.1	36.30	1.9 e	0.5	17.33	17.93	1
Zinc	5.0	61.90	81	7.0	162	83.70	1
Organic Compounds							
Chlordane	0.5	0.25 f	0.0043	0.0005	0.03371	0.00822	0
DDT	1.0	0.50 f	0.001	0.001	0.05484	0.01752	0
DDE	1.0	0.50 f	NA	0.001	0.03468	0.00522	0
Dieldrin	1.0	0.50 f	0.0019	0.001	0.01123	0.00280	N
Endosulfan	0.5	0.25 f	0.087	0.0005	0.00318	0.00025 f	N
Endrin	1.0	0.50 f	0.0023	0.001	0.0005 f	0.00050 f	N
Gamma-BHC	1.0	0.50 f	0.16 e	0.001	0.0005 f	0.00050 f	N
Heptachlor	1.0	0.50 f	0.0036	0.001	0.01886	0.00050 f	N
Heptachlor Epoxide	1.0	0.50 f	0.0036	0.001	0.00050 f	0.00050 f	N
PCBs (as Aroclors)	19.50 g	19.50 g	0.03	0.0195 g	0.682 g	0.193 g	0
Toxaphene	500	500	0.0002	0.5	0.250 f	0.250 f	N

a: Ambient water quality criteria for the protection of aquatic organisms (EPA 1993). Marine chronic c presented
b: Shacklette and Boerngen (1984), except for cadmium and silver which represent average concentrat the earth's crust from Lindsay (1979).
c: Effects Range-Low represents the 10th percentile for the dataset in which effects were observed or in studies compiled by Long et al (1995).
d: Criterion expressed as total recoverable metal
e: Chronic criterion not available; acute criterion presented
f: One-half MDL substituted for non-detect concentrations
g: Sum PCB congener total
ND: Not detected; detection limit not available.
NA: Screening guidelines not available.
NM: Not measured
MDL: Method Detection Limit

Table 2. Percent Survival of L. plumulosus in bulk sediment and porewater

Station	Bulk Sediment *L. plumulosus*	Porewater *L. plumulosus*	Porewater *M. beryllina*
GC-1	98.9%	100 %	30 %
GC-2	99.0%	100 %	0 %
GC-3	94.4%	100 %	30 %
GC-4	100 %	100 %	0 %
GC-5	101.0 %	100 %	0 %
GC-6	100 %	100 %	40 %
GC-7	105.3 %	100 %	0 %
GC-8	99.0 %	90 %	70 %
GC-9	96.8 %	100 %	100 %
GC-10	97.0 %	100 %	70 %