REPLY TO
ATTENTION OF:

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, ALASKA
REGULATORY DIVISION
P.O. BOX 6898
ELMENDORF AFB, ALASKA 99506-0898

MAY 13 2009

Regulatory Division
POA-2000-495-M3

Mr. Dick Somerville, P.E.
PND Engineers, Inc.
9360 Glacier Highway, Suite 100
Juneau, Alaska 99801

Dear Mr. Somerville:

Thank you for forwarding the two documents entitled "Dredged Material Evaluation for the Douglas Harbor Marina, Juneau, Alaska", dated March 2009, and "Supplemental Evaluation for Bioaccumulation Data from the Dredged Material Evaluation for the Douglas Harbor Marina-Juneau, Alaska, March 2009", dated April 2009. Enclosed please find our comments concerning these documents.

We look forward to discussing these comments and comments provided by other reviewing parties with both your firm and with City and Borough of Juneau.

You may contact me via email at Richard.G.Jackson@usace.army.mil, by mail at the address above, by phone at (907) 753-5646, or toll free from within Alaska at (800) 478-2712, if you have questions. For additional information about our Regulatory Program, visit our web site at www.poa.usace.army.mil/reg.

Sincerely,

Richard G. Jackson
Project Manager

Enclosure

Technical Comments
US Army Corps of Engineers

Dredged Material Evaluation for
the Douglas Harbor Marina
Juneau, Alaska

Introduction:
These comments were generated from the review of the report dated March 2009 and the supplemental report dated April 2009. They represent the views of Bret Walters of CEPOA-EN-CW-ER. Some of the comments can be attributed to comments received from Dr. Guilherme Lotufo, of the Corps' Environmental Research and Development Center, whom Bret asked for assistance in interpreting the results presented in the reports. A complete set of Dr. Lotufo's comments is attached.

Comments:
1. The report is comprehensive and well written. No significant flaws in the data presented were identified and the data generally appear to be of sufficient quality to base a decision.
2. Bret Walters' name is incorrectly spelled "Brett" throughout the report. Please correct.
3. The report states in a couple of places that "the agencies decided that a concentration of 0.32 mg methyl Hg/kg tissue is an acceptable concentration". That criterion came out of discussions with the state pertaining to extending the duration of the bioaccumulation test beyond the 28 days. The Corps did not intend to require extended analysis so did not actively contribute to the related discussions nor did it agree to use the criterion as a screening level for the 28-day test.
4. Some of the proposed dredge material has greater potential to harm the environment but the overall effects cannot be evaluated and the practicality of alternative disposal options cannot be determined with the information provided. Please present estimates of the depth range for each sample and the volume of material associated with each DMMU and, if possible a calculated estimate of the bioaccumulation potential of the combined dredge prism.
5. Recent studies indicate that steady state condition for Hg is not accurately predicted by the 28 day test and that a conversion factor should be applied to the data prior to comparing tissue results to screening levels. Please address this concern and apply an appropriate conversion factor to the results.
6. Please provide a brief discussion of the nature and timing of Hg-related chemical changes likely to occur at the newly exposed surface within the harbor and at the proposed ocean disposal site.
7. Please present a summary of the input data used to run the STFATE model.
8. The potential to run a TCLP analysis to evaluate alternative disposal options was considered. Are TCLP results available?

9. There seems to be disagreement among experts about the use of the SEM:AVS ratio for Hg-contaminated sediments. Please address the concern that it is inappropriate to use the ratio to estimate bioavailability of Hg.
10. Figure 1-3 should be modified to show the subsamples within the reference area
11. The "Mean Normal Development" results presented in Table 3-21 are notable. Please address the counter-intuitive results where the 100% concentration results for all but the lower Comp sample were significantly lower than the control.
12. Please incorporate Figure 2 from the Supplemental Report into the final report and present some related information about the nature and magnitude of potential ecological effects.
13. Please provide additional information relevant to the potential and likelihood of human exposure. This should include topics such as food sources present, biomagnification, present and historical use of the disposal site for harvesting food, and the location of the sewer outfall and its impact on subsistence use of the area.
14. When discussing Tier III vs. Tier IV evaluations, please specify the specific items that fall into each category.
15. Mercury in pore water is mentioned as an objective (bullet 4 on page 4). The data is presented but not applied. Please include a discussion of the pore water data relevant to the proposed action.
16. Please cite the guidance documents used for the benthic tests in Section 2.5.1.
17. Please cite the guidance documents used for the water column tests and size/age for the organisms in Section 2.5.2.
18. Please cite the guidance document for the acclimation methodology in Section 2.6.
19. Please cite the source, and size/age for the benthic bioaccumulation test organisms.
20. Please add ADEC to the list of acronyms.
21. Please explain dispersive and non-dispersive as it is used on page 27.
22. Please define PSEP on page 28.
23. On page 69, "performance criteria" are mentioned. "Decision criteria", not performance criteria. Revise according to section 6.1 of the ITM: If the 100% dredged material elutriate toxicity is not statistically higher than the dilution water the dredged material is not predicted to be acutely toxic to water column organisms. l The concentration of dissolved plus suspended contaminants, after allowance for mixing, does not exceed 0.01 of the toxic (LC5O or EC50 concentration beyond the boundaries of the mixing zone. Therefore the dredged material is predicted not to be acutely toxic to water column organisms.
24. For sediment to be considered suitable for aquatic disposal the mean percentage survival or normality in the water column 100% concentrations must not be statistically significantly different than the 0% SPP treatment *and* the modeled concentration at the edge of the disposal site must not exceed Limiting Permissible Concentration (LPC). This is not correct. If it were correct open water disposal would not be allowed under ITM guidance for this project. See Section 6.1 of the ITM. It is stated in the previous page that "In the larval development test for *Mytilus* sp., statistically significant differences were

observed between the 100% elutriate concentration and the 0% elutriate (site water) for treatments Area 1, Area 2, Area 4A and Area 4B

25. Section 4.4-"For some organic chemicals that have a slower rate of uptake to a state of tissue equilibrium there are application factors applied to these 28-day uptake values. Mercury is not one of these"

Methyl mercury is not an organic compound. Twenty-eight day is not a sufficient time for tissue residues to achieve steady state

The log Kow of the neutral organic compound of concern should be compared with the log Kow in Figure 6-1 (from the ITM 1998) and will indicate the proportion of steady-state concentration (Css) expected in 28 days based on empirical evidence.

Mercury is not a neutral organic compound

"Figure 4-2 shows that Log Kow values below 4.25 reach steady state within the 28-day exposure period. The low Log Kow for methyl mercury suggests that a 28-day exposure is an appropriate amount of time to for any methyl mercury present in the bioaccumulation organisms to reach steady state".

True only for most neutral organic compounds. Methymercury is not a neutral organic compound. It is incorrect to state that 28-day exposure is an appropriate amount of time to for any methyl mercury present in the bioaccumulation organisms to reach steady state. See discussion in the next section of this review.

26. The ERED database was queried for all potential ecological effects resulting from mercury exposure. The output in the form of a graph (Figure 4-4) shows that all of the published effects related to mercury are at or above 3 mg/kg. The most sensitive assessment end-point for mercury in marine organisms is growth and it 95% LCL is ~3 mg/kg (wet weight).

The 95% LCL is reported as approximately 0.2 mg/kg rather than 3 mg/kg per the Hg supplement "*Figure 2 summarizes this data and depicts the 95% protective levels for all LOED responses and compares this value to the NOED value for this same protective level. The 95% protective level for all LOED effects values is ~0.2 mg/kg wet weight which is the same value suggested by Beckvar et al. 2005.*"

27. Background section of the Supplemental Report "Recently, a document was issued by USEPA that provides additional information on establishing tissue guidance values for mercury for protection of ecological resources (RSET 2009: Sediment Evaluation Framework for the Pacific Northwest – Draft of the Final)." Consider deleting (or disregarding) any reference to this document as it is in draft form and has not been revised following peer review.
28. On page 3 of the Supplemental Report "The concentration of bioaccumulated total Hg from exposure to this composite was 0.21 mg total Hg/kg tissue or 0.092 mg methyl Hg/kg of tissue (wet weight). Please state that the concentration was not measured. Estimate assumed that 44% of total Hg was methyl mercury.

29. On page 4 of the Supplemental Report "These concentrations are recorded as total Hg but in most of the studies (five of eight) the concentrations included in the review were based on methyl Hg concentrations and the test species were Trophic Level 3or higher which the general assumption from EPA is that total mercury is equal to methyl mercury. Based on this assumption, the Hg concentration protective of sublethal effects on juvenile and adult fish is 0.2 mg/kg. Because the data represent a high trophic level and the high percentage of total Hg represented by methyl Hg in tissue of these fish, the protective level determined by Beckvar et al. is assumed to be based on methyl Hg. Hg form measured in almost all the fish was total mercury, not MeHg. Exposure was primarily to MeHg so one can reasonably assume that most of the Hg in fish tissue was the methyl form. However since it was not measured, the % MeHg cannot precisely be known.

CEERD-EP-R

7 May 2009

MEMORANDUM FROM: Guilherme Lotufo

MEMORANDUM FOR: Bret , CEPOA-EN-CW

SUBJECT: Technical review of "Dredged Material Evaluation for the Douglas Harbor Marina Juneau, Alaska" and "Supplemental Evaluation for Bioaccumulation Data from the Dredged Material Evaluation for the Douglas Harbor Marina –Juneau, Alaska March 2009"

General Comments

Sampling and compositing for biological evaluation was adequately performed.

Tier I evaluation determined that mercury is the only compound of concern for water column and benthic evaluation.

Tier III benthic toxicity evaluation data clearly suggest suitability for open-water disposal.

Elutriate test results using fish and mysid shrimp clearly suggest suitability for open water disposal based on Tier III water column evaluation, as no significant mortality occurred in the 100% elutriate treatment. Effects observed in mussel larvae may at least partially caused by high ammonia concentration in the elutriates. The mixing zone analysis indicates that biological effects outside the mixing zone are unlikely. Comparison concentration of contaminants of concern in dredged material elutriates, as well as predicted concentrations outside the mixing zone, with applicable water quality criteria was not performed. Suitability for water disposal regarding water column effects based on toxicity test results seem adequate for this project.

Prediction of 28-d bioaccumulation data as predictive of steady-state benthic bioaccumulation is not correct based on current knowledge on mercury uptake and elimination in aquatic organisms. A conservative conversion factor of 2.5 for predicting steady-state body residues using 28-d bioaccumulation data is recommended before comparisons with action levels and critical body residues are made.

Specific Comments

A. Dredged Material Evaluation for the Douglas Harbor Marina Juneau, Alaska

1) Page 1. "The *confirmatory* chemistry and performance of biological and bioaccumulation testing of the sediment within Douglas Harbor is a Tier III evaluation with some Tier IV assessment of the bioavailability of mercury toxicity and bioaccumulation"

Here and elsewhere in the document where Tier IV activities are cited, , specify what project evaluation items falls under TIER IV, but not III, of the ITM.

2) Page 4. Mercury was the ***only*** contaminant determined to be of potential ecological concern with concentrations above the project screening level of 0.41 mg/kg and the PSDDA maximum level of 2.1 mg/kg. "Concentrations of the other potential contaminants of concern were below screening levels and were not be analyzed as part of this program."

Provide list of contaminants of potential ecological concern and their associated PSDDA maximum level. Provide citation of PSSDA document.

Page 4. "Measure mercury concentrations in sediment, pore water, and tissue".

The use of pore water data is not explained in this report. Either state use of porewater data or cite the mercury supplemental report.

4) Page 4. "Detailed sediment chemistry analysis for a variety of potential contaminants of concern was performed in 2007 as part of the Tier II assessment."

Sounds more like Tier I evaluation.

5) Figure 1-2. First box under Tiers II, III and IV "Evaluate Compliance with WQS" was not conducted (or was not reported). This should be mentioned in the report.

6) Section 1.3. and Figure 1-5. "Three of these DMMU areas (1, 2, and 4) are part of this investigation"

Why the DMMU area 3 was not part of the present investigation? Where is DMMU 3 located? Location noot in Figure 1-5.

7. Section 2.4.4.

Total mercury in tissue is described in the next section, not this one.

8. Section 2.4.5.

Describe method for Hg analysis of tissue samples. What was the detection limit?

9. Section 2.5. "This program included bioassay analysis of four area composite samples and two reference samples (a reference composite and one reference sample (REF X) comprised of five reference samples as independent replicates."

Provide citation for this methodology here (it is provided later in the report).

10. Section 2.5.1.

State what guidance documents were used for benthic tests (e.g., Benthic toxicity tests were conducted in accordance with those procedures outlined in Appendix E of the ITM (USEPA/USACE 1998)...).

11. Section 2.5.2

State what guidance documents were used for water column toxicity tests

"Three species were tested: *Mytilus sp.* (Bivalve larvae), *Americamysis* (formerly *Mysidopsis*) *bahia* (mysid shrimp), and *Menidia beryllina* (inland silverside fish)"

Provide source and size/age for the water column test organisms.

State what guidance documents were used for water column tests.

12. Section 2.6. ACCLIMATION OF TEST SEDIMENT

Provide citation of the acclimation methodology

13. Section 2.6.1 Bioaccumulation Potential Testing

Provide source and size/age for the benthic bioaccumulation test organisms.

14. Section 2.7

Define ADEC. Not in acronym list.

15. Page 27. "
"Mean test mortality is significant if it is greater than 20% (absolute) over the mean negative control response, and mean test mortality is greater than 10% (dispersive) or 30% (non-dispersive) over the mean reference sediment response and statistically significant compared to reference (alpha = 0.5) sediment is considered a hit"

Explain dispersive and non-dispersive.

16. Page 28.

Define PSEP

17. Page 43.

Methyl mercury concentration in porewater is reported but never interpreted or discussed in relationship to benthic toxicity or bioaccumulation potential in this document.

18. Page 69, last paragraph. "For the water-column tests, the performance criteria from the ITM is that the 100% elutriate concentration is not statistically higher than the 0% elutriate concentration and that the dissolved and suspended contaminants, after allowance for initial mixing, do not exceed 0.01 of the toxic concentration (expressed as the EC50 or LC50) beyond the boundaries of the mixing zone."

Decision criteria, not performance criteria. Revise according to section 6.1 of the ITM: If the 100% dredged material elutriate toxicity is not statistically higher than the dilution water the dredged material is not predicted to be acutely toxic to water column organisms. I The concentration of dissolved plus suspended contaminants, after allowance for mixing, does not exceed 0.01 of the toxic (LC5O or EC50 concentration beyond the boundaries of the mixing zone. Therefore the dredged material is predicted not to be acutely toxic to water column organisms.

19. Section 4.3.1 LIMITING PERMISSIBLE CONCENTRATION DETERMINATION
For sediment to be considered suitable for aquatic disposal the mean percentage survival or normality in the water column 100% concentrations must not be statistically significantly different than the 0% SPP treatment *and* the modeled concentration at the edge of the disposal site must not exceed Limiting Permissible Concentration (LPC).

This is not correct. If it were correct open water disposal would not be allowed under ITM guidance for this project. See Section 6.1 of the ITM.
It is stated in the previous page that "In the larval development test for *Mytilus* sp., statistically significant differences were observed between the 100% elutriate concentration and the 0% elutriate (site water) for treatments Area 1, Area 2, Area 4A and Area 4B

19. Section 4.4

"For some organic chemicals that have a slower rate of uptake to a state of tissue equilibrium there are application factors applied to these 28-day uptake values. Mercury is not one of these"

Methyl mercury is not an organic compound. Twenty-eight day is not a sufficient time for tissue residues to achieve steady state

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True only for most neutral organic compounds. Methymercury is not a neutral organic compound. It is incorrect to state that 28-day exposure is an appropriate amount of time to for any methyl mercury present in the bioaccumulation organisms to reach steady state. See discussion in the next section of this review.

20. Conclusions, page 76.

The ERED database was queried for all potential ecological effects resulting from mercury exposure. The output in the form of a graph (Figure 4-4) shows that all of the published effects related to mercury are at or above 3 mg/kg. The most sensitive assessment end-point for mercury in marine organisms is growth and it 95% LCL is ~3 mg/kg (wet weight).

The 95% LCL is reported as approximately 0.2 mg/kg rather than 3 mg/kg per the Hg supplement "*Figure 2 summarizes this data and depicts the 95% protective levels for all LOED responses and compares this value to the NOED value for this same protective level. The 95% protective level for all LOED effects values is ~0.2 mg/kg wet weight which is the same value suggested by Beckvar et al. 2005.*"

B. Supplemental Evaluation for Bioaccumulation Data from the Dredged Material Evaluation for the Douglas Harbor Marina –Juneau, Alaska March 2009

1. Background section "Recently, a document was issued by USEPA that provides additional information on establishing tissue guidance values for mercury for protection of ecological resources (RSET 2009: Sediment Evaluation Framework for the Pacific Northwest – Draft of the Final)."

I suggest deleting (or disregarding) any reference to this document as it is in draft form and has not been revised following peer review.

2. Page 3 "The concentration of bioaccumulated total Hg from exposure to this composite was 0.21 mg total Hg/kg tissue or 0.092 mg methyl Hg/kg of tissue (wet weight).

State that the concentration was not measured. Estimate assumed that 44% of total Hg was methyl mercury.

3. Page 4 "These concentrations are recorded as total Hg but in most of the studies (five of eight) the concentrations included in the review were based on methyl Hg concentrations and the test species were Trophic Level 3or higher which the general assumption from EPA is that total mercury is equal to methyl mercury. Based on this assumption, the Hg concentration protective of sublethal effects on juvenile and adult fish is 0.2 mg/kg. Because the data represent a high trophic level and the high percentage of total Hg represented by methyl Hg in tissue of these fish, the protective level determined by Beckvar et al. is assumed to be based on methyl Hg.

Hg form measured in almost all the fish was total mercury, not MeHg. Exposure was primarily to MeHg so one can reasonably assume that most of the Hg in fish tissue was the methyl form. However since it was not measured, the % MeHg cannot precisely be known.

Steady-state Concentration of Mercury and Methyl mercury in *Macoma*

A discussion of the use of 28-day bioaccumulation data for mercury in *Macoma nasuta* for bioaccumulation potential evaluation is provided.

Section 3.5.2, page 41 of the report states that "Methyl mercury [...] represent the organic form of mercury that is more easily absorbed into the living tissue of aquatic organisms, is not easily eliminated, accumulates in organisms and may be transferred up the food chain.

That statement is correct, total mercury and methyl mercury are eliminated slowly in aquatic macro invertebrates and in fish. Such slow rate of elimination is responsible for the long time to achieve steady state associated with this organo-metal. Slow elimination rate of methyl mercury in aquatic organisms occur despite the relatively low hydrophobic of this organo-metal. The overall relationship between log kow and time to achieve state state body residue (i.e., the lower the log kow the faster time to steady state) has been established for neutral organic compounds, not for organo-metals. Rate of elimination and time to steady-state are inversely relate, the slower the elimination rate, the longer the time to steady state (time to approach steady state is rough estimate by 3 divided by the rate of elimination). Infaunal invertebrates may never approach maximum attainable body residue in laboratory sediment exposures, even if the estimated necessary exposure duration is provided, due to undesirable factors such as decrease of bioavailable fraction (e.g., porewater) of the contaminant and physiological and behavior changes of the organisms over time during long laboratory sediment exposures.

Research conducted at ERDC demonstrated that body residues of mercury in *Macoma nasuta* are well below steady-state following 28-d and even 56-d exposures. The temporal pattern of mercury bioaccumulation was investigated in *Macoma* exposed to sediment collected from the

Hamilton Airfield tidal wetland (San Francisco Bay) , Bay Edge location (Best et al. 2005). The bioaccumulation data indicated that the apparent steady-state body burden was not reached following a 56-day exposure, suggesting that the elimination of Hg is very slow in this clam. The final body burdens of the experimentally exposed clams were only 60 percent of those recorded in *Modiolus* sp. clams collected from the a nearby site with similar sediment concentration further suggested that long exposure periods are needed for total mercury to approach apparent steady state in this species.

Considering the available data on mercury bioaccumulation of mercury in benthic invertebrates exposed to sediment (Best 2005; Best 2007; Nuutinen and Kukkonen 1998), the mercury body residue reported for *Macoma* exposed to Douglas Harbor sediment for 28 days are unlikely to represent steady state concentration of clams residing in that sediment (i.e., exposed for several months). Based on available information, the reported highest total mercury body residue of 0.2 mg/kg likely represent no more than 50% of the steady-state concentration of mercury in clams. The use of estimated body residue of 0.5 mg/kg for total mercury in *Macoma* exposed to lower harbor composite sediment is recommended.

The approach used in this evaluation to estimate methyl mercury body residue using total mercury concentration (i.e., methyl mercury body residue = 0.44 x total mercury concentration) is adequate. The fraction of total mercury corresponding to methyl mercury in clams collected from the Hamilton Airfield tidal wetland was 18.3% in the Baltic clam, *Macoma baltica* and 47.5% in the Chinese clam, *Potamocorbula amurensis*.

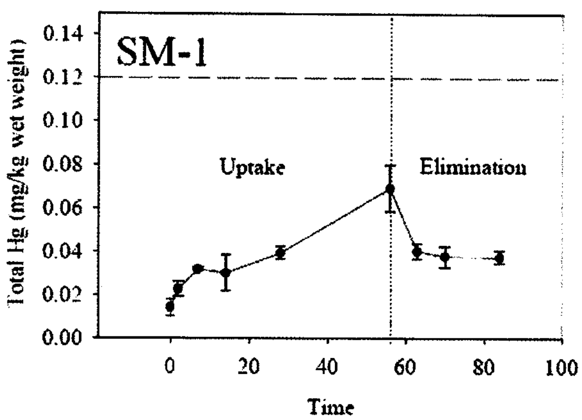

Figure 1. Uptake and elimination of total mercury from *Macoma nasuta* exposed to Hamilton Airfield bay edge sediment. Dashed line indicates the body burden in field-collected *Modiolus* sp. (0.12 mg/kg)

Even considering that the use of 28-d bioaccumulation data used in evaluation was not adequate due to long time for methyl mercury to attain steady state in *Macoma*, I concur with the overall conclusion of the evaluation.

"Based on the entire set of test results reported in Newfields 2009 and this supplemental evaluation, Hg present in the Douglas Harbor sediment is not available for uptake to Trophic level 2 organisms in excess of guidance levels established at the initiation of this dredged material evaluation (0.32 mg methyl Hg/kg) or those put forth by EPA and state agencies (OEHHA or RSET (Region 9).

Interpretation of Bioaccumulation Evaluation Data

The report states that "Based on consensus discussion, the agencies decided that a concentration of 0.32 mg methyl Hg/kg tissue is an acceptable concentration for the consumption of 16 meals per month for Alaskans". The use of 0.32 mg/kg as an acceptable methyl mercury body residue protective of human consumers and ecological receptors, instead of more conservative values (e.g., unrestricted consumption value of <0.15 mg/kg provided by Verbrugge, 2007 or 0.11 mg/kg Target Tissue Levels for Aquatic Life provided in RSET 2009) seem adequate. Therefore, open water disposal of dredged material predicted to generate methyl mercury body burden in infaunal invertebrates lower than 0.32 mg/kg would be considered acceptable.

Therefore, applying the approach used to estimate methyl mercury from total mercury concentration, the highest predicted steady state methyl mercury body residue would be 0.44 x 0.5 = 0.22 mg/kg, a value lower than 0.32 mg/kg, and therefore considered acceptable.

The approach of deriving a 95% protective level for all LOED effects values used in the evaluation presented a few problems. It would have been preferred to select the lowest applicable methyl mercury NOED and LOED for benthic marine invertebrates only out of published literature. The highest estimated methyl mercury concentrations would then be compared to those values. For evaluating potential effects of predator fish feeding or benthic invertebrates from the disposal, a simple food-web model approach would be used to estimate body residue in fish, which would then be compared to the Beckvar et al. 2005 value of 0.2 mg/kg. It is likely that the predicted body residue in predator fish would exceed the Beckvar and Dillon recommended value. Spatial issues would then be discussed to determine what fraction of predator fish diet would come from the disposal site, which would likely make up an area much smaller than the fish foraging range.