

Technical Comments

US Army Corps of Engineers

Dredged Material Evaluation for the Douglas Harbor Marina
Juneau, Alaska

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.

Response to Comment 1.

Thank you.

2. Bret Walters' name is incorrectly spelled "Brett" throughout the report. Please correct.

Response to Comment 2.

"Brett" has been changed to "Bret" throughout the report.

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.

Response to Comment 3.

The communication among project participants has been frequent encompassing all aspects of the program including interpretation criteria for each test and, in particular, the bioaccumulation test as noted below. The discussions on the importance of establishing a screening level criteria for body burdens prior to obtaining bioaccumulation test results was emphasized during these meetings. ADEC provided the suggested levels that were used in the final SAP. No additional comments were provided by agencies to the final SAP (2/3/2009) which included the screening level; therefore based on previous communications with the agencies, no comment on the use of the tissue screening level of 0.32 ppm was taken as concurrence to use this value to interpret the Douglas Harbor tissue data.

- 8/4/08: Submittal of sampling and analysis plan (SAP) to PND, CBJ, Environmental Protection Agency (EPA), the Army Corp of Engineers (USACE), Alaska Department of Environmental Conservation (ADEC), and U.S. Fish and Wildlife Service (USFW)
- 8/4 – 8/20/08: NewFields receives agency comments on the SAP
- 8/20/08: Teleconference with PND, CBJ, Newfields, EPA, USACE, ADEC, and U.S. Fish and Wildlife Service to discuss agency comments on the SAP
- 10/21/08: NewFields responds to extensive comments from agencies and revises the SAP to include elements in a Quality Assurance Plan
- 11/05/08: Meeting in Juneau Alaska includes a presentation of the SAP/QAPP by JQ Word to PND, CBJ and regulatory agencies (EPA, USACE, ADEC, USFW)
- 11/12/ - 11/17/08: NewFields reviews and responds to agency comments to SAP via memorandum

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- 11/17 – 11/21/08: Field sampling in Douglas Harbor, the disposal site and the reference areas. EPA, USACE and ADEC conduct site visit; Bret Walters is onboard for disposal site investigation. During the field sampling two meetings are held at EPA offices to discuss field sampling of the reference site and address concerns from ADEC regarding the bioaccumulation test. EPA, USACE, ADEC, and CBJ staff present for meetings.
- 12/09/08: Discussions with PND, USACE and NewFields regarding acclimation and testing of sediment.
- 12/09/08: ADEC sends additional comments regarding extending bioaccumulation test to 45-days and suggests project specific fish tissue levels are more appropriate than FDA action levels.
- 12/15/08: NewFields responds to ADEC comments, responses are sent to all participants for review and comment
- 12/17/08: Teleconference to discuss the duration of the bioaccumulation test. Consensus reached on a 28-day bioaccumulation test. The project specific wet weight tissue concentration was not resolved. ADEC wanted to time to discuss within the agency and a deadline was set to receive project specific interpretation guidance values prior to the termination of the bioaccumulation test.
- 1/12/09: ADEC provides (via email) to all project participants the project specific guideline of 0.32 ppm wet weight tissue concentration based on the Alaska fish advisory.
- 2/03/09: Final SAP sent to agencies included all of the elements discussed to date including reference sampling approach, acclimation of test sediment prior to testing, 28-day duration of bioaccumulation test and new project specific guidance of 0.32 ppm wet weight in test organisms tissues. Agencies did not provide any comments to the final SAP. Since no comments were provided it was assumed agencies concurred with the SAP.

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.

Response to Comment 4.

The table below shows the dredge volumes represented by each composite sample. We have used the volumes to calculate a weighted mean estimate of bioaccumulation potential of the combined dredge prism of 0.128 µg/g ww of total Hg.

| Composite | Tissue ug/g total Hg | Volume (cy) |
|-----------|----------------------|-------------|
| 1 Upper | 0.03 | 2000 |
| 2 Upper | 0.05 | 900 |
| 4A Upper | 0.04 | 5300 |

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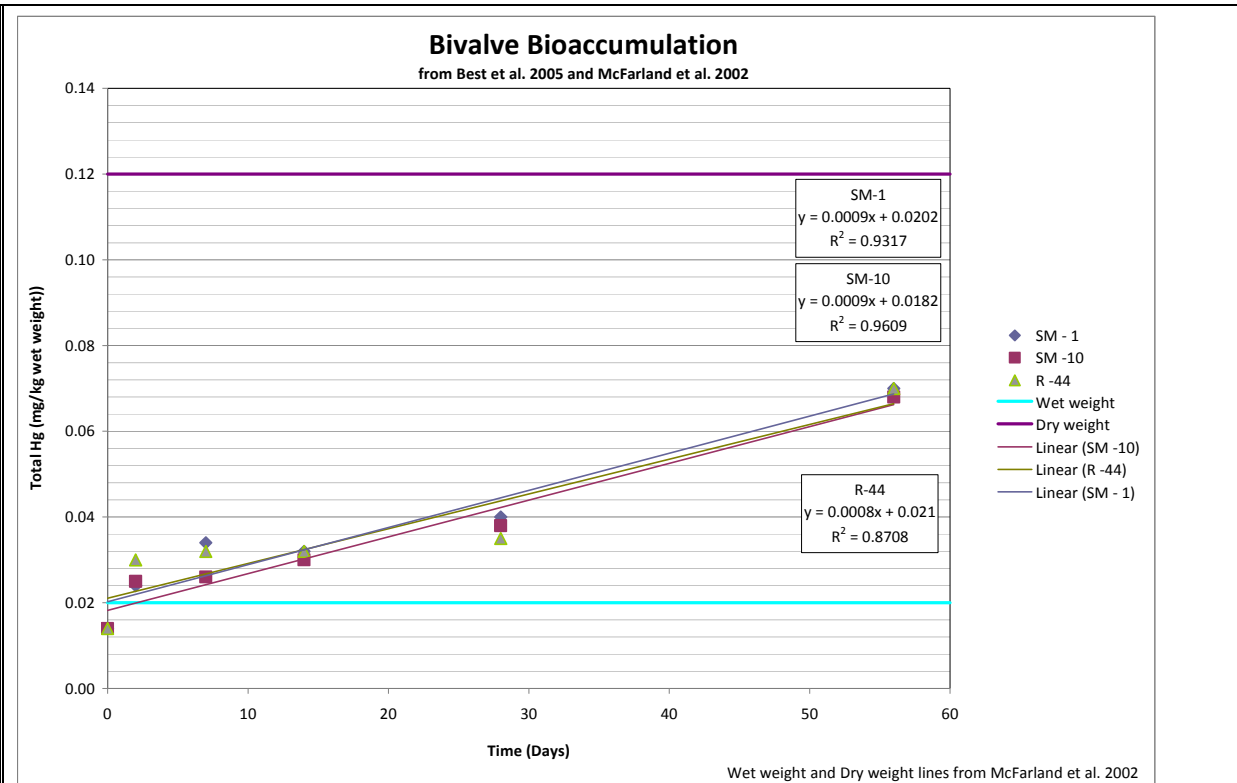
| | | |
|---------------|-------|-------|
| 4B Upper | 0.04 | 5900 |
| Lower | 0.21 | 15400 |
| Total volume | | 29500 |
| Weighted Mean | 0.128 | |

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.

Response to Comment 5.

We have reviewed the documents referenced in Dr. Lotufo's comments. In attempting to apply the information to the Douglas Harbor data, it appears that the line attributed to the field-collected concentrations on the graph presented from Best et al. (2005) and obtained from MacFarland et al. (2002) is in dry weight units and therefore cannot be directly compared to the laboratory uptake of wet weight concentrations. Data provided in MacFarland et al. (2002) show wet weight mean tissue concentrations at SM-1 to be 0.020 mg/kg and at SM-10 to be 0.017 mg/kg. Converting these concentrations to dry weight using the 85% moisture content reported in the document yields 0.13 mg/kg and 0.11 mg/kg dw, the average of these two numbers is used in Dr. Lotufo's Figure 1. These field collected tissue samples were assumed to be at steady state and were used to provide an evaluation of whether steady state had been attained in the laboratory study. We have reproduced the figure below showing the line we believe is dry weight (0.12 mg/kg) and with an even distribution of the days of uptake on the x-axis. The appropriate wet weight concentration to use for *Modiolus* sp. body burden is 0.02 mg/kg (also shown on figure below). In this case either the laboratory exposure overestimates the uptake of mercury or comparison to *Modiolus* uptake is inappropriate.

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Unfortunately, no bioaccumulation data were collected between Day 28 and Day 56 in the Best et al. (2005) study. Concentrations at Day 56 were approximately twice those on Day 28.

However, the conclusion of the reviewer is that even with the use of his recommended estimate of 0.5 µg/g for steady state concentration of total Hg and applying a factor of 44% to estimate methyl Hg at 0.22 µg/g in the tissues; this value is less than the 0.32 µg/g guidance value developed for the protection of human health (ADEC and the Alaska Division of Public Health - ADPH). So, while we disagree with some of the observations reported in Best et al. (2005 and 2007) relative to attainment of steady state concentrations within 28 days it does appear that the conclusion of no predicted adverse effect due to the concentrations of Hg in the Douglas Harbor sediment is still a reasonable conclusion from the existing knowledge on Hg bioaccumulation. Because of the wet weight and dry weight comparisons and the laboratory uptake data that shows higher concentrations than the field steady state values we have also decided not to apply a correction factor for steady state to these data.

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.

Response to Comment 6.

Exposure of newly uncovered anaerobic sediments to seawater creates a potential for increased

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aerobic conditions and biogenic processes. This change results in the production of aerobic microbial communities that enhance the production of methyl Hg. Dissolved Hg appears to have two primary responses under aerobic and anaerobic conditions. A simple approach to these responses is that dissolved Hg can be bound to sulfides under anaerobic conditions while becoming methylated and more available for biological uptake under aerobic conditions (Sadiq, 1992). The Lower Comp sample represents sediments that would be newly exposed after dredging within the harbor. This sediment was found to have elevated sulfides, low total organic carbon, high sand content and was well consolidated with small amounts of water.

The concern with the Lower Comp samples in the bioaccumulation test was that the more deeply buried and non-biogenically active sediments would not provide sufficient conditions for the test organisms to survive and grow throughout the testing period without addressing other contributing factors. NewFields suggested an acclimation process for the lower composite sediment by layering the sediment into testing containers, covering with natural seawater, and allowing the sediment to acclimate until ammonia concentrations were stabilized by the development of a natural microbial community. This process occurred over a 30 day period prior to the introduction of test organisms. In this process, we simulated what would happen to the newly exposed sediments in the harbor and at the disposal site. *Macoma nasuta* and *Nephtys caecoides* exposed to the Lower Comp had higher concentrations of total Hg in their tissues than those exposed to the upper composite (more aerobic and biogenically active) sediments; both the upper and lower composite had similar sediment mercury concentrations, indicating that this acclimation procedure may have made more Hg available.

The acclimation of sediments in the benthic amphipod test also provides information that can be applied to what might be expected from the newly exposed harbor surface. Sediments were acclimated for the Lower Comp in the benthic amphipod test. The results of the amphipod test, where both unacclimated (representing newly exposed material) and acclimated (representing material exposed to seawater for one week) sediments demonstrate that the sediments are not toxic to benthic organisms according to ITM criteria immediately after exposure. After one week of exposure to seawater, the Lower Comp had *higher* survival than the reference sediment and the control sediment.

7. Please present a summary of the input data used to run the STFATE model.

Response to Comment 7.

Table 4-7 and the text in Section 4.3.1 has been amended to include additional input information, particularly on current speed. Please see response to ADEC Comment 6 for details.

8. The potential to run a TCLP analysis to evaluate alternative disposal options was considered. Are TCLP results available?

Response to Comment 8.

The TCLP results were provided electronically to PND on 3/05/09. The sediment composites

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from Douglas Harbor were analyzed for the toxicity characteristic leaching procedures (TCLP) at the request of the USACE. This procedure is a soil sample extraction method for chemical analysis employed as an analytical method to simulate leaching through a landfill. The TCLP analysis determines which of the contaminants, identified by the EPA, are present in the leachate and their relative concentrations.

The analysis simulates landfill conditions where, over time, water and other liquids percolate through landfills. The percolating liquid can react with the sediment or soil placed at the landfill. If contaminants leached from sediment over time are then transported to other locations, theoretically the leachate could pose an environmental risk.

Battelle Marine Sciences Laboratory performed TCLP analysis of metals using extraction method EPA 1311 and analysis methods EPA 1638m and 1631e). The samples were analyzed within the 28 day holding time. Quality assurance samples included method blanks, laboratory control samples, matrix spikes, replicates, and a standard reference material (SRM). A quality assurance/quality control summary was provided within the raw data package. All of the quality control sample data were within quality criteria established for the methods, indicating the TCLP data set is acceptable for use in interpretation.

| Station | % Dry Weight | Hg | Cd | Cu | Ni | Pb | Zn |
|--------------------------|--------------|------------|------------|--------|-------|--------|-------|
| | | (ug/g) ppm | | | | | |
| COMP 1-LOWER | 82.9 | 0000210 | 0..0236 | 0.0947 | 0.795 | 0.0953 | 0.830 |
| COMP 1-UPPER | 61.8 | 0.0000896 | 0.00662 | 0.0694 | 1.08 | 0.0516 | 1.80 |
| COMP 2-UPPER | 60.1 | 0.000406 U | 0.000659 U | 0.0738 | 1.62 | 0.0679 | 1.73 |
| COMP 2-LOWER | 80.7 | 0.00172 | 0.0322 | 0.116 | 0.679 | 0.174 | 0.978 |
| COMP 4A-LOWER | 80.8 | 0.00250 | 0.0126 | 0.0798 | 0.701 | 0.224 | 1.05 |
| COMP 4A-LOWER | 80.8 | 0.00284 | NA | NA | NA | NA | NA |
| COMP 4A-UPPER | 61.6 | 0.000822 J | 0.00119 J | 0.0872 | 1.55 | 0.0778 | 1.35 |
| COMP 4B-UPPER | 64.9 | 0.000486 U | 0.000761 U | 0.0757 | 1.52 | 0.0885 | 1.46 |
| COMP 4B-LOWER | 80.9 | 0.00116 | 0.0296 | 0.0921 | 0.744 | 0.157 | 1.11 |
| COMP 4B-LOWER | 80.9 | NA | 0.0279 | 0.0988 | 0.781 | 0.158 | 1.14 |
| Max. concentration ppm * | | 0.2 | 1.0 | NA | NA | 5.0 | NA |

*Maximum concentrations were taken from this website: www.ehso.com/cssepa/TCLP.htm

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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.

Response to Comment 9.

While we determined the SEM and AVS concentrations for the sediment samples based on a discussion with the regulatory agencies (pro and con) during one of the phone conversations to discuss the project SAP, the actual bioavailability of Hg was measured during the bioaccumulation test. The SEM/AVS was examined in case there was a need to describe the presence or lack of relationship between the simultaneously extracted materials and the presence or absence of bioaccumulation.

The relationship of SEM and AVS has been controversial because the biological availability of Hg is based on the occurrence of a bacterially mediated production of methyl Hg which occurs most readily in the dissolved Hg form under optimum Eh conditions in aerobic environments. Other easily extracted materials also influence Hg availability. For example, Hg sulfide is a highly favored reaction based on its low solubility as a sulfide complex. Sulfides are primarily present under anaerobic conditions and the relationship of dissolved sulfides on a molar basis to the dissolved Hg concentrations on a molar basis after the extraction process is only the first part of determining potential 'bioavailable' Hg. There are other compounds that react with soluble Hg that are not a part of the AVS. These compounds may be extracted during the same process resulting in an over-prediction of the amount of available Hg. More importantly the methylation process that is bacterially mediated under aerobic conditions can be enhanced or decreased based on other factors (Eh, pH, oxygen content of sediment, pore water content, bioturbation, etc.).

Many of the controlling factors mentioned affect the ability to accurately predict the potential bioaccumulation of Hg. Therefore, the effects based testing of measuring the actual bioaccumulation responses of test organisms under similar testing conditions has been the primary means of establishing potential risk of Hg to organisms and ultimately humans. The effects based testing concentrations are the *primary* data for this evaluation not the SEM/AVS ratios.

10. Figure 1-3 should be modified to show the subsamples within the reference area

Response to Comment 10.

Figure 1-3 has been modified as requested.

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.

Response to Comment 11.

The elutriate concentration that produces an EC₅₀ result is the assessment in this table. The

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higher the elutriate concentration producing an effect the less toxic it is. The results of the larval development test in Table 3-21 are discussed in Section 4.3 and as shown in Table 4-6, it appears that ammonia concentrations contributed to the test results. Ammonia concentrations in the upper composites were near or above those concentrations which caused effects in the ammonia reference toxicants tests. Ammonia results in elutriates are a short-lived phenomena during dredging and disposal and as such have generally been discounted when assessing the effects of persistent contaminants for dredged material assessment programs.

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.

Response to Comment 12.

Figure 2 from the supplemental report will replace Figure 4-4 of the report. The supplemental evaluation will be appended to the report as Appendix I.

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.

Response to Comment 13.

The potential for adverse impacts to humans by the removal of Douglas Harbor sediment in the marina to the designated disposal site was evaluated through a Tier IV evaluation including bioaccumulation testing, acclimation of sediment to conditions after dredging in the harbor and placement at the disposal site, specialized mercury analysis of sediment, tissue and pore water, and use of region specific fish tissue mercury threshold values.

The highest measured concentration of Hg in test tissues (representing Trophic Level 2) was 0.2 µg/g wet weight Total Hg. Methyl mercury concentrations were calculated to be 0.09 µg/g wet weight of methyl Hg based on the assumption that 44% of total mercury is methyl mercury (EPA 2000). This estimated methyl mercury tissue concentration is below the region specific guidance value of 0.32 µg/g wet weight (ADEC 2009) and is equivalent to the 95 percentile of the lowest observed effect concentration reported in the ERED database (all aquatic organisms- marine and freshwater) of ≤0.2 µg/g Hg. This database considers multiple endpoints including biochemical and sublethal effects.

Macoma nasuta and *Nephtys caecoides* represent Trophic Level 2 in food web models. A project specific Trophic Level 2 BAF was generated using the highest measured wet weight tissue Hg concentration converted to methyl mercury divided by the measured pore water methyl mercury concentration. These are shown in the supplemental evaluation (Appendix I of the final report); the highest one, for Lower Comp, was 9.4×10^4 .

Almost all of the studies to calculate BAF for Trophic Levels 2, 3, and 4 are based on terrestrial or freshwater species. The California OEHHA (2006) report "*Bioaccumulation Factors and Translators for Methylmercury*" has some estuarine estimates based on a few

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studies. The report calculated BAFs for Trophic Level 4 from ambient water at four sites; upon evaluation of the data used for each estimate we selected those that were based on a minimum of 10 biota samples. The three BAFs that met this criteria average $1.6 \times 10^5 \pm 0.5 \times 10^5$. These three BAFs applied to the Douglas Harbor highest porewater dissolved MeHg yield tissue estimates of 0.17, 0.10, and 0.21 mg MeHg/kg; all below 0.32 mg MeHg/kg. This report includes two other estimates for Trophic Level 4 (Table 31). One was calculated using only measured dissolved MeHg that is higher than those shown above (8.3×10^6); however when comparing the available tissue data (Table 26) to the available measured dissolved MeHg (Table 27) it is evident that this number is only based on two samples. We feel this is not based on sufficient data to use as an estimated BAF. The other estimate is a calculated estimate of 2.2×10^5 which, if applied to the Douglas Harbor porewater yields a tissue estimate of 0.22 mg Hg/kg.

Estimating tissue concentrations using BAFs to compare to fish consumption levels as done above assumes that 100% of the fish's diet is from the disposal site, that 100% of fish consumed by humans are from the site, and that there is no dilution of the porewater concentrations into the water column; this is not a realistic or complete assessment of the potential risk.

Higher trophic level organisms have much larger home ranges, complex diets, and may even be migratory compared to lower trophic level organisms. It becomes less likely these organisms reach an equilibrium state with respect to contaminant exposure from all compartments of its environment and, in particular, the disposal site. In addition, the BAF model does not address the physio-chemical characteristics of the contaminant of concern such as whether it is hydrophobic or readily metabolized. While a comprehensive human health risk evaluation is beyond the scope of this study, it is apparent that using published BAFs for estuarine environments and applying factors to address the relative area of the disposal site to a home range of resident species would result in tissue concentrations likely less than 0.32 mg MeHg/kg and within the ranges noted in Verbrugge (2007) and Beckvar (2005).

The proposed Gastineau Channel disposal site is located approximately 1500 feet southeast of the municipal sewage outfall (distance provided by PND). The disposal site is not an area typically considered by locals for fishing based on its placement in the Channel and its proximity to the municipal sewage outfall. If necessary, the CBJ has the authority to issue fishing advisories or within the marina and can work with regulatory agencies to do the same for the disposal site

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14. When discussing Tier III vs. Tier IV evaluations, please specify the specific items that fall into each category.

Response to Comment 14.

Testing was performed under Tier III and Tier IV as shown below. Case specific testing under Tier IV is identified.

| Test Type | Type of Organism | Taxon | Tier III | Tier IV |
|---------------------------|------------------|---------------------------------|----------|---|
| Benthic | Polychaete | <i>Neanthes arenaceodentata</i> | ✓ | |
| | Amphipod | <i>Ampelisca abdita</i> | ✓ | ✓ Acclimation of sediment to address potential ammonia toxicity as contributing factor |
| Water-Column | Fish | <i>Menidia beryllina</i> | ✓ | |
| | Mysid | <i>Americamysis bahia</i> | ✓ | |
| | Bivalve larvae | <i>Mytilus sp.</i> | ✓ | |
| Bioaccumulation Potential | Bivalve | <i>Macoma nasuta</i> | ✓ | (✓) Lower Comp was acclimated, prior to test initiation, with raw sea water to encourage microbial growth to provide a food source for the test organism throughout the duration of the testing. Although not specifically a Tier IV test per the ITM for bioaccumulation, it is an application of case specific testing of benthic organisms. |
| | Polychaete | <i>Nephtys caecoides</i> | ✓ | |
| Other | | | | Pore water analysis and methyl mercury analysis in sediment were performed for site-specific data. |

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.

Response to Comment 15.

Mercury concentrations in pore water are reported and have been applied to the question of bioaccumulation in the Supplemental Report (included in the Final Report as Appendix I). Pore water concentrations were also used to address ADEC's question regarding compliance with state water quality criteria (see Response to ADEC comment 7).

16. Please cite the guidance documents used for the benthic tests in Section 2.5.1.

Response to Comment 16.

The first sentence of Section 2.5 cites the guidance of the ITM for all biological tests. This

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sentence has been expanded to include specific reference to Appendix E of that document.

17. Please cite the guidance documents used for the water column tests and size/age for the organisms in Section 2.5.2.

Response to Comment 17.

The first sentence of Section 2.5 cites the guidance of the ITM for all biological tests. This sentence has been expanded to include specific reference to Appendix E of that document. The summaries of test conditions, Tables 3-17, 3-20, and 3-23 contain the sources and ages of the water column test organisms.

18. Please cite the guidance document for the acclimation methodology in Section 2.6.

Response to Comment 18.

Acclimation was performed as generally described in Word et al. (2005) as a case specific toxicity test under Tier IV of the ITM to consider the confounding factor of ammonia toxicity. Testing was performed concurrently with unacclimated sediment to determine the amount of toxicity that might be contributed by ammonia. Other than the exposure of the sediment to seawater for a period prior to adding test organisms, all testing was performed according to ITM guidance.

19. Please cite the source, and size/age for the benthic bioaccumulation test organisms.

Response to Comment 19.

The summary of test conditions, Table 3-26 contains the sources and ages of the bioaccumulation test organisms.

20. Please add ADEC to the list of acronyms.

Response to Comment 20.

ADEC (Alaska Department of Environmental Conservation) has been added to the list of acronyms.

21. Please explain dispersive and non-dispersive as it is used on page 27.

Response to Comment 21.

This sentence is quoted from Dredged Material Evaluation and Disposal Procedures (Users Manual) (July 2008). Dispersive and non-dispersive refer to the conditions at the designated disposal site for the dredged material under evaluation. This document identifies this characteristic for each disposal site in the Puget Sound area.

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22. Please define PSEP on page 28.

Response to Comment 22.

PSEP (Puget Sound Estuary Program) has been added to the list of acronyms.

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. | The concentration of dissolved plus suspended contaminants, after allowance for mixing, does not exceed 0.01 of the toxic (LC50 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.

Response to Comment 23.

"Performance criteria" has been changed to "evaluation criteria" on page 69 and also in Section 2.8.3 and the paragraph on page 69 has been revised to correspond to the ITM as indicated above.

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

Response to Comment 24.

This statement has been revised to "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 *or* the modeled concentration at the edge of the disposal site must not exceed Limiting Permissible Concentration (LPC)." This statement now concurs with Section 6.1 of the ITM.

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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. Methylmercury (sic) 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.

Response to Comment 25.

These comments relate to the application of octanol water partitioning coefficients, Log Kow and the use of those factors to address the period of time required to attain equilibrium of Hg into the tissues of organisms exposed to contaminated sediment. While we used these methods to suggest that 28-days of exposure were sufficient we also recognize that neutral organic concepts and Kow are not exactly applicable. The text has been modified to reflect this.

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 its 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.*"

Response to Comment 26.

Figure 4-4 in the report *Dredged Material Evaluation for the Douglas Harbor Marina Juneau Alaska* was based on mercury effects for the endpoints shown relative to *marine* organisms. Figure 2 of the Supplemental report includes both *marine and freshwater* organisms and all

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measured endpoints for LOED and NOED effects with a lower 95% CL of ~0.2 mg/kg wet weight. This figure has been substituted for Figure 4-4 in the final version of the report.

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.

Response to Comment 27.

Chris Meade (EPA) and Jack Word and Meg Pinza (NewFields) held a teleconference on 4/09/09 to discuss the Douglas Harbor bioaccumulation test results. Chris indicated he had previous discussions with EPA colleagues about a new draft of the final *Sediment Evaluation Framework for the Pacific Northwest* document released in 02/09. Chris asked NewFields to review and comment on Chapter 8 Bioaccumulation Evaluation relative to interpretation of the Douglas Harbor bioaccumulation results. This RSET document was finalized (May 2009) following peer review and public comment. The information contained in Chapter 8 has not changed and will remain in the supplemental report. There are still hurdles for this procedure to be accepted within Puget Sound. It is one source of information that we used in the preparation of the report.

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.

Response to Comment 28.

The sentence has been revised to "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), estimated as 44% of total Hg."

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 3 or 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.

Technical Comments

US Army Corps of Engineers

Dredged Material Evaluation for the Douglas Harbor Marina
Juneau, Alaska

Response to Comment 29.

Methyl mercury concentrations were not measured and cannot be precisely known. We *assume* the Hg concentration reported in Beckvar of 0.2 mg/kg equates to approximately 0.092 mg methyl Hg/kg tissue wet weight. This assumption is based on the EPA (2000) conversion factor for trophic level 2 of 44% total mercury estimates methyl mercury.