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CITY/BOROUGH OF JUNEAU
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Port of Juneau

March 8, 2010

Heidi Firstencel
U.S. Army Corps of Engineers
8800 Glacier Highway, Suite 106
Juneau, Alaska 99801-8079

Subject: Response to your February 12, 2010 Letter

Dear Ms. Firstencel,

In your February 12, 2010 letter to me, you transmitted four enclosures and said that "some of the concerns expressed in this correspondence appear to be substantive." You stated that it is the policy of the DA to provide an applicant the opportunity to furnish a proposed resolution or rebuttal to all objections and other substantive comments. The correspondence attached to the letter included:

1. FWS letter dated February 2, 2010 (this letter references their January 26, 2010 letter)
2. NMFS letter dated February 4, 2010 (this letter references their September 9, 2009 letter)
3. AKDEC Letter dated February 4, 2010
4. Douglas Indian Island Association Letter dated Jan 27, 2010

On February 25, 2010, Mr. Andrew Schict of PND, acting on my behalf, sent an email to you with several attachments. These attachments were intended to address the substantive concerns expressed in the above-referenced letters. I am resubmitting the following comments for the record:

1. "Response to comments from Fish and Wildlife Service dated January 6 and February 2, 2010"
2. "Response to comments received from NOAA on September 9, 2009"
3. Letter to Carrie Bohan dated February 22, 2010. This letter addresses AKDEC's February 4, 2010 letter.

Please let me know if there are substantive concerns in the above referenced agency letters that we have not addressed as required for you to make a decision concerning our application.

In your February 23, 2010 letter, you provided February 5, 2010 comments from the EPA. On March 2, 2010, EPA provided with us with additional information pertaining to their February 23, 2010 letter.

On March 5, 2010, we met with you and other regulatory agencies concerning our proposed action. As a result of the meeting, you asked for additional information concerning practicable alternatives.

As we understand it, we owe you the following in order for you to proceed with a decision on our proposed action:

1. A response to substantive concerns expressed in the EPA letters.
2. Additional information concerning practicable alternatives.

Please let me know if this does not address where we are at this point in the process.

Sincerely,

John M. Stone, P.E.
Port Director

Response to comments from Fish and Wildlife Service dated January 6, 2009.

Comment: "Of major concern is that disposal of Hg-contaminated harbor sediments will result in uptake of Hg by marine invertebrates (Dungeness and king crab, spotted and coonstripe shrimp) and bottom-feeding fish (Pacific halibut) that are used for human consumption?

Other Hg bioaccumulation research has reported additional Hg uptake over time periods longer than the 28-day bioassay period. Because Dungeness crabs have an estimated life span of 8 to 13 years, (www.adfg.state.ak.us/pubs/notebook/shellfish/dungie.php), Hg uptake could exceed bioassay result concentrations reported in NewFields 2009. We request the applicant provide additional information for Hg uptake rate by crabs over longer periods than the 28-day bioassay.

Summary of Comment: Length of time for conducting the 28-day bioaccumulation test may be inappropriate?

Response: The length of the 28-day bioaccumulation test is based on the federal guidance for testing of dredged material evaluation programs (USEPA 1998). There was consensus discussion with the agencies (USACE, EPA, ADEC) based on a teleconference held on 12/17/2008 regarding the overall duration of the 28 day test. It was agreed that the 28 day test period would be followed for this project. A summary of the test duration is described on pages 72 and 73 of the NewFields 2009 report. Further, communications with USACE in the form of response to comments further discussed the duration of the bioaccumulation test were provided.

Earlier comments from the USACE related to "Recent studies indicate that steady sate 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. " ...Considering the available data on Hg bioaccumulation in benthic invertebrates exposed to sediment (Best 2005; Best 2007..) the Hg body residue reported for *Macoma* exposed to Douglas Harbor sediment for 28 days are unlikely to represent steady state concentrations of clams residing in that sediment.....

In attempting to apply the information from the Douglas Harbor data to the study conducted by Best (2005) and McFarland et al (2002), 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 McFarland 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. 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 in Figure 2). In this case, either the laboratory exposure overestimates the uptake of Hg or comparison to *Modiolus* uptake is inappropriate. Based on this analysis we also decided not to apply a correction factor

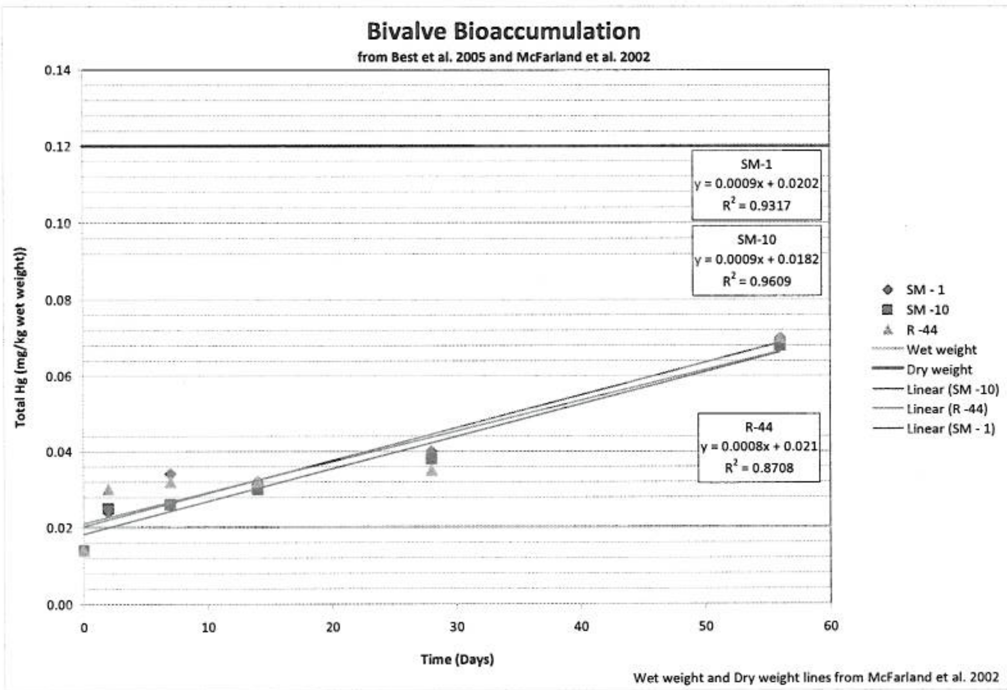

Figure 2 Adapted from Best et al. 2005 and McFarland et al 2002 (field collected data).

to these data because the 28-day exposure tests exceeded the tissue levels that had been collected at the comparison site which were assumed to be at the steady state for those exposures to Hg in the field.

Also, in examining the data presented the uptake and depuration of Hg into the tissues of this experimental clam does show rapid depuration for a fraction of the Hg. In this case, the uptake to 28-days and the depuration for 2 days after exposure the concentrations of Hg were essentially the same and these concentrations remained at these levels for more than 30 days after the original exposure. This indicates that both depuration processes and the length of exposure time used for these tests provide a reasonable estimate of the body burden steady state for these trophic level 2 organisms.

However, the conclusion of an outside reviewer (Dr. Lutufo) of this information at the request of US Army Corps of Engineers 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).

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. In other words, the available data does not support a correction factor for the 28 day test. If a conversion factor were to become an standardized accepted practice, we would encourage the Army Corps and the US EPA to revise guidance documents relative to dredged material testing.

Hg accumulation in crab and other shellfish

Comment: It is important to note that bioaccumulated methyl Hg is tightly bound to tissue and thus is not likely to be depurated or released by aquatic species. Several recent studies have found elevated concentrations of Hg in muscle tissue of blue crabs (Karouna-Reiner et al, 2007 and Sastre et al. 1999) and green crabs (Coelho et al., 2008), indicating bioaccumulation by these species. A study of blue crabs (Reichmuth et al., 2009 on-line citation date) found higher Hg concentrations occurred in the muscle than in the hepatopancreas. This was unexpected as the hepatopancreas is one of the main storage sites for other toxins (Brouwer and Lee, 2007). In Reichmuth et al., (2009) on-line citation data) crabs fed clean food or transplanted into clean environment did not show a significant decrease in Hg which indicates that Hg may be harder or slower to depurate than to accumulate. Similar findings were seen in the estuarine fish mummichogs (Smith and Weis 1997). Once marine organisms' bioaccumulate Hg, they are unlikely to lose Hg back to the environment.

Response: The information provided by USFWS represents recent and historical assessments of uptake of Hg into the tissues of various crab species. The concern expressed in their letters of January 6, 2009 and February 2, 2010 revolves around the longer term/life cycle uptake of Hg into the tissues of long lived organisms (crab species). Additionally the letters also indicated a potential uptake to concentrations that might exceed those observed in clams and worms directly exposed to sediment from Douglas Harbor, Alaska. Four technical papers were provided by USFWS and required additional response.

A summary of these papers and the appropriate application to interpretation of the Douglas Harbor analyses follows:

Jessica M. Reichmuth, Peddrick Weis, Judith S. Weis. 2010. Bioaccumulation and depuration of metals in blue crabs (*Callinectes sapidus*) from a contaminated and clean estuary. Environmental Pollution 158 (2010) 361-368.

In this paper, two different experimental procedures were employed. In the first, lab exposures of 8 weeks duration were performed in artificial seawater with adult male crabs being fed fish three times a week for 8 weeks (trophic transfer study). The other experimental procedure was a field exposure for periods of 8 weeks at a time for three years. These studies were conducted in exclusion cages within the Hackensack Meadowlands (salinity of ~15‰) and in an area surrounded by a National Estuarine Research Center, Tuckerton (salinity of ~30‰), one of the cleanest estuaries on the Atlantic Coast. Male crabs were placed in exclusion cages and fed fish from the transplant site and then moved to the alternate site and fed fish from that site (transplant studies). All of the tissue data analyses provided in this document was based on dry weight determinations of total Hg. The fresh weight/dry weight relationship of these tissues was not provided in this paper so comparisons to fresh weight values in the other papers was derived by using a dry weight conversion based on other crab species where the dry weight mass of tissues was ~15% of the wet weight or the water content was 85% for fresh weight determinations -). The background tissue concentrations ranged from an average of 0.2 µg Hg/g of dry weight tissue to an average of 0.4 µg Hg/g of dry weight. These are equivalent to fresh or wet weight concentrations of 0.03 to 0.06 µg Hg/g of tissue.

The maximum concentration of Hg in various tissues was found in the muscle tissue for the transplant study. This maximum tissue concentration averaged ~1.0 µg Hg/g of dry weight muscle tissue from Tuckerton crabs transplanted to Hackensack Meadows and fed fish from Hackensack Meadows. This concentration is equivalent to a maximum fresh weight concentration of 0.15 µg Hg/g of tissue. All other tissues for the trophic transfer or the transplant studies were lower than these values (ranging from an average of 0.1 to 0.6 µg Hg/g of dry weight or 0.015 to 0.09 µg Hg/g of fresh weight tissue with none of them significantly different from baseline prior to test initiation. Since these are tissue values obtained by fish feeding crabs the Hg concentrations at this trophic level (Step 3) are likely to be methyl Hg.

Conclusion from this study in comparison to the Douglas Harbor assessment:

1. The concentrations of methyl Hg in crabs, exposed for 8 week periods over their 3 year life span are equal to or less than the levels observed in the tissues of the clams exposed to sediment from the lower composite sample of Douglas Harbor sediment. In contrast to the suggestion that crab exposed to Douglas Harbor sediment over their life time would have higher concentrations than the clams directly exposed to Douglas Harbor sediment is not supported by this paper. The time frame for the experimental testing of Douglas Harbor demonstrates uptake equivalent to these longer periods of time.

J.P. Celho, A.T. Reis, S. Ventura, M.E. Pereira, A.C. Duarte, M.S. Pardal. 2008. Pattern and pathways for Hg lifespan bioaccumulation in *Carcinus maenas*. Marine Pollution Bulletin 56: 1104-1110.

This study was a field evaluation of the change in concentration of Hg in the tissues of a crab whose life span is 3-4 years. The pattern of uptake and change through time in various tissues was compared to the sediment and water concentrations of Hg. There were three groups of data, one having very high concentrations of Hg in sediment and overlying waters, a moderate level of Hg contamination and a group with very low Hg contamination. The following table extracted from the paper contains values that can be compared to the Douglas Harbor values.

Station	Sediment (mg/kg)	Reactive Hg (ng/L)	Total Dissolved (ng/L)	Suspended (mg/kg)
A1 High	51.7	60.5	275.4	25.8
A2	6.8	15.8	73.2	20.1
A3	5.2	24.0	97.8	9.0
A5	6.2	9.0	34.4	8.9
Moderate	>5	>9	>34.4	>8.9
A6	0.4	2.9	10.0	1.1
A7	0.1	4.0	6.8	0.7
A8	0.2	2.6	4.4	0.8
A13	0.2	0.6	1.0	0.6
A15	0.1	1.5	4.6	1.2
Low	<0.4	<4.0	<10.0	<1.2
Maximum Douglas Harbor Values	2.56		29.2 (total Hg) 0.979 (methyl Hg)	

The maximum sediment concentrations reported for Douglas Harbor are intermediate in concentration between the moderate and low group of Hg concentrations. The maximum total dissolved Hg concentrations in Douglas Harbor pore waters is less than the concentration of dissolved Hg observed above the moderately contaminated sediments from this estuary. Comparisons of the tissue burdens and uptake rates from Douglas Harbor exposures should be compared with the moderate and low groups not the highest contamination group.

The tissue concentrations adjacent to very high sediment contamination levels (red highlight) showed significant annual accumulation rates (especially in the gill and muscle tissue of female crab), representing an increase of ~25% per year. Other tissues and male crab showed different responses ranging from slower increases to decreases through time. The tissues of crabs adjacent to moderate and low sediment contamination levels had tissue values ranging from 0.1 to 0.5 mg/kg fresh weight and showed little inter-annual change in the concentrations observed in various tissues.

Conclusions from this study indicate that there is little likelihood for longer term crab species to demonstrate increased concentrations through their life span when exposed to sediment with concentrations of Hg similar to those in Douglas Harbor.

J.M. Laporte, J.P. Truchot, F. Ribeyere and A. Boudou. 1997. Combined effects of water pH and salinity on the bioaccumulation of inorganic Hg and methylHg in the shore crab *Carcinus maenas*. Marine Pollution Bulletin Vol 34, no 11, pp. 880-893.

This study was a short term exposure (3-15 days) to very high concentrations of methyl Hg (1 µg/L) that were 1,000 fold higher than the highest pore water concentrations in any of the Douglas Harbor treatments. Additionally this concentration is maintained by daily static renewal with artificial seawater containing no suspended particles. This means that the test organisms are exposed to freshly prepared methyl Hg on a daily basis, there are no particles in the water to adsorb Hg and that after 15 days of maximized exposure the crabs can increase their tissue concentrations for the whole crab from ~40 ng/g to ~110 ng/g or 0.11 µg/g, equivalent to those values observed in the tissues of the crabs from the previous two studies for sediment with low levels of Hg contamination.

Natalie K. Karouna-Reiner, Richard A. Snyder, Jeffrey G. Alliosn, Matthew G. Wagner, K. Ranga Rao. 2007. Accumulation of organic and inorganic contaminants in shellfish collected in estuarine waters near Pensacola, Florida: Contamination profiles and risks to human consumers. ScienceDirect. Environmental Pollution 145 (2007) 474-488.

This study examined the potential human health risks associated with eating Blue crabs (*Callinectes sapidus*) and oysters (*Crassostrea virginica*) that exceeded the Florida Specific Consumption advisories using the following: Consumption rates of 46 g/day, every day for a lifetime of 70 years. The tissue screening level that would be protective is 0.15 mg/kg with these parameters. With USEPA guidelines for consumption rates of 17.5 g/day, every day for a lifetime of 70 years the screening tissue value is 0.4 mg Hg/kg of tissue. Florida also has a DO NOT EAT VALUE for any concentration above 0.85 mg/kg for sensitive populations which include children and women of child-bearing age.

Based on this report the comparisons for human health should be made at these levels. Because Alaska Department of Health has developed separate criteria for Alaska consumption rates and subsistence fishers these values were used to compare the tissue burdens obtained by modeling uptake from the trophic level 2 values obtained during the sediment testing to trophic level 4 (e.g., halibut) and people.

The following data was used to compare test results with additional papers provided by USFWS in their letters of January 6, 2009 and February 2, 2010.

NewFields 2009 - Dredged material evaluation for the Douglas Harbor Marina, Juneau, Alaska.

Sediment and Pore Water Measurements of total and methyl Hg (extracted from Tables 3.5 and 3.7 of NewFields 2009)

Station ID	Total Hg in sediment (μg/g dry weight)	Methyl Hg in sediment (μg/g dry weight)	Total Hg in pore water (ng/L)	Methyl Hg in pore water (ng/L)
Area 4A Lower Comp	2.56	0.00333	29.2	0.979
Ref -01	0.178	0.000294	5.1	0.405
Ref -02	0.195	0.000308	10.3	1.36
Ref – 03	0.199	0.000314	10.7	0.582
Ref – 04	0.268	0.000445	19.4	1.9
Ref – 05	0.303	0.000350	4.11	0.147
Ref Comp	0.226	0.000277	8.83/8.09	0.433/0.393

Mean tissue concentrations in clams and worms (total Hg μg/g wet weight) abstracted from Table 4-9 (NewFields 2009) and methyl Hg calculation from supplemental report

Station ID	*Macoma nasuta*		*Nephtys caecoides*	
	Total Hg (μg/g wet)	Methyl Hg (μg/g wet)	Total Hg (μg/g wet)	Methyl Hg (μg/g wet)
Lower Comp	0.213	0.094	0.027	0.012

Response to comments from Fish and Wildlife Service dated February 2, 2010.

Comments directed toward accumulation and transfer of Hg within the marine food web were addressed in response to comments from September 9, 2009

Comments regarding length of time for conducting the bioaccumulation study were addressed in response to comments from September 9, 2009.

The use of the Sediment Evaluation Framework (SEF) for the Pacific Northwest (May 2009) for interpretation of data is not recommended as it represents a significant departure from work generally conducted in the Northwest. The following statement in the document provides some context for the present status of this effort.

> *The RSET (Regional Sediment Evaluation Team) agencies are committed to continuing work with regional and national experts and stakeholders to further develop and evaluate approaches to assessing bioaccumulation impacts to meet our legal responsibilities in a manner that is scientifically defensible yet does not present an undue hardship on the regulated community. However, until these approaches are more fully reviewed, the existing approaches as described*

by DMMP or the Oregon Department of Environmental Quality (ODEQ) will be considered as viable options and available to applicants to assess bioaccumulation until the approaches outlined in this chapter (Chapter 8: Bioaccumulation Evaluation) is fully developed and reviewed for its regulatory applicability, reliability, and impacts."

The SEF document provides several guidance values that can be used to determine potential risk from Hg. These guidance values were cited in the comments provided by Fish and Wildlife Service. A discussion of these values is summarized here. While not specifically stated, the bioavailable Hg concentrations which provide the basis for interpretation framework are based on *methyl Hg and not total Hg*. This is in line with guidance issued by other regulatory agencies (USEPA, SAB, and OHHEA).

- The Toxicity Threshold Level (TTL) developed for protection of aquatic life is 0.11 mg/kg wet weight. The TTL is derived from Beckvar et al. 2005 and is protective for mortality, growth, reproductive and behavioral endpoints represented by the data summarized in this document. Most of the test species were fish dosed with methyl Hg resulting in methyl Hg in tissue body burden.
- The literature discussed by Beckvar et al. 2005 provides the highest no observable effect dose (NOED) as 0.23 mg/kg and the lowest observable effects dose (LOED) as 0.25 mg/kg with an extrapolation to 0.2 mg/kg wet weight as being protective of the effects with this assessment. Therefore, the cited value of 0.11 mg Hg/kg tissue for the protection of aquatic life in the RSET document is inconsistent with this information, and does not appear to base the guidance value on methyl Hg. While the specification of total or methyl Hg is not a major concern for fish species, it is a significant factor when evaluating lower trophic levels.
- Regarding Hg concentration in the tissues of wildlife consuming aquatic resources, distinctions are made between deep water and nearshore environments and endangered or threatened species and other wildlife species (referred to as "population"). The concentrations protective for these environments (deep or shallow) and types of organisms (ESA or population) range from 0.02 to 0.12 mg Hg/kg tissue wet weight. For application to Gastineau Channel we selected the population value for deep water as the appropriate assessment endpoint (0.12 mg Hg/kg tissue) for the following reasons.
    - The aquatic-dependent wildlife values for the shallow and endangered or threatened species are predominantly represented by shorebirds and are not appropriate for the deeper water disposal site within Gastineau Channel (>120 ft). The two species that are appropriate for deep water that are likely to dive to deep waters of the Gastineau Channel disposal site include the Harbor seal and the Orca Whale and with reported TTL values of 2.67 and 0.42 mg Hg/kg wet weight, respectively.
    - Because these values are higher than the guidance for the aquatic life (0.11 mg Hg/kg wet weight) they will not influence or control decisions for protection of ecological receptors.
- The human health guidance value provided in the document is the EPA reference dose value of 0.0001 mg methyl Hg/kg body mass-day. Assuming a person is either 63 kg (Asian or Pacific Islander), 70 kg for the general population and 79-82 kg for tribal populations the consumption of methyl Hg that would still be protective on a daily basis would range from ~0.006 to 0.0082 mg methyl Hg/day. Based on the concentration of total Hg in the test organisms from the lower composite exposure (0.2 mg total Hg/kg * 0.44 = 0.092 mg methyl Hg/kg tissue wet weight) a

consumption of between 68 and 100 g of shellfish per day would need to be consumed to exceed this guidance value, assuming all shellfish consumed were at this equivalent concentration.

Response to comments received from NOAA on September 9, 2009

September 9, 2009

The NewFields 2009 report does *not* suggest that Hg concentrations present in Douglas Harbor represent native levels. The report does indicate on page 41 that the concentrations reported in the NewFields 2009 report are "similar to those reported in the sediment samples collected in 2007..."

With regard to the comment regarding the use of SEM and AVS concentrations, the SEM and AVS analyses for the sediment samples were added to the program 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 potentially '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, porewater 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. This was agreed upon during development and review of the SAP by the applicable regulatory agencies.

Specific responses to questions 1 – 4 follow.

1. What are the chronic effects of Hg exposure and bioaccumulation in the aquatic food web? Marine organisms will be exposed to Hg from the fill material for decades, if not longer. While the NewFields report focuses on acute effects, juvenile salmon experience sublethal chronic effects at Hg levels much lower than 0.2 mg/kg .

The comments from NOAA refer to Beckvar et al. (2005) when discussing low Hg concentrations and potential chronic impacts to salmonids and other aquatic species.

Table 2 (Beckvar et al. 2005) provides no effects residue data (NER) and low-effect residue (LER) data collected from ten different peer reviewed papers. For all but one paper, (Birge et al 1979), the LER values are equal to or greater than the highest Hg tissue concentration of 0.2 mg/kg reported for clams exposed to the lower composite from Douglas Harbor. In other words 9 of the 10 papers had Hg residue effects based values *greater* than the highest tissue concentration of 0.2 ppm reported in *M. nasuta* exposed to sediment from Douglas Harbor (NewFields 2009).

In reviewing Beckvar et al. 2005 we found a discrepancy between the NER shown for rainbow trout eggs reported at 0.02 ppm and the NER value of 0.04 ppm shown in Birge et al. 1979. Apparently the tissue residue from a control sample was used as the NER; we feel this is an inappropriate use of the control sample. Birge et al. 1979 does not summarize data relative to an NER or LER, rather the only statistical evaluation conducted for this study was Probit analysis to calculate lethal concentrations relative to 1% of the population or LC_1.

Beckvar et al. 2005 states "deriving protective tissue residues is hampered by a lack of consensus in the scientific community regarding the treatment and analysis of published residue-effect information." We would agree with this statement as reflected in the difference we have pointed out in calculating NER data from Birge et al. 1979. **We do agree with the final conclusion in Beckvar et al. 2005 "...the following tissue residues are deemed protective of fish. For Hg, we recommend 0.2 mg/kg whole body as protective for juvenile and adult fish."**

We believe a more robust comparison of Hg tissue data would be to use the Effects Residue database (ERED; USACE/USEPA 2008). This database contains data from 2180 studies published between 1964 and 2007. From these studies, 13,981 distinct observations have been included for 404 analytes, 446 species, 15 effect classes, and 74 endpoints. The database was developed to reduce the level of uncertainty associated with interpreting bioaccumulation data for the purpose of making regulatory decisions, contains approximately 14,000 pairs of chemical specific tissue burdens to adverse effects extracted from the scientific literature. The use of the large ERED database prevents the possibility of interpreting data based on only a small number of scientific studies.

ERED was queried to examine effects based body burdens for Hg and the results comprised 37 different species and included acute and chronic endpoints. Figure 1 (Figure 4-4 of the NewFields 2009 report) summarizes this data and shows the *95% protection levels for all of the LOED - lowest observable responses is 0.2 ppm.* This effects based level corresponds with the conclusions of Beckvar et al. 2005. **The highest tissue level of 0.2 ppm reported in NewFields 2009 would *not* be predicted to elicit adverse impacts as supported by Beckvar et al. 2005 and the ERED (USACE/USEPA 2008).**

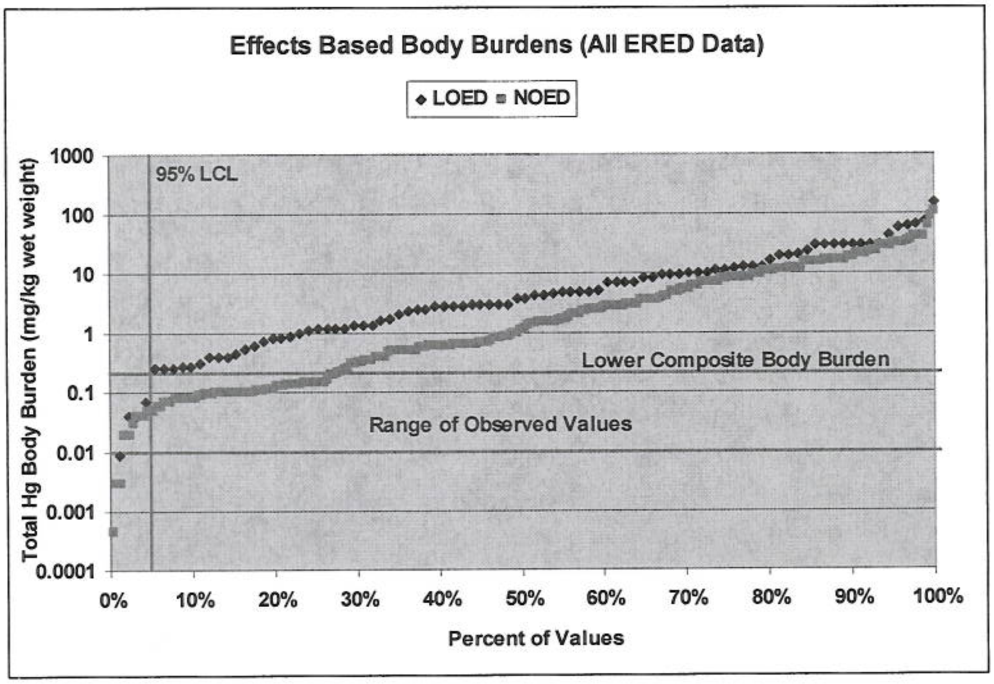

Figure 1 95% Lower Confidence Limit of Tissue Residue Effects for Mercury

2. What are the effects on Hg bioaccumulation at higher trophic levels in the food web? The NewFields tests evaluated clams and worms, not organisms such as forage fish, or commercial or sport caught fish intended for human consumption.

   Response to question #2 – The effects of Hg at *higher* trophic levels in the food web, was addressed in the Supplemental Evaluation for Bioaccumulation Data from the Dredged Material Evaluation for the Douglas Harbor Marina-Juneau Alaska March 2009 and has been addressed in response to US Army Corp of Engineers Comments (Question #13) dated June 9, 2009, and in the response to question #9 sent by Carrie Bohan on January 7, 2010. Please see these documents for a detailed discussion of bioaccumulation at higher trophic levels.

3. What are the effects of Hg methylation by microbial action on marine organisms? Hg moved from the anaerobic to aerobic conditions is more easily methylated by microbial action, the sediment dredged from the Douglas Harbor basin will be exposed to aerobic conditions.

   Response to question #3 – methylation of Hg was discussed in the Supplemental Evaluation for Bioaccumulation Data from the Dredged Material Evaluation for the Douglas Harbor Marina-Juneau Alaska March 2009, specifically pages 1 and 2 and in the responses to the US Army Corp of Engineer Comments. A brief summary follows.

Exposure of newly uncovered anaerobic sediments to seawater creates a potential for increased 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, and 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 a microbial 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 Hg 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.

4. Acclimation of the Lower composite sediment prior to testing provides a realistic assessment of the potential for mercury to become methylated during the dredging and disposal operation. The results showed the acclimated sediment did not cause lethality to test organisms and did not cause accumulation of mercury above the project screening levels. What is the appropriate Hg threshold for bioaccumulation effects? This level should be determined through collaboration with EPA, Alaska Department of Environmental Conservation (ADEC) and other appropriate specialists.

Response to question #4 – The appropriate project tissue screening of 0.32 ppm wet weight was provided by the Alaska Department of Environmental Conservation. This project screening level was the culmination of project meetings, phone conversations and submittal and approval of the project sampling and analysis plan (SAP). The actual number of 0.32 ppm came from a Bulletin prepared by the Section of Epidemiology Division of Public Health Department of Health and Social Services. Dr. Lori Vebrugge led the study team which included members from the Alaska Scientific Committee for fish consumption.

Participants of project meeting and recipients of the SAP included Environmental Protection Agency, the Army Corp of Engineers, ADEC, U.S. Fish and Wildlife Service, and NOAA. The memo from ADEC describing the project specific action level is provided for informational purposes.

Hi,

We've had some discussion back and forth, with a response to comments about ADEC & COE earlier comments. Here is ADEC response to the response to our earlier comment about tissue concentrations for Hg.

In the Inland Testing Manual on page 6-7 the paragraph at the bottom of the page says the following: " (t)he above comparisons to FDA values address human health concerns, and follow from EPA/USACE (1991). Other approaches which should be considered in addition to the use of the FDA values include comparisons to ***state fish advisories****, cancer and non-cancer risk models, existing ambient fish concentration data." (Emphasis added)*

In 2007 the State of Alaska Division of Public Health published the Epidemiology Bulletin Volume 11, Number 4 entitled, "Fish Consumption Advice for Alaskans: A Risk Management Strategy to Optimize the Public's Health." This Bulletin includes information about Hg in fish in Alaska and gives recommended consumption allowances. The Bulletin describes an EPA screening value for unlimited consumption defined as over 16 meals per month (p.5). In Table 8 of the Bulletin it lists for 16 meals per month a monthly consumption allowance for fish of 0.32 ppm wet weight of total Hg (assumed that all Hg is methylHg)(p.31). ADEC considers the 0.32 ppm as the tissue concentration number to use based on the Alaska fish advisory.

We look forward to reviewing the results of the testing.

William Ashton
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February 22, 2010

Ms. Carrie Bohan
Project Review Supervisor
State of Alaska Department of Natural Resources
Division of Ocean and Coastal Management
302 Gold Street PO Box 110030
Juneau, Alaska 99811-1030

Re: Douglas Harbor POA-2000-495-M3 Response to DNR Request for Additional Information

The following is written to respond to the requests for additional information contained in the DNR Division of Coastal and Ocean Management letter dated January 7, 2010. Responses to the (15) inquiries are given following a brief summary of the history of the basin and an explanation of why dredging is required.

As stated in our application, the Corps of Engineers constructed the Douglas Harbor moorage basin in 1960 and dredged the basin to a controlling depth of minus 12 feet MLLW. The Corps chose this depth during design of the harbor and judged it adequate for the vessels expected to use the facility taking into account the low tides experienced in 1960.

NOAA has been recording tide levels in Juneau Harbor since the 1930's. Douglas Harbor is about 1.5 miles south of the official NOAA tide recording station. An examination of verified tidal data from Juneau Harbors shows that the lowest low tides experienced during the original design timeframe was minus 3.2 feet MLLW (see table below).

1959 Lowest Tides

Month	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Tide(ft)	-1.72	-1.52	-1.32	-3.22	-3.02	-2.61	-1.81	-1.12	0.18	-1.92	-2.72	-3.12

This means that the harbor had a maximum depth at the lowest tides of about 8.9 feet. In other words, vessels drawing less than 8.5 feet could use the harbor at all stages of the tide.

The proposed action calls for dredging the existing moorage basin to minus 14 feet MLLW. This may seem that we are proposing to increase the effective depth of the harbor. However, an examination of verified tidal data from the Juneau Harbor station shows the lowest tides currently being experienced are a little over minus 6.1 feet MLLW, nearly 3 feet lower than the lowest tides experienced in 1959 (see table below). This is because the sea level in Juneau is falling due to glacial rebound and other factors.

2008 Lowest Tides

Month	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Tide(ft)	-4.51	-3.82	-2.53	-4.53	-5.10	-4.12	-3.87	-4.01	-2.15	-3.13	-4.78	-6.13

Therefore, the maximum depth of the moorage basin at today's lowest tides is about 7.9 feet. Our proposed action allows vessels drawing less than 7.5 feet to use the harbor at all stages of the tide, one foot less than the original harbor design. During the design process, we considered dredging to minus 15 feet MLLW to match the original operation of the harbor. However, after careful evaluation, we elected to give up a foot so we could minimize the dredging volume. We are not comfortable reducing the operating envelope further as we expect that deeper draft vessels will not be able to operate at all stages of the tide towards the end of the useful life of the replacement facility due to falling seal level.

We are proposing to modestly enlarge the original moorage basin. This is being done to increase the operating area for vessels using the perimeter of the facility. At the current facility, vessels mooring at the landward perimeters of the float system (along Savikko Road and Mayflower Causeway) are greatly restricted in their ability to maneuver. Though the area footprint of the new float layout is less than the original footprint, we are proposing to modestly enlarge the basin so that vessels can use the facility during more of the tide cycle without grounding. Again, we chose a design that would minimize dredge operations and provide good access to landward perimeter of the float system during typical tidal stages.

Maintenance dredging is probably the best way to characterize the true nature of the work. We are trying to preserve the existing operation of the harbor and at the same time removing the current grounding hazards. We are not trying expand the harbor to accommodate classes of vessels different that those currently using the facility.

The following are responses to the (15) requests for additional information:

1. <u>Provide information and a description of why allowing lower water quality is necessary to accommodate important economic or social development in the area where the water is located.</u>

This is a question based on an assumption that water quality will be exceeded and why that should be allowed. The first part of this question has been addressed by a series of controlled experiments required by law that were performed using Federal Guidelines administered by USEPA/USACE for placement of dredged materials in Inland Waters of the United States (USEPA/USACE, 1998). Plans for sampling and analyses of proposed dredged materials were provided for review and concurrence by State and Federal Agencies in October, 2008 and these plans directly addressed the bioavailability and toxicity of various chemical forms of mercury that were examined as a chemical of potential concern for this project. The data was used to demonstrate compliance with State Water Quality at the dredging and the disposal site. Proposed dredged materials were obtained from Douglas Harbor in November 2008 using sediment collected with coring tools to the proposed project depth. These sediments were physically, chemically and biologically characterized throughout the project area. Because there was a potential for chemicals to be distributed differently at depths within the harbor sediment, core samples were also sectioned into upper and lower segments. The testing plan included chemical analyses of sediment (mercury and methyl mercury), porewater created from the sediment, acute and chronic estimates of water column toxicity using juvenile fish, mysids and larval bivalves, and acute and chronic estimates of sediment toxicity using organisms that live in sediment (amphipods and worms). The bioavailability of mercury into benthic organisms (clams and worms) that live in Gastineau Channel sediment was evaluated using the standard 28-day bioaccumulation test. The test results were compared to applicable and available chemical specific guidelines. The tests results were also used to demonstrate the presence or absence of adverse biological effects on test organisms. Additionally, the availability of these chemicals for uptake into food webs and the potential magnification of the contaminant concentrations that would be in shellfish and fish that are consumed by Alaskan residents, including subsistence harvesting were modeled and compared to guidance values provided by the state of Alaska.

Federal regulations require that the discharge of dredged materials cannot violate the Water Quality Standard (WQS) outside of the mixing zone, unless the state provides a variance to the standard (Clean Water Act Section 404 230.10(b)(1)). Inland Testing Manual Paragraphs 5.1.1 and 5.1.2 provide chemical based screening requirements while paragraph 6.1 provides water column toxicity assessments and interpretation of results guidance (USEPA/USACE, 1998). The Manual states that either WQS are met chemically and/or biologically at the edge of the disposal site mixing zone or the sediment proposed for placement at the site is not acceptable.

The response to question 2 provides detailed information from the documents produced during the assessments of Douglas Harbor. Briefly, the concentrations of mercury are less than the WQS requirements, the lack of measureable biological effects beyond the mixing zone of the designated disposal site on sensitive juvenile and larval species are all consistent with Federal Guidance for placement of dredged material at the disposal site. The low level of bioaccumulation into test organisms is comparable to body burden evaluations that show no adverse biological effects at the 95% confidence level of all measurements on sensitive organisms in the scientific literature (Beckvar et al., 2005 ERED, 2009). The further accumulation of mercury into the food web and into tissues of organisms consumed by higher level predators and eventually by people was modeled and demonstrated compliance with the state of Alaska consumption values (Verbrugge 2007). Based on these observations the WQS for mercury is not exceeded in the Gastineau Channel outside of the boundary of the disposal site and Federal Requirements as well as more stringent State of Alaska requirements have been met for all of the test results.

In summary, disposal of sediment from Douglas Harbor into Gastineau Channel will not lower water quality. This has been demonstrated by extensive testing and analysis. Notwithstanding compliance with all applicable standards and the exceptional level of testing and analysis, we believe the economic and social merits of Douglas Boat Harbor must be considered in conjunction with any ecological concerns.

2. Provide information and a description of how the addition of sediment contaminated with mercury will not violate the applicable criteria of 18 AAC 70.020, specifically 70.020(23)(C).

   "The concentration of substances in water may not exceed the numeric criteria for aquatic life for marine water and human health for consumption of aquatic organisms only shown in the *Alaska Water Quality Criteria Manual* (see note 5), or any chronic and acute criteria established in this chapter, for a toxic pollutant of concern, to protect sensitive and biologically important life stages of resident species of this state. There may be no concentrations of toxic substances in water or in shoreline or bottom sediments, that, singly or in combination, cause, or reasonably can be expected to cause, adverse effects on aquatic life or produce undesirable or nuisance aquatic life, except as authorized by this chapter. Substances may not be present in concentrations that individually or in combination impart undesirable odor or taste to fish or other aquatic organisms, as determined by either bioassay or organoleptic tests."

The Alaska water quality standards for total mercury are presented in the Table 1 and were taken from the Alaska Water Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances, amended through December 12, 2008. The most recent revision to Alaska Water Quality Standards - September 17, 2009 does not change or amend the mercury values from the 2008 standards.

To determine compliance with the water quality standards, total and methyl mercury concentrations were measured in the sediment and porewater of the samples collected from Douglas Harbor. These data were used to determine the highest concentrations of mercury present in the sediments. The measured porewater concentrations collected from sampling stations within Douglas Harbor are presented in Table 2. Comparing the measured porewater values with the Aquatic Life Saltwater Criteria; the highest porewater concentration was 29.2 ng/L or 0.029 µg/L, which is below both acute and chronic standards. The standards also state that if a substantial portion of the mercury in the water column is methyl mercury, the criterion may be under-protective. In this case, methyl mercury represents a relatively small percentage of total mercury for the Douglas Harbor stations (0.03 to 3%). Therefore, we believe the existing standards are protective for methyl mercury as applied to this site.

Table 1 Alaska Water Quality Standards for Mercury - 2008

Chemical	Drinking Water	Aquatic Life for Marine Waters (ug/l)		Human Health for Consumption (ug/L)
Total Mercury	2	Acute	Chronic	Aquatic Organisms
		1.8 (1-hr ave.) dissolved	0.94 (4-day ave) dissolved	0.051

Table 2 Methyl and Total Mercury Concentrations in Porewater from Stations within Douglas Harbor

Sample ID	Methyl Mercury	Total Mercury (ug/L)	% of Methyl Mercury in
Area 1 Upper Comp	0.000347	0.0131	0.03%
Area 1 Lower Comp	NM	NM	NM
Area 2 Upper Comp	0.000225	0.0253	1%
Area 2 Lower Comp	NM	NM	NM
Area 4A Upper Comp	0.000382	0.0148	3%
Area 4A Lower Comp	0.000979	0.0292	3%
Area 4B Upper Comp	0.000225	0.0174	1%
REF-01	0.000405	0.0051	8%
REF-02	0.00136	0.0103	13%
REF-03	0.000582	0.0107	5%
REF-04	0.0019	0.0194	10%
REF-05	0.000147	0.00411	4%
REF-Comp	0.000433	0.00883	5%
REF-Comp Dup	0.000393	0.00809	5%

The water quality criteria for aquatic organisms only is reported to be 0.051 ug/L indicating that organisms living or in waters with concentrations of mercury below this value are not expected to accumulate mercury to levels that would cause a human health concern. Again all measured porewater values for Douglas Harbor are well below this human health value for mercury.

When the sediment from Douglas Harbor is disposed of in Gastineau Channel the total mercury porewater concentrations would be further reduced during initial mixing with the receiving waters. The ST Fate Model was run with the Tier II option to determine compliance with water quality criteria during disposal of the dredge spoils. Using the maximum porewater concentrations observed in the Douglas Harbor sediments (0.029 μg/L) and the lowest Alaska water quality standard in Table 1 (0.051 μg/L), at no time during the one-hour simulation were water quality standards violated. The model was rerun with increasing concentrations to determine what concentration in porewater would cause disposal site water to exceed the water quality criterion. A porewater concentration 250 times higher than the maximum observed concentration would result in a violation of the criteria (0.061 μg/L) at 1.5 minutes after initiation of the disposal operation. Three minutes after disposal the maximum water column concentration does not violate the criteria anywhere within the site or outside of the disposal site. The model output is available upon request, it is excess of one hundred pages.

Based on our evaluation, we do not believe that the dredging operation will violate the applicable criteria of 18 AAC 70.020.

3. Provide a description of the methods of pollution prevention, control, and treatment found to be the most effective and reasonable that will be applied to all wastes and other substances to be discharged.

The dredged material will be transported by barge to the disposal site and deposited via a bottom-dump barge. All visible garbage (steel, plastics, etc.) will be removed from the dredged material prior to ocean disposal. Tides and currents will be monitored to ensure that the dredged material is placed within the specified disposal area. Deposit of the dredged material will be limited to 3-hrs either side of low tide to reduce the height of water column impacted by the material as it settles.

In addition, a silt barrier will be installed at the north end of the moorage basin during the dredging operation to keep sediments suspended during the dredging operations within the moorage basin.

4. Provide information and a description of how all wastes and other substances discharged will be treated and controlled to achieve the highest statutory and regulatory requirements.

See response to question #3.

5. Provide information and a description of how the activity, when completed, will not cause a long-term, chronic, or recurring violation of the water quality standards.

As summarized in the response to question #2, there are no water quality criteria violations for long-term chronic effects at the site based on the measured data obtained from the biological tests and from the measured analytical chemistry in the sediment, water and in the tissue of organisms exposed to Douglas Harbor sediment. Since there are no violations of porewater quality calculated at the time of disposal, there is no reason to believe there will be a long-term or recurring violation of the current water quality standards after placement of the dredged material at the disposal site.

6. Expand on the description of the proposed activity provided in the USACE Public Notice. Specifically describe the time of year of the proposed activity and the project duration. Please also clarify the amount of dredge materials you propose to dispose of on State tide and submerged lands.

If a permit for the work is issued within the next few months, dredging and material deposit will occur between October 2010 and January 2011. The quantity of material dredged from the harbor and placed at the disposal site will be approximately 30,000 CY. We expect the dredging operation will take about one month. It is a relatively small dredging operation. Approximately 2000 CY of clean filter rock will be placed within the harbor to stabilize the dredged slopes.

7. Provide information and a description of the areal extent of the discharged dredge material and quantify the degree of variance from the applicable criteria.

The Gastineau Channel disposal site has an approximate footprint of 5-acres. Tides and currents can be monitored so that deposit of the dredged material occurs at a location that ensures the material settles within the designated boundaries.

8. Expand on the alternative analysis already provided (go beyond economic consideration) to include the ecological impact and water quality impact of each alternative.

The following (12) disposal alternatives were identified in the referenced practicable alternative analysis report dated June 25, 2009. Additional assessments of the ecological and water quality impacts associated with each disposal alternative are given following the alternative listing.

1. *Unconfined aquatic disposal in Gastineau Channel near the project site.* The ecological and water quality impacts of this option have been thoroughly tested, studied and previously presented to the agencies. The findings contained in these reports indicate that the proposed activity will not have adverse ecological impacts or a negative effect on water quality.

2. *On-site, intertidal confined disposal behind newly-constructed timber retaining wall extension.* The amount of material handling and construction activity requiring the use of heavy equipment is increased with this disposal option leading to increased carbon emissions when compared to the preferred disposal option. Additionally, this disposal option does not meet the storage capacity requirements for the project since it only accommodates about 15% of the dredging volume.

3. *On-site, intertidal confined disposal beneath expanded parking lot.* Increased carbon emissions due to increased material handling and construction activity requiring the use of heavy equipment would occur when compared to the preferred disposal option. Additionally, this disposal option does not meet the storage capacity requirements.

4. *Intertidal, confined disposal at Treadwell Mine cave-in.* The potential for groundwater infiltration would need to be studied further prior to making assertions about the water quality impact of this option. Additionally, this disposal option does not meet the storage capacity requirements nor is it likely that filling would be allowed due to historical preservation issues and community sensitivity issues

5. *Intertidal, confined disposal at DNR controlled tidelands near the Thane Ore House:* Ecological and water quality impacts for this option are not applicable since this has been ruled out as a viable disposal option due to land use issues and is not allowed under state land use laws.

6. *Intertidal, confined disposal at Alaska Marine Lines storage yard expansion:* There would be an increase in construction related activity and the corresponding increase in carbon emissions as with the other disposal options versus the preferred option. Dredged material and imported fill rock would be placed on existing tidelands. Significant legal liability and indemnification issues would need to be overcome in order to pursue this option.

7. *Upland disposal at Fish Creek Quarry.* Ecological and water quality impacts for this option are not applicable since this has been ruled out as a disposal option due to land use and community sensitivity issues.

8. *Upland disposal in various depressions within the Treadwell Mine complex.* Because there is no road access to the depressions, a road across tidelands would need to be constructed which would constitute a negative impact on ecology. Additionally, as with all of the other disposal options, material handling and the subsequent increased equipment operation would be increased over the preferred disposal option. This option has significant community sensitivity issues since it is within a public park and historic area.

9. *Upland disposal at the Juneau Waste Management Landfill.* Placement of dredged material in the Juneau landfill would require much more handling of the dredged material by heavy equipment. A 20 yard dump truck would need to make approximately 1500 trips from either a dock on the Juneau side of Gastineau Channel or from Douglas Harbor. Energy consumption and the subsequent impact to the environment would be increased over the preferred option. Additionally, material spillage would potentially contaminate the Juneau road system and adjacent residences and businesses.

10. *Upland disposal in an approved landfill in Washington or Oregon.* Because the travel distance involved with this option would exceed 1000 miles, the resulting carbon emissions from transport and increased material handling would be extensive.

11. *COE to evaluate practicable alternatives for disposal of material generated during COE maintenance dredging of their harbor.* We remain open to COE suggestions of alternate disposal options for maintenance dredging of their harbor. However, the COE maintenance group would be subject to the same constraints as CBJ and it is unlikely they would come to a different conclusion.

12. *Do nothing.* In the short term, boats will continue to contact the seafloor which could result in significant ecological impacts if fuel spills occur due to vessel collisions with the seafloor. Additionally, the potential for vessel fires exists due to the decrepit harbor electrical system. In the near future, the harbor will need to be shut down forcing the CBJ to evaluate alternate locations in the Borough to build a harbor to moor the displaced vessels.

9. Provide information and a description of the potential direct and indirect impacts on human health of the proposed activity.

The potential for direct and indirect impacts on human health were examined as part of the designed testing program which followed Federal USACE/EPA guidance (1998). Briefly, benthic marine organisms representing genera and species which were encountered at the Gastineau Channel reference area (*Macoma nasuta* and *Nepthys caecoides*) were exposed to sediment from Douglas Harbor and Gastineau Channel reference areas for 28 days as recommended by the ITM. The average accumulated concentrations of total Hg ranged from 0.08 to 0.21 mg/kg wet weight. These total Hg concentrations are equivalent to methyl Hg concentrations of 0.018 to 0.092 mg/kg wet weight based on USEPA extrapolations for Trophic Level 2 methyl Hg contributions to total Hg values (methyl mercury is 44% of total mercury at Trophic Level 2). The highest concentration of methyl mercury in the tissues of *Macoma* was found in the lower composite, represented by the deeper sandy sediments in the harbor, the methyl mercury concentration for this composite was calculated to be 0.092 mg/kg wet weight. This highest calculated methyl mercury concentration is below the federal action level of 1.0 ppm wet weight methyl mercury established by the Food and Drug Administration and the project specific action level of 0.32 ppm wet weight methyl mercury established for fish and shellfish by the Alaska Department of Health and Human Services (Verbrugge et al. 2007).

The project specific action level is based on unlimited consumption of all fish for everyone except pregnant (or potentially pregnant) or nursing women and children under twelve. For these groups of people the suggested consumption is four fish servings per week or 16 per month. The estimated methyl mercury concentration of 0.092 mg/kg wet weight is also less than the 95 percentile of the lowest observed effect concentration reported in the ERED database (all aquatic organisms-marine and freshwater) of ≤0.2 mg/kg Hg. The USACE/USEPA Environmental Residue-Effects Database (ERED) was developed to reduce the level of uncertainty associated with interpreting bioaccumulation data for the purpose of making regulatory decisions regarding dredged material. This database considers multiple endpoints including biochemical and sublethal effects

Moreover, the methyl mercury levels in the tissue of *M. nasuta* for the lower composite are within guidelines provided by Verbrugge (2007) for unrestricted consumption of fish/shellfish (<0.15 mg/kg wet weight methyl mercury). Finally, the concentrations in the *M. nasuta* from the lower composite, although statistically significantly greater than reference, are less than those provided for the protection of aquatic life and the deep water aquatic dependent wildlife values by Northwest United States Regional Sediment Evaluation Team (RSET 2009) (0.11 mg/kg or 0.12 mg/kg – assumed to be methyl Hg based on cross reference to the Beckvar paper from which the guidance was derived).

The sediment in Douglas Harbor does have elevated concentrations of total Hg ranging from 1.1 to 3.2 mg/kg dry weight in the composite samples. The measured concentration of methyl Hg in the sediment ranges from 0.8 to 2.6 μg/kg. The methyl Hg in the porewater of the core samples ranged from 0.2 to 1 ng/L in the Douglas Harbor sediment and overlaps the range of 0.4 to 1.9 ng/L observed in the reference sediment samples; an indicator of the background mercury concentrations in lower Gastineau Channel sediments. These project specific mercury and methyl mercury concentrations were used to calculate project specific bioaccumulation factors (BAFs). The project specific BAFs and the concentrations of mercury in the sediment, porewater and tissues are summarized in Table 3.

Table 3 Summaries of Mercury Concentrations in Sediment, Water and Tissue and Associated BAFs

Station Composite	Estimated Volume cy	Sediment (dry weight)		Pore Water		*Macoma* (wet weight)			*Nepthys* (wet weight)		
		Total Hg □g/g	Measured Methyl Hg ng/g	Total Hg ng/L	Measured Methyl Hg ng/L	Total Hg mg/kg	Estimated Methyl Hg mg/kg	Project BAF X 105	Total Hg mg/kg	Estimated Methyl Hg mg/kg	Project BAF X 105
Station 1	2000	1.11	2.47	13.1	0.35	0.03	0.012	0.34	0.008	0.003	0.008
Station 2	900	2.50	0.80	25.3	0.23	0.05	0.023	1.0	0.012	0.005	0.22
Station 4A	5300	3.22	1.34	14.8	0.38	0.04	0.017	0.45	0.010	0.004	0.11
Station 4B	5900	2.33	1.08	17.4	0.23	0.04	0.018	0.8	0.009	0.004	0.17
Lower Compositea	15400	2.24	2.62	29.2	0.979	0.21	0.092	0.94	0.027	0.012	0.12
Total	29500	--	--	--	--	Volume weighted BAF		0.79	Volume weighted BAF		0.12
Trophic Level 2 BAFb	--							1.6 ± 0.5			

a Values are an average of the lower composite samples.
b Mean of pertinent values from OHHEA 2006

A supplement to the final report "Supplemental Evaluation for Bioaccumulation Data from the Dredged Material Evaluation for the Douglas Harbor Marina Juneau, Alaska June 2009" (Appendix I of the report) contains detailed information addressing human health concerns. The human health issue was also addressed in the Response to USACE response to comments # 13. The Supplemental document is attached to this memo. A brief summary of the findings from the supplemental are included here.

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 porewater methyl mercury concentration. These are shown in Table 3; the highest BAF was for Lower Comp, was 9.4 X 104. This project specific BAF is slightly lower than those reported for marine applications (OHHEA 2006).

The lower project specific BAF indicates that the conditions at Douglas Harbor are less conducive to bioaccumulation of methyl mercury the generic BAFs reported for marine sites. However to provide a conservative estimate, the generic average BAF of 1.6 X 105 was used to estimate methyl mercury concentrations in tissues of organisms at higher trophic levels. Almost all of the studies to calculate BAF for Trophic Levels 2, 3, and 4 are based on terrestrial or freshwater species. Use of these BAFs is not appropriate in estuarine applications. The California OEHHA (2006) report "Bioaccumulation Factors and Translators for Methyl mercury" has some estuarine estimates based on a few studies. These appear to be the best estuarine estimates available. The report calculated BAFs for Trophic Level 4 came 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 X 105 ± 0.5 X 105. These three BAFs were 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 MeHg/Kg .

When calculating BAF for higher trophic levels, it is important to keep in mind that these organisms typically have larger home ranges, more complex diets, and migratory behavior when compared to lower trophic level organisms. However, our models do not include these potential steps that would reduce predicted concentrations of Hg in higher trophic levels. This is a very conservative approach and it is less likely these organisms can reach the predicted maximum concentrations from the sediment placed at the disposal site. It is apparent that even 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 that are much less than those modeled as well as the 0.32 mg MeHg/kg and within the ranges noted in Verbrugge (2007) and Beckvar (2005).

10. Provide information and a description of the existing uses (such as recreational, personal use, subsistence, or commercial) of the water body in the project area and within an area of anticipated impacts from the project area.

The previously authorized and utilized Gastineau Channel dredge material disposal site is not utilized as a commercial, recreational, subsistence or personal use fishery. The site is located in a heavily trafficked area near the middle of Gastineau Channel and near the outfall of the Juneau Sewer Treatment plant. At an average depth of 120' MLLW, this location is too deep for dungeness crab fishing. King crab fishing in Gastineau Channel has not been allowed for several years and any pots that dropped at the disposal site would be in peril due to the heavy vessel traffic including cruise ships. To put it plainly, no one fishes or crabs at the disposal site. No one involved in this project from the Docks and Harbors Department staff, the local consultants and contractors, to Douglas Harbor vessel owners can recall witnessing anyone fishing or crabbing at the proposed disposal site.

Please see the enclosed letter from Captain Ed Page, Executive Director Marine Exchange of Alaska for an additional discussion of navigational impacts and recreational usage at the Gastineau Channel disposal site.

11. Provide information and description of the estimated impact (both short-term and long-term) of the proposed activity's discharge of dredged material on the existing uses of the water involved, including recreation and use for habitat, rearing, growth, or migration by fish, shellfish, other aquatic life, and wildlife including the potential for bioaccumulation and persistence.

Dredged material that is determined by testing under the Federal Guidance provided by USEPA/USACE (1998) to have no unacceptable adverse biological effects (acute or chronic, including body burden and food web contamination) to organisms living outside the disposal site boundaries is acceptable for disposal and may not require additional variances from the State. Adverse effects on test organisms were not observed or demonstrated to occur in sediment or water outside of the disposal site boundaries. The adverse effects observed during the testing program included a reduced normal development of larval mussels at the highest test suspended particulate phase (SPP) concentration and elevated (relative to reference exposures over comparable periods of time) body burden levels attained by the clam when exposed to the lower portion of the proposed dredged material.

The water-column test conducted using bivalves was found to have an adverse effect at the 100% SPP treatment. This 100% SPP treatment (created by mixing in one part sediment with four parts water) represents the maximum concentration of contaminants and suspended particulates that would be observed during the dredging process. When sediment is released through the water column, the maximum suspended water column concentration (100% SPP) is rapidly reduced (less than five minutes) within the disposal site boundaries by mixing with the water column (a depth of ~120 ft).

Federal regulations require that at an unconfined disposal site the parameters such as water currents and placement locations of dredged material in the designated disposal site will result in a concentration at the edge of the mixing zone that is greater than 100-fold *lower* than the observed acute or chronic biological response (LC or EC_{50}) measured in the test. The models run for these tests results showed that the concentration of water borne materials would be 100-fold *lower* than the any effects levels measured by testing prior to any materials that would be transported beyond the disposal site boundaries.

The elevated contaminant concentrations in the clam were based on an exposure period of 28-days which exceeded the time require for tissue levels to come to equilibrium with exposure concentrations in experimental tests conducted by the USACE/ERDC (Best et al. 2005; MacFarland et al, 2002). The concentrations attained during this test procedure were equal to or less than the no observable effects levels for acute and chronic test results in over 95% of the body burden/effects data contained in ERED (2009) and are consistent with the no effects levels obtained by Beckvar, et al. (2005). Additionally, modeling of food web amplification through multiple steps and comparison of these values to potential risk of exposure to people (including subsistence fishers) demonstrated compliance with Alaska Department of Health tissue screening levels for mercury (Verbrugge 2007).

Because of these test results the proposed dredged material from Douglas Harbor is acceptable for placement in the Gastineau Channel dredged material site based on Federal guidance.

12. Provide information and a description of the expected duration of proposed deposit and the potential transport of pollutants by biological, physical, and chemical processes. Include consideration of the potential of propeller wash from cruise ships, current and tides to move the dredged material out of the disposal site and disperse the material over a larger area.

In general, ocean current velocity follows a logarithmic distribution in which the velocity is zero at the boundary layer, i.e. the sea floor. As such, once the material is placed, it will not disperse by physical processes due to current. Cruise ship propeller wash will not cause physical transport of the material either. The seafloor elevation at the disposal site following placement of the dredged material will be approximately -115' MLLW. The draft of the largest cruise ships is 27'. As such, a cruise ship traveling over the disposal site at extreme low tide would have in excess of 80' from propeller to seafloor. Additionally, the disposal location is in a no-wake zone for vessels of all sizes including cruise ships due to the proximity to the Douglas Harbor entrance so propellers will not be engaged at high rpm's at the location. The abundance of fine-grained sediment that can be seen in the ADF&G conducted dive video currently available for viewing on the CBJ Docks & Harbors Department website lends credence to these statements. It is probable that the sediment observed in the video was dredged and deposited at the site during the previous Douglas Harbor dredging projects.

USEPA and USACE jointly developed the Inland Testing Manual (USACE/USEPA 1999) to conduct chemical and biological testing to determine if contaminants can be released from the sediment and cause adverse ecological or human health impacts. These procedures were followed to determine the potential effects of mercury to larval fish, small crustaceans and larval mussels that live in the water column, to small marine crustaceans and worms that live within the sediment, and to determine the availability of mercury for uptake into the tissues of organisms living in the sediment using clams and worms.

The results of this assessment demonstrated the dredged sediment from Douglas Harbor would not negatively influence the water quality or water column organisms of Gastineau Channel outside of the dredged material disposal site and would not adversely affect the organisms exposed directly to the sediment.

To determine if sediment is considered *suitable* for aquatic disposal the following criteria must be met:

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).

Compliance with these regulatory criteria requires the applicant to run the STFATE model provided as part of the regulatory assessment to determine whether water quality criteria would be violated during the disposal of sediments at the Gastineau Channel Disposal Site (USACE/USEPA 1999).

The model requires the input of site specific parameters (Table 1.0) including determination of the limiting permissible concentration (LPC). The LPC for the water column bioassays is one-hundredth of the acutely toxic concentration (the LC_{50} or EC_{50}) of dredged material in the water column after the initial 1-hour mixing period.

Based on the results of the larval test (the most sensitive test used to estimate adverse effects), the LPC for the test composites was calculated as 42.2% concentration for Area 4B Upper. This was the lowest LC_{50} (most toxic) for any of the sites and also the finest sediment. Using the STFATE model, the LPC was calculated for the Gastineau Channel Disposal Site, a summary of the input parameters and model outputs are shown in Table 1.0. The maximum concentration at the site boundary after one hour was calculated to be 0.347%. This value is below the LPC for each of the test composites.

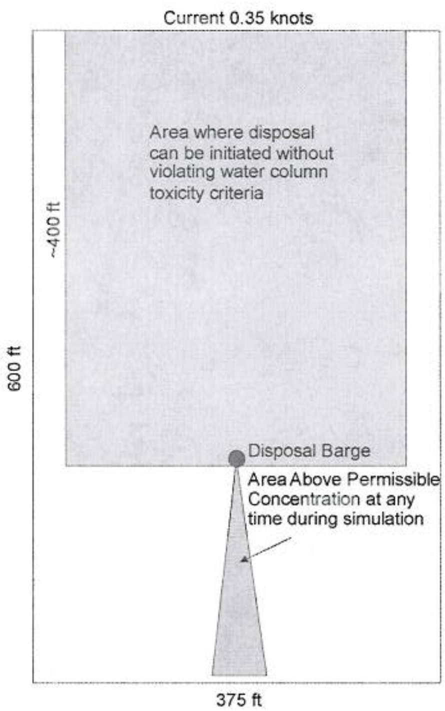
Table 1.0 Input Parameters to STFATE

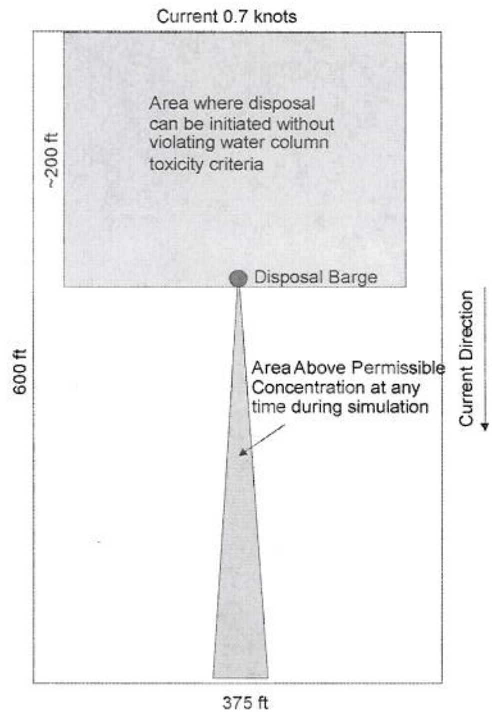
Calculation of Limiting Permissible Concentration Using STFATE (Ver 5.01)	
Model Input	Gastineau Channel
Mixing Area	
Depth of site (ft)	120
Width of site (Northeast to Southwest, ft)	375
Length of site (Northwest to Southeast, ft)	600
Area of site (sq ft)	225,000
Volume of disposal vessel (cu yd)	500
Length of simulation (hrs)	1
Composition of material	
Solids (%)	64.9
Sand (%)	10.9
Silt (%)	65.1
Clay (%)	21.7
Fluids (%)	35.1
Density of water (g/cc)	1.02
Water Quality Results	
Lowest LC50 or EC50 (%)	42.2
Limiting Permissible Concentration (%) = 0.01 of LC50 or EC50	0.422
Maximum concentration within mixing area during simulation (%)	0.455
Maximum concentration within mixing area at end of simulation (%)	0.0245
Maximum concentration outside disposal site during simulation (%)	0.347
Maximum concentration disposal site at end of simulation (%)	0.0245
Water Quality Criteria Violated?	No

The ST Fate model used two current input velocities of 0.35 knots (0.59 feet per second) and 0.7 knots (1.18 feet per second) in the longitudinal direction of the disposal site. The slower velocity was selected because it corresponds to the most frequently occurring current (0.3-0.4 knots). Because the disposal site is so small the dump site was retained at the upcurrent end of the site under the assumption that disposal would be done at whichever end of the site was upcurrent at the time. The figure below shows the area within the disposal site where disposal can be initiated without violating water column toxicity criteria under each current scenario.

This model output that the disposal of sediment into the Gastineau Channel disposal site is not expected to *release materials outside of the disposal site and based on the biological results the deposited* material is not expected to cause adverse effects to water-column or sediment dwelling organisms living within the disposal site boundaries.

Finally, if the pore water mercury measurements (See response to comment #2) are compared to the Aquatic Life Saltwater Criteria, *there would be no violation of these criteria; the highest porewater concentration observed was 29.2 ng/L or 0.029 μg/L, well below even the chronic criterion of 0.94 μg/L.*





13. <u>Describe in detail the methods of disposing of dredge materials. Will the dredged material be dumped from the barge, or pumped down to the bottom of the channel?</u>

The majority of the dredged material will be collected in the harbor via a clamshell bucket operated by a crane on a barge and placed into a dredge scow moored to the side. Lesser amounts of the near shore dredged material will be gathered by an excavator and placed into the dredge scow. When the dredge scow is full (approx. 500 CY), the scow will be towed to the disposal site via tug. Material will be released from the scow by bottom dump.

14. <u>The proposed disposal site currently has a depth of 18 fathoms, what is the anticipated final depth of the disposal site following placement of the dredged materials?</u>

Our soundings indicate that the depth at the disposal site is closer to 20 fathoms If the dredged material is evenly spread over the disposal site, 30,000 yards of material equates to approximately 3-½ ft. As such, the average depth at the disposal site will decrease by approximately one-half fathom.

15. Could the disposal site be capped following use? What depth would be necessary for a cap to be effective?

Typically, caps are used at the dredging site to provide a new surface to a dredged area to accommodate settlement by benthic organisms and to minimize the potential for any residual contaminants to become bioavailable. Caps are not generally used at disposal sites because the sediment that is placed at these sites has generally undergone extensive testing to demonstrate that there will be no unacceptable adverse effects associated with the disposal on the water, surrounding sediment or the organisms that might live in these sediments. Because these materials are acceptable for placement in unconfined disposal sites the additional placement of more sediment at a disposal site is not considered necessary or desirable. There are special cases for placement of contaminated sediment in a confined aquatic disposal (CAD) sites. These sediments are those that have demonstrated the presence of unacceptable adverse effects in addition to having no other disposal option. In these cases the CAD site is generally near the dredging site, in shallow waters and the materials are placed at depths below the surface of the surrounding sediment. The depth of burial of the sediment at the CAD varies but is meant to bury the contaminated sediment below biogenic zones and also beneath depths where propeller or vessel traffic can disturb the capped sediment. Typically the cap depth has been at approximately 1 to 2 m but this may vary depending on the types of organisms that may inhabit the cap material. Some of the deeper burrowing clams and crustaceans that may occur at the site need to be examined to determine the minimum depth of a cap to preclude bioturbation and exposure of any buried contaminants. The placement of 1-2 m of cap material on the disposal site to cover the 30,000 cubic yards of Douglas Harbor dredged material that has demonstrated the lack of unacceptable adverse effects would require an equal to as much as twice the amount of cover material.