Dredged Material Management Program
Dioxin Project

Analysis of Stakeholder Input

Prepared for
DMMP Work Group

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For the DMMP Dioxin Project, this document summarizes input received from the public between May and November, 2007.

- *This Executive Summary presents the key issues raised in public comment*
- *The Executive Summary also overviews the primary suggestions raised by the public on how to proceed*
- *The body of the document provides more detail on the project, the process for public input and comments received*
- *Appendices include documentation of the public process, meeting handouts, meeting summaries, summaries of comments, and the written comments received by email.*

EXECUTIVE SUMMARY

Key Issues Raised in Public Comment

Consistency Across Regulatory Program Policies is Important

- Cleanup, source control and dredging programs are interrelated and should be coordinated. DMMP is one of many programs that will address ubiquitous pollutants in the Sound.
- Unintended policy outcomes for other programs may come from a revised DMMP framework for dioxins.

Open Water Disposal of Bioaccumulatives is a Regulatory Dilemma

- Existing conditions in the Sound (sediment, bottom-fish, and crab tissue) likely exceed acceptable risk levels based on the "absolute risk" approach that is currently the standard for regulatory programs and using recent superfund guidelines for determining reasonable maximum exposure (RME;USEPA 2007).
- When calculated, sediment or tissue risk-base levels are below background, current state regulations allow for the use of "natural" background based on non-urban reference bays such as Carr Inlet, where dioxin is present at low levels.
- In contrast, maintenance dredging activities most often occur in urbanized harbors and waterways, where dioxin concentrations are typically elevated above non-urban reference bays.
- If the dioxin suitability disposal framework were to be based on sediment or tissue levels from non-urban reference areas, a substantial fraction of dredged material would not be acceptable for open water disposal.
- The framework developed for dioxins will have implications for other widespread persistent bioaccumulative compounds such as PCBs and carcinogenic PAHs, for which background-derived risk values may also be unacceptably high under current regulatory approaches.

It is Important that the Solution be Viewed in the Context of a Healthier Puget Sound and Tribal Fishing Rights

- It is the Governor's intention and the mission of the Puget Sound Partnership (PSP) to improve the health of the Sound. The DMMP framework and associated decision-making should be viewed in a context of contributing to this overall goal.
- All of the DMMP-managed non-dispersive unconfined open-water disposal sites are located within tribal U&A areas.
- It is likely that background sediment in Puget Sound, including the non-urban reference sediments, contain dioxins at levels that present an unacceptable risk to tribal/subsistence seafood consumers according to the current absolute risk evaluation approach.

Data Gaps and Scientific Uncertainties Should be Accounted For

- Dioxin data characterizing existing conditions (sediment and tissue) in Puget Sound are limited.
- There are uncertainties associated with the risk of dioxin at low levels, the cumulative risk of dioxin chemical mixtures, the degree of transfer of dioxins from sediment to seafood tissue, from tissue to humans, ecological effects to high trophic levels, and dioxin chemical fate and transport.

There are Many Benefits of Maintaining a Viable Open Water Disposal Program

- Maintenance and navigation dredging is crucial to the Puget Sound economy. If the framework for dioxin suitability for open-water disposal of dredged material is too stringent, affected projects would be numerous, and beneficial uses of dredged material in environmental restoration could be affected, to the detriment of restoration projects. This is an important part of the toolkit for improving the quality of the Sound.
- Dredging and harbor area redevelopment projects using DMMP disposal sites often create habitat and stormwater improvements that may become infeasible if unconfined, open-water sites are unavailable for some of the materials. These projects and improvements are also important parts of the toolkit for improving the quality of the Sound.
- Alternate disposal methods would have substantial impacts to the economy and the environment, including high disposal costs, potential reduction in redevelopment projects and environmental cleanups or restorations, increased carbon footprint due to fuel consumed to move the material, the need for improved transportation infrastructure, and reduction in the operational life of landfills.

Primary Suggestions Raised by the Public on How to Proceed

Process

Defer DMMP Decisions to Follow Development of Coordinated Regulatory Approach to Address Low-Level, Persistent Bioaccumulative Compounds in the Sound

- Prior to a DMMP decision on how to move forward with the dioxin framework, make policy decisions across multiple programs and agencies regarding the overall risk management approach and priorities for dealing with low level contamination by persistent bioaccumulative compounds in Puget Sound.
- Establish a technical forum with individuals reflecting a range of perspectives to frame choices for policy makers.

Utilize a Transparent, Multi-criteria Approach for Developing Guidelines and Adaptively Managing Them

- Multi-Criteria Decision Analysis is a structured approach to evaluate multiple objectives and document the decision rationale. Objectives may include human health and ecological risks; economic benefits and costs; environmental impacts and benefits; and regulatory consistency. In a program such as the DMMP, this approach has the ability to incorporate new information (e.g., toxicity, site monitoring data) and update management processes.

Options for a Revised Framework

Base the Framework on Non-Urban Background Concentrations

- Use existing sediment and tissue concentrations in primary basins of Puget Sound or reference areas without urban influence, to set suitability thresholds for the disposal sites.

Base the Framework on Existing Conditions in Puget Sound with Some Urban Influence

- Use existing sediment and tissue concentrations in primary basins of Puget Sound, - including areas that are not highly impacted by urban activities, but have some urban influence.

Determine Suitability Based on Incremental, as Opposed to Absolute Risk

- Calculate acceptable sediment or tissue levels for disposal that would keep the risk at the disposal site within an acceptable increment of risk above the existing background risk at the time that the framework was established. (Existing background risk would not be considered.)

Utilize Comparative Risk Evaluations to Consider Total Project Effects

- Develop a comparative risk evaluation framework template to determine whether the risk of the material after placement at the disposal site is less than or greater than the risk of the material remaining in place at the dredging site.

Set Multiple Suitability Thresholds by Depth at the Disposal Site, and Require Sequencing of Material Placement

- Define suitability dredged material thresholds for dredged material based on urban-influenced existing conditions, or an acceptable incremental risk (using methods as described above).
- Require that material placed at the surface of the disposal site during each placement event meet a more stringent (lower) threshold, perhaps based on a non-urban background.

Evaluate Existing Disposal Sites to Determine Acceptability of Past Disposal Practices

- Use monitoring of the disposal site areas to determine whether concentrations in the target areas of many of the disposal sites are hard to distinguish from surrounding disposal site background levels, as a component in the evaluation of the need for adjusted protocols.

Consider Establishment of Multi-User Confined Aquatic Disposal Sites

- Implement agency permitting and management of publicly-accessible confined aquatic disposal sites. The September, 2003 Multi-User Disposal Site (MUDS) EIS could be a starting point.

INTRODUCTION

This report presents a summary of the stakeholder comments and input received from the dioxin public meetings and technical workshops held from September to November for the Dredged Material Management Program (DMMP) Agencies consideration for the development of revised interpretive guidelines for dioxins under the Puget Sound Initiative.

This document meets the contract requirements for "Deliverables 3, 4 and 5." The project scope originally assumed separate deliverables would be prepared summarizing the input received from the Public Meetings and Technical Workshops, however, those summaries are included in this report as attachments and included in the analysis of input received as discussed below.

Floyd|Snider has supported the DMMP Agencies (Agencies) by organizing, facilitating, and documenting a series of public meetings and technical workshops to elicit input from stakeholders on the subject of open-water disposal of dredged material containing dioxins. The Agencies will use this input to develop interpretive guidelines to determine suitability of dredged material containing dioxins for open-water disposal. Floyd|Snider will also provide services to facilitate the process used by the Agencies for development and decision-making regarding the interpretive guidelines. Initial public input was elicited through a questionnaire process implemented in May 2007. Public meetings in four locations throughout Puget Sound were conducted from September to October. A total of two technical workshops were held in late October and early November.

BACKGROUND ON PREVIOUS AND INTERIM DIOXIN DMMP GUIDELINES

In the PSDDA Dredged Material Evaluation and Disposal Procedures user's manual there are no screening levels (SLs) or maximum levels (MLs) for dioxins (DMMP 2000). Analysis of dioxins and furans, identified as PCDDs and PCDFs, is only required on a project-specific basis in areas where available data indicated their presence or at specific project sites on the basis of "reason to believe". The "reason to believe" approach to requiring what COCs will require testing in the material to be dredged is based on the site history, historical operations, existing site data, adjacent available data, and current operations. If there was reason to believe that dioxins were present at the site, then dioxin testing was conducted on the dredged material (sediment).

In the past, because there are no numerical guidelines for the interpretation of dioxin and furan data in sediments, the DMMP have relied on informal "concern" levels derived from a previous risk assessment. These "concern" levels functioned as bioaccumulation triggers. If a bulk 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD; the most toxic dioxin compound) concentration greater than 5 ng/kg, or a total toxic equivalent concentration (TEQ) greater than 15 ng/kg was detected then the project proponent was required to perform bioaccumulation testing, or to use alternative disposal methods (upland). Since there are no tissue guidelines for dioxins to use in the interpretation of bioaccumulation test data, the DMMP's approach was to utilize current advisory guidelines and best professional judgment.

In light of several high-profile dredging and clean-up projects involving dioxins in Puget Sound, as well as the recent publication of the Superfund framework for estimating reasonable maximum exposures (RME) to subsistence tribal fishers (USEPA 2007), DMMP staff recognized

that an updated approach to determining suitability of dredged material containing dioxins was needed. The DMMP's "concern" levels were based on a 1991 risk assessment conducted for Grays Harbor in which tribal subsistence fishing was not included. Furthermore, the Grays Harbor risk assessment did not include an evaluation of effects to ESA fish species or wildlife.

The interim guidance for dioxins that is currently in place was based on an analysis done in 2006 for the Anderson/Ketron (A/K) site to support a suitability determination for the Port of Olympia. This analysis included a screening-level risk assessment which derived risk-based tissue levels that were both lower than limits of detection and lower than dioxins observed in field-collected tissues from the A/K site and other non-urban areas. Therefore, suitability of sediments relative to dioxin was determined by comparison to dioxin concentrations (TEQ) in sediments surrounding the A/K site (termed disposal site area background). This background approach is being applied to the other non-dispersive sites as an interim guidance until a revised framework for dredged materials containing dioxins is recommended.

For non-dispersive sites the interim guidelines are that individual test sediment dioxin concentrations cannot exceed the disposal site area background *maximum* concentration and that average volume-weighted sediment dioxin concentrations cannot exceed the disposal site area background *mean* concentration. The term "area background" refers to concentrations in the vicinity of the disposal site but outside the influence of the material deposited at the sites (includes perimeter and off-site samples taken during site monitoring). For dispersive disposal sites test sediment, dioxin concentrations cannot exceed reference site background dioxin concentrations.

PROCESS TASKS PERFORMED TO DATE

Questionnaire and Fact Sheet

A fact sheet and questionnaire were developed and released on May 1, 2007 (Appendix A). The questionnaire was posted on the U.S. Army Corps of Engineers (USACE) Dredged Material Management Office webpage, and notices of the questionnaire were e-mailed to a broad mailing list, provided at the May 2 Sediment Management Annual Review Meeting. Response to the questionnaire was requested by May 31, 2007.

A total of 32 responses were received, from a cross-section of people representing agencies, ports, consulting firms, community and environmental non-governmental organizations (NGOs; Appendix B).

Following a review of the questionnaire responses, Kate Snider conducted several interviews by phone to receive additional feedback on possible processes to use to implement the planned workshops. The questionnaire responses and interview feedback are included in the summary analysis below.

Tribal Coordination

Public meeting and technical workshop notifications were sent to environmental and natural resources managers at all tribes. Additionally, letters were also sent to the Tribal Chairs from

the Department of Ecology, formally inviting them to participate in the process and providing them with a separate government to government meeting upon request (Appendix C). Following the notifications, DMMP staff members called the tribal department managers to confirm receipt of the letters and invite the tribes to the meetings and workshops. Plans are underway to schedule at least one meeting hosted by the Northwest Indian Fish Commission which all interested tribes can attend to discuss this process in more detail. Tribes that have expressed interest in attending this meeting include the Upper Skagit, Skokomish, Lower Elwah, Nooksak, Nisqually, and Port Gamble tribes.

Public Meetings

A public meeting notice was posted on the USACE Dredged Material Management Office webpage, and notices of the meetings were e-mailed to a broad mailing list that also received and/or responded to the May questionnaire. The public meeting logistics and objectives were also provided to the public via an Ecology press release. Public meetings were held in Seattle (2), Olympia, Bellingham, and Port Angeles. The attendance at each public meeting, in addition to the DMMP dioxin work group staff members, was 22 at the first Seattle meeting, 5 at the second, 18 at the Olympia meeting, 6 at the Bellingham meeting, and 5 at the Port Angeles meeting.

At the public meetings a Power Point presentation was presented by Floyd|Snider and DMMP agencies staff, which included the objectives of the process, timeline, background information regarding the DMMP and dioxin science, and five potential framework options with considerations for each option. It was made clear that the options presented were only to stimulate discussion, and were not an exclusive list of options to be considered. Posters containing more detailed information as well as maps presenting available dioxin sediment data and recent testing results near DMMP disposal sites were posted at each meeting. Presented posters were also provided to all attendees in an informational handout (Appendix D).

Comments and feedback received at the public meetings, and suggestions for the technical workshops, as well the stakeholder group that put forward the input, are documented in summary tables (Appendix E). Stakeholders that could not attend the meetings or who had additional input were able to e-mail their feedback to the dioxin work group e-mail address. Comments regarding the development of revised framework for dioxins in dredged material were requested by November 15, and subsequently revised to November 30, 2007 at public request. The input received from the public meetings was used to help develop the agendas for the subsequent technical workshops. The comments and input received at the public meetings and via e-mail are included in the summary below.

Technical Workshops

A notice of the technical workshops was posted on the USACE Dredged Material Management Office webpage, and notices of the workshops were e-mailed to a broad mailing list which also included those stakeholders who attended the public meetings. Technical workshops were held in Seattle on October 30 and November 6, each consisting of four to five hour work sessions. Agenda topics included technical issues related to risk based and background based framework options, topics received from the public meetings, and general process and policy issues and concerns. The feedback on agenda items and discussions from the technical workshops are

summarized in two Word documents (Appendix F). Attendees of the technical workshops included consultants, agency representatives, non-governmental agencies, and tribal representatives. The attendance at each technical workshop, in addition to the DMMP dioxin work group staff members, was 19 at the first workshop and 20 at the second workshop. The comments and input received at the technical workshops and via e-mail are included in the summary below and Appendix G.

INPUT RECEIVED FROM STAKEHOLDERS

The input received from stakeholders throughout this process has generally consisted of comments and feedback related to the following topic groups:

1. General Process and Policy Concerns
2. Comparative Risk, Incremental Risk and Risk Management
3. Background Methodologies
4. Evaluation of Multiple Variables Regarding Impacts of the Revised Framework
5. When to Test and Testing Methods
6. Sequencing and Thresholds By Depth

The input received from stakeholders is discussed below in more detail for each of these six topics and supporting materials are provided in the attachments to this report.

1. General Process and Policy Concerns

Consistency of DMMP with Other Regulatory Programs Including Cleanup and Puget Sound Partnership

In all of the forums for stakeholder input, comments and concerns were expressed regarding the consistency of the revised dioxin framework for dredged material open-water disposal with state and federal cleanup regulations and the RSET process. Under MTCA, state cleanup levels for individual carcinogens are based upon the upper bound of an excess lifetime cancer risk of one in one million (1×10^{-6}). Recent amendments to MTCA now establish this same risk level for chemical mixtures of dioxin/furans. This differs from USEPA's risk level of one-in-a-hundred thousand (10^{-5}). Concerns were received that there is currently, or potentially will be, a disconnect between cleanup goals and PSDDA disposal guidelines. Primarily the concern was that bioaccumulation test results may fail risk-based site cleanup site goals, but may still be suitable for open-water disposal and that there is a need to make the programs consistent again. Whatever framework is recommended for dioxins, it is likely that it will have implications for additional wide spread bioaccumulative compounds such as PCBs.

The concept of "regulatory beauty" that was in place when PSDDA was developed was discussed—that substantial policy effort and energy was invested in coordinating guidelines used in cleanup, source control, and dredging programs. Caution was expressed that all these programs are very interrelated and there may be unintended policy outcomes from a revised DMMP framework for dioxins. Although dredged material disposal sites are not cleanup sites

and should potentially be addressed in another manner, consistency with regulatory programs remains important.

Under the Puget Sound Partnership, the presence of ubiquitous pollutants throughout the Sound at low to moderate levels is being addressed. The regulatory and policy status of the evaluation are dynamic. Concern was received that this overall evaluation is not the purview of the DMMP and that dredge disposal should not drive this effort. However, is was also expressed that the DMMP is one of the many programs that need to address ubiquitous pollutants such as dioxins and that there needs to be consideration of the relationship with other regulatory programs. It was suggested that there needs to be a better understanding of the issue—Are dioxins throughout Puget Sound a concern? Is there really a problem? Dioxins are not listed on the state 303d list, likely due to lack of data.

Several respondents recommended that prior to a DMMP decision on how to move forward with the dioxin framework, policy decisions need to be made across multiple programs and agencies relative to the overall risk management approach and level of priority for low level contamination and persistent bioaccumulative compounds present throughout Puget Sound, developing a regional strategy that can inform the DMMP process.

Dredge Material Disposal Thresholds in the Context of Increasing Puget Sound Health

A challenge of any framework that is recommended is that Puget Sound as a whole is being evaluated with objectives to increase overall cleanliness and therefore reduce what we are currently identifying as background levels of contamination. The challenge is how to evaluate what sediment background and/or risk-based thresholds are today versus what they may be in 20 years when the Sound is healthier. The PSP goal of trying to reduce concentrations over time has implications in the evaluation guidelines; what would be the "baseline" to which we would compare for disposal sites? It is currently difficult to understand what is historical versus "new/ongoing" contamination due to the lack of dioxin data, and to predict future concentrations. How should the framework account for and deal with an evolving background and avoid creating localized "hot spots" resulting from the disposal of dredge material containing dioxins that are at levels consistent with "today's background"?

To allow the revised dioxin framework to be sustainable there needs to be an adaptive management component that includes decisions on the time periods and monitoring methods that will be used to re-evaluate the framework as needed and will allow the process to adapt to changing expectations and goals.

Implementability of "Absolute Risk" Based Thresholds

The risk-assessment methodologies in the state and federal guidance are highly constrained, targeting narrow areas near sources that may be associated with individuals and groups that have created the sources and therefore may be held accountable. The risk of the contamination in the environment is evaluated based on its "absolute risk"—where the risk of the contamination being present in the environment is determined (as compared to the absence of risk if it was not in the environment).

Several respondents held the opinion that while an absolute risk assessment approach may be appropriate for cleanup programs to identify the extent of cleanup necessary in areas found to be sufficiently contaminated to require cleanup, it is not appropriate for use in the dredging program, for which they felt that evaluating the incremental risk of disposal is a more appropriate approach.

The absolute risk assessment approach results in implementability challenges when evaluating the risk of dioxin exposures to humans because of the high level of potency associated with dioxins. Dioxins are currently considered a potent carcinogen and are globally distributed with both anthropogenic and natural sources. The use of absolute risk to derive dioxin suitability thresholds, whether that is the DMMP human health risk level of one-in-one hundred thousand (10^{-5}) or the revised MTCA one-in-one million (10^{-6}) risk level, would most likely result in thresholds less than existing concentrations throughout the Sound, therefore potentially prohibiting disposal of the typical material containing dioxins that is dredged from harbors.

The risk assessment that was performed for the A/K disposal site used an absolute risk approach, which resulted in dioxins levels that were lower than existing conditions in the environs of the A/K site. As the risk-based thresholds were not implementable, the DMMP defaulted to using the existing conditions within the disposal site environs to set suitability guidelines.

Concern was expressed that if the existing concentrations in Puget Sound sediments already have an unacceptable level of *absolute* risk, then dredging the material from shallower "easier to manage" locations and disposing of it in deeper "harder to manage" locations, where the risk is unacceptable in both locations does not make sense.

Alternatively, it was expressed that if the sediments in harbors and the sediments in the environs of the disposal site both already pose unacceptable levels of absolute risk, dredging the material from shallower, potentially more biologically available locations, where it may be spread out more widely, and disposing of it in deeper, less biologically active locations where it is concentrated in a relatively small area, may provide environmental as well as economic benefits. The other perspective on this concept that was expressed in public meetings is that the dioxin levels in surface sediments (0-10 cm) in harbors may be lower than the levels at depth thereby minimizing the pre-project dioxin exposure to the nearshore biotic community. However, during the maintenance dredging activity, the dredge residuals and the exposure of a new sediment surface, with contaminant contributions from historical operations, may increase the bioavailability of dioxins in the nearshore environment over what it was prior to the dredging activity.

Adaptive Management, Supporting Data and Research, Scientific Uncertainty

Several participants focused on the point that the current and ongoing monitoring of the disposal site areas demonstrates that concentrations in the target areas of many of the disposal sites are similar to, and hard to distinguish from, surrounding disposal site background levels—that the DMMP sites do not appear to represent any significant risk to the public and environment—demonstrating that previous dioxin protocols have been effective and may not need to be adjusted. Others believed that past disposal of sediments that had not been characterized

relative to dioxin may have inadvertently increased dioxin concentrations in the area surrounding the disposal sites.

Currently Puget Sound dioxin data includes sediment samples collected from Superfund and/or MTCA sites where dioxin testing was conducted, recent PSDDA disposal site monitoring of sediment and tissue dioxin concentrations at disposal sites, and three reference sites. There is currently no Puget Sound dioxin database other than from those locations. In nearly all framework options there is a need for the collection of additional sediment and tissue dioxin data from disposal sites, reference areas, and basins of Puget Sound. Especially if a background-based option is selected, enough data will need to be available for a statistically robust data evaluation and derivation of suitability thresholds. Funding will need to be considered with the revised framework option.

It was suggested that an evaluation be performed to summarize data regarding dioxin levels that went to the disposal sites in the past, current surface quality, and predicted concentrations for future disposal. It was suggested that sediment coring at the disposal sites with dioxin analysis be performed in order to conduct a trend analysis of dioxin concentrations. It would be anticipated that there has been a general improvement in the quality of dredged material relative to dioxins due to source control.

Questions and concerns were raised with the way the agencies have dealt with The National Academies (The National Academies 2006) review of USEPA's 2003 Dioxin Reassessment. A subset of the stakeholders was highly critical of how USEPA (nationally) is addressing the toxicity of dioxins at low levels. Their interpretation of The National Academies review was that it questioned USEPA's overall classification of dioxin carcinogenicity as well as USEPA's approach to addressing uncertainty about dioxin toxicity at low levels. They wanted to know if and how the DMMP agencies would address The National Academies' concerns in this process?

Several stakeholder groups commented on the uncertainty associated with the risk of dioxin at low levels, the cumulative risk of dioxin chemical mixtures, the transfer of dioxins from sediment to seafood tissue, from tissue to humans, ecological effects to high trophic levels, and dioxin chemical fate and transport. A research package that includes funding for additional dioxin research and data collection may need to be presented with a revised framework.

2. Comparative Risk, Incremental Risk, and Risk Management

Several people suggested that if risk assessment methodologies are going to be used, a programmatic recommendation should be developed that looks at a comparative or incremental risk approaches.

Comparative and incremental risk approaches acknowledge that risk is not only at the disposal site, but is also at the harbor, marina, or river that is being dredged, and throughout the environs of the disposal site. Both risk approaches assume the fish or seafood are only at the site for a selected period of time, identified as a site utilization factor. A caveat to this approach is that there is little known on the fish home ranges. These approaches that were suggested included the following:

Comparative Risk

- Comparing the risk between the dredged material at its existing location (e.g., marina, waterway) and the risk associated with that material being placed at the non-dispersive disposal site;
- Comparing the risk at the disposal site today with existing conditions and the risk of the disposal site with new dredged materials being added;
- Comparing the risks of open-water disposal with those of other disposal alternatives.

Incremental Risk

- The incremental risk between the existing human health risk from dioxins in the basin or area if the disposal site was not present, versus the additional risk that results from the disposal site being present (using different suitability thresholds for disposal);
- The incremental risk from exposure to the dioxins at disposal sites in addition to the existing risk from dioxin exposure in a regular diet.

An aspect of comparative risk that was discussed at the technical workshops was risk reduction, in that if sediment containing dioxins spread over a broad area or large footprint is dredged and disposed of at a localized disposal site the potential risk is would be reduced. However, it was questioned whether most dredging sites have dioxin at levels of concern in the surface sediments, or just the subsurface where they are not being exposed.

A tribal stakeholder pointed out in response to this discussion that tribal consumption can not be reduced or limited at the disposal sites. The tribes can not pay for the dioxin issue by having tribal consumption constrained, the end result of the process is key. The comparative or incremental risk approaches also have a policy level concern for DNR, as they would assume the liability for the open-water disposal sites and there is the issue of the transfer of liability of material with dioxin levels greater than regulatory acceptable risk based levels from dredged areas to the disposal sites.

An aspect that was discussed relative to risk management was the incremental increase in risk that can result from the dredging and disposal process. For example, it was stated that the tissue burdens in seafood and fish in the Duwamish River are variable between years. It is believed that this variability is related to various dredging activities, in which the activity and dredged residuals increase the availability of the contaminants. An aspect of comparative or incremental risk and risk management would be to consider the acute impact of the dredging activity and methods to address the resulting risk.

Anchor Environmental, and Windward Environmental on behalf of the Port of Seattle, put forward proposals as to methods to evaluate incremental risk due to the disposal activity, the concept being establishment of a target risk level that acknowledges background risk from other exposure pathways. One suggestion put forward at the technical workshops was to look at the background dioxin risk in Puget Sound as “0” and calculate the exposure and risk of the disposal site, a relatively tiny fraction of the entire area a fish is exposed to. Then assess a

variety of disposal guidelines to evaluate the excess risk or "incremental dose" from the operation of the disposal site. This concept was discussed as conducting a gradient of risk assessment, looking at the incremental risk of operating the disposal site relative to background. Both the Anchor and Windward materials received put forward proposed methods and assumptions that could be used in this approach. The key policy issue related to this approach is—if the background risk is already unacceptable, then what if any incremental risk above that would be acceptable?

It was also suggested that in evaluating risk associated with the disposal sites, the fact that the disposed material is relatively quickly buried by subsequent disposal be taken into account. The assumption was that the exposure time is shorter than evaluated in cleanup sites. However, it can also be argued that nearly all of the material disposed of at the disposal site may have similar dioxin concentrations and that the surface dioxin level will remain relatively constant. It was also suggested that volume weighting be used to determine the concentrations disposed.

Comments were received regarding assessing the risk of dioxins up the food web to marine mammals, such as orcas, and marine birds. The previous dioxin thresholds were developed prior to the listing of some endangered species. How to evaluate the protectiveness of the suitability thresholds to sentinel species and other higher trophic level ecological consumers if a comparative risk based or background based approach is selected needs to be considered.

3. Background Methodologies

Concern was expressed that if a non-urban reference site was chosen for dioxin thresholds, it is likely that all other areas will exceed this level and as a result dioxin could be the COC that consistently fails thresholds and severely restricts urban navigational and maintenance dredging, and is therefore not a realistic option for revised framework. However, multiple public stakeholders did express support of a non-urban reference area background alternative that would define dioxin open-water disposal suitability thresholds based on levels detected in reference areas such as Carr Inlet or Sequim Bay.

A number of suggestions received have been to use regional, basin wide background or background around the disposal site as the means to determine disposal thresholds because these approaches would have a lesser impact on the viability of maintenance dredging with open-water disposal. However, thresholds developed from these approaches would result in an absolute risk that is higher than the current regulatory guideline of $10^{\wedge -6}$, and may be higher than non-urban reference area background. Due to lack of data, it is not entirely certain whether or to what extent reference area concentrations are different from those in the main basins of Puget Sound.

Aspects of a background-based approach that need to be determined include how often to recalculate background, and what method will be used to evaluate dredged material (mean/maximum sediment concentration, tissue concentrations, compositing of DMMUs for testing and to reduce cost of bioaccumulation tests).

Input was received that the cost of sampling to establish background options would need a new approach, with shared responsibility between the agencies and the project proponents.

The policy question was raised as to whether move to a background option would require a SEPA evaluation.

4. Evaluation of Multiple Variables Regarding Impacts of the Revised Framework

Suggestions were made that it is important to address multiple variables in the evaluation of framework options and not just focus on effects to human health. Use of multi-criteria decision analysis could assist in setting goals and values to evaluate multiple issues while comparing alternatives. This analysis could include the following topics that were suggested by stakeholders:

- Maintenance of tribal fisheries and treaty rights
- Cost to project proponents for dioxin testing and potential uplands disposal
- Benefit of maintenance dredging and removal of impacted sediment from harbors
- Synergy between navigation/development and cleanup projects, where the feasibility of the navigation/development projects (and availability of DMMP disposal sites) influences the timing, scope and feasibility of cleanup, habitat restoration and stormwater management projects.
- Risk to humans and the environment, including Threatened and Endangered Species
- Net benefit to the environment, effect on restoration of Puget Sound
- Availability of DMMP disposal sites for the disposal of a portion of dredged material from large cleanup sites
- Increased carbon footprint and traffic impact: Inability to dispose of dredge material in open-water will cause material to be carried upland. This will result in increased truck trips and emissions and increased traffic considerations.
- Use of landfill space.

The USACE and USEPA have used Multi-Criteria Decision Analysis tools to provide a transparent method for managers to understand factors, select alternatives and document rationale. These formal decision analysis tools could be considered to assist decision making for the revised dioxin framework.

In all of the forums for stakeholder input, comments and concerns were expressed regarding the incorporation and consideration of potential economic and environmental impacts of the revised dioxin framework. Input was received that stakeholders view the dioxin approach developed under this process as translating to other bioaccumulative compounds (e.g., PCBs) and that the impact on other compounds should be included in the economic and environmental analysis.

5. When to Test and Testing Methods

It was suggested that the DMMP agencies could develop a database of dioxin sediment and/or tissue concentrations throughout Puget Sound to provide the basis for when to require testing based on existing data and that the responsibility and cost of the data collection should not be

all on the dredge proponent. DNR also indicated that the currently available monitoring budget, supported by user fees, is not sufficient for this additional monitoring need.

The thresholds for when to test are related to what option is chosen. If the thresholds are based on an absolute human health risk assessment or non-urban reference area background then the thresholds will likely be so low that it is possible that the majority of projects, regardless of location and site history, could need to test for dioxins. If the thresholds are based on comparative or incremental risk or regional basin wide or disposal site background, then a continued, but potentially modified, reason to believe approach may be appropriate. It was also suggested that there are additional techniques for dioxin analysis such as immunoassays that could be less costly to the dredge proponent and need to be considered by the agencies.

Suggestions were made that since the analytical detection limits for dioxins are so low and that it is highly likely that the dredged material thresholds will be low it is critical that the complexities and uncertainties in the methods, such as reporting at low levels, and non-detect values be addressed. Included in any alternative for the revised framework is the need for standardized policies regarding dioxin analysis and an approach for interpretation of historical data.

Several respondents recommended maintaining the current “reason to believe” requirements for testing, relative to existing data and known point sources, as monitoring at exiting sites shows that the previous protocols resulted in concentrations at the disposal sites that are similar to those of the environs around the disposal sites.

6. Sequencing and Thresholds by Depth

Careful placement of dredged material containing dioxins was recommended as an approach to allow dredging to continue while maintaining the existing conditions of the disposal sites. It was suggested that potentially the application of sequencing could be implemented on a case-by-case basis where significant variability in DMMUs were observed, but the levels were still within the range of thresholds. Sequencing the placement of dredged material could occur within one project or involve the sequencing of several projects, where the project proponents could arrange and commit to the coordination. The difficulty of constraining dredging sequencing and timeline was acknowledged.

It was also recognized that there is a substantial level of uncertainty regarding the effect of sediment concentrations on dioxin tissue concentrations. Sequencing would not be used to allow for the disposal of dioxin concentrations that are greater than the suitability thresholds, although it is not yet clear how to establish suitability thresholds for subsurface material. Multiple suitability thresholds could be defined for material to be placed last, at the surface, within a disposal event. Whether or not such placement of cleaner material over material that would not be suitable at the surface would be considered capping was a point that did not receive consensus among the participants.

This approach is a key policy concern for DNR—as they would assume the liability for the dredged material at the disposal sites, and are not interested in accepting institutional controls on disposal sites.

The sequencing of dredged material could result in a new monitoring paradigm as placement and control of the different levels of material may need to be evaluated. It could also change the placement methods to more controlled Best Management Practices.

Questions arose regarding how to develop thresholds for the surface relative to the immediate background. What if the immediate background area gets cleaner as is the objective of PSP? A potential approach to address the change in background is to install check points to review the results and conditions over time in order to trigger the need to change the thresholds if the background or disposal site is outside of the predicted conditions.

Suggestions were received for the development of Confined Aquatic Disposal (CAD) sites for controlled disposal of this material. If CAD sites were a potential option then the reevaluation of a Multi-User Disposal Site (MUDS) type program could be considered. The development of CAD sites could be at new selected locations that are different from the current open-water disposal sites and would require coordination with all agencies, specifically DNR. If the development of CAD sites were evaluated, the permitting process could take several years and careful thought would have to go into an interim framework that is the same or potentially different than the current interim framework to be used prior to CAD site availability.

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