DRAFT RSET ISSUE PAPER #26 – Grain Size, Analysis and Exclusion Criteria

POLICY COMMITTEE, S. Stirling, Chair
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QUESTION/ISSUE: Grain Size, Analysis and Exclusion Criteria.

Question #1: To what degree are organochlorine compounds only associated with the fine-grained sediments, and is the grain size rule of 80% sufficient to represent contaminant associations in the LCR? Should other techniques be used to evaluate the potential for larger grain sized materials to also contain contaminants?

Question #2: Should organic carbon content of bed sediment be characterized or evaluated differently? For a single whole bed sediment sample, should only the fine-grained fractions from bed sediment for contaminants be analyzed to minimize the "dilution" effect of including larger-grained components from bed sediment?

DISCUSSION: The DMEF states that if the results of grain size analysis are at least 80% sand, total volatile solids is less than 5%, and no active sources of contamination are determined to be present, then the proposed dredged material qualifies for unconfined aquatic disposal (without further chemical characterization) (DMEF 1998).

During evaluation of sediment proposed for dredging, the volume of dredged material partly determines the minimum number of sediment samples and analyses required for full characterization of a dredging project. The majority of sediments dredged in the LCR are considered homogenous, as described in the DMEF. Table 6-1 determines the size of a dredged material management unit (DMMU) based on the ranking of sediment as Exclusionary, Low-Low-Moderate, Moderate, and High. A low ranking DMMU containing up to 100,000 cyds of homogenous material can be characterized by a minimum of one sample. Small projects can be excluded from testing based on volume and ranking (Table 6-2). For example, no samples are required for a low ranking project when less than 10,000 cyds are proposed for dredging.

REFERENCES: Included in attachment (see below)

RECOMMENDATION: Specific text and table revision to appropriate sections of DMEF.

PROPOSED LANGUAGE CHANGES: None yet.

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Technical/Policy Problem Statements

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Draft Issue Paper

Topic: Grain size, analysis and exclusion criteria

Background:

Few studies have specifically evaluated sediment contaminant concentrations in the lower Columbia river (LCR); most sediment samples from the area have been collected to specifically evaluate sediment quality for proposed dredging projects. Sediment collected to evaluate material for dredging in the LCR is often excluded from further chemical analysis because the grain size evaluations show the sediment to be primarily sandy materials, and most contaminants of concern are associated with the organic carbon fractions within finer-grained materials (e.g., silts and clays). Sediment from the LCR navigation channel is sandy with generally less than 1% fine materials, and therefore considered very unlikely to contain contaminants. Even in depositional and backwater areas where finer-grained materials are encountered, organic contaminants such as DDT and PCBs are infrequently found or are below the Dredged Material Evaluation Framework (DMEF) screening values (Tetra Tech 1993, 1994). However, nearly all samples of fish and other wildlife within in the LCR contain contaminants such as DDT and PCBs (Tetra Tech 1993, 1994; U.S. Fish and Wildlife Service 2002). Therefore, a source for organochlorine contaminants exists, and other studies have suggested that bed sediment is a primary source for uptake of hydrophobic contaminants in biota (Zaranko et al. 1997, Maruya and Lee 1998). However, it remains unclear as to whether LCR bed sediment serves as a source for this contaminant pathway, or whether the number of samples collected to characterize a dredged material management unit (DMMU) as identified in the DMEF sufficiently addresses site specific conditions and contaminant associations in the LCR.

The lower Columbia River system is also characterized as carbon limited. It has been proposed that whatever carbon is available moves quickly into tissue along with any associated contaminants, and therefore even small concentrations of contaminants would be readily available and incorporated into tissue (Tetra Tech 1993,1994; U.S. Fish and Wildlife Service 2002). Given the site specific conditions in the lower Colombia River system, a key question is whether or not the thresholds currently used in the DMEF for excluding sediment for further chemical analysis based on grain size characteristics is a good representation of the contaminant content of the material, or if changes in the threshold levels should be made.

How is this issue currently addressed:

The DMEF states that if the results of grain size analysis are at least 80% sand, total volatile solids is less than 5%, and no active sources of contamination are determined to be present, then the proposed dredged material qualifies for unconfined aquatic disposal (without further chemical characterization) (DMEF 1998).

During evaluation of sediment proposed for dredging, the volume of dredged material partly determines the minimum number of sediment samples and analyses required for full characterization of a dredging project. The majority of sediments dredged in the LCR are considered homogenous, as described in the DMEF. Table 6-1 determines the size of a dredged material management unit (DMMU) based on the ranking of sediment as Exclusionary, Low-Low-Moderate, Moderate, and High. A low ranking DMMU containing up to 100,000 cyds

of homogenous material can be characterized by a minimum of one sample. Small projects can be excluded from testing based on volume and ranking (Table 6-2). For example, no samples are required for a low ranking project when less than 10,000 cyds are proposed for dredging.

What are the issues/questions? Any examples, case studies?

Questions:
To what degree are organochlorine compounds only associated with the fine-grained sediments, and is the grain size rule of 80% sufficient to represent contaminant associations in the LCR? Should other techniques be used to evaluate the potential for larger grain sized materials to also contain contaminants?

Case study/examples: Total PCBs were detected in the LCR at Bradford Island, apparently within sandy sediments. High river flows often limit the amount of fines in this area, yet high concentrations were observed in sediments and extremely high concentrations were observed in crayfish. Presumably, the PCB oils may have coated the sands and even the crayfish due to the proximity of leaking PCB-containing materials in the area, and this type of contamination may be site specific. However, in a carbon-limited system, it may not take much of a concentration of an organic contaminant to be readily available, especially if the contaminant is associated with sandy material and not more firmly attached to the organic materials within fine particulates.

Question: Should organic carbon content of bed sediment be characterized or evaluated differently? For a single whole bed sediment sample, should only the fine-grained fractions from bed sediment for contaminants be analyzed to minimize the "dilution" effect of including larger-grained components from bed sediment?

Concern/example: The results of Tetra Tech (1993) and U.S. Fish and Wildlife Service (2002) indicated that further characterization of contaminant concentrations and the organic carbon content, specifically within various grain-sized fractions of depositional sediment in the lower Columbia River, would be worthwhile to help determine the true availability of sediment-borne contaminants to organisms, and the degree to which bed sediment acts as a source of organochlorine compounds.

Information Need/Discussion Points - brainstorming, what information is needed? What do we know now?

Additional background information supporting the 80% rule would be helpful. For the site specific conditions in the LCR described in the background section above, does the 80% rule still hold? What about samples that are 14% fine materials (silts or clays), would these samples be suspect? The DMEF states that: "*The adoption of exclusion category is based upon numerous studies and sampling efforts done on the LCR verifying that coarser-grained sediments are characterized by very low to negligible levels of chemical contamination*." Having access to these studies or having these studies available for review or discussion would be helpful.

Would it be helpful to further characterize sediment for organic carbon, fine materials, or contaminants? For instance, rather than sampling whole sediment, it may be helpful to sieve

and sample only the fine materials for organic carbon and contaminants in some locations, thereby obtaining a larger sample size of only fines and minimizing the “dilution” affect that could arise when analyzing whole samples with lots of sand. These methods have been used and recommended by USGS in past studies.

What is the value of elutriate studies to determine sediment quality? What data is available on the LCR for sediment elutriate samples? What are the benefits and problems associated with elutriate sample interpretation?

Is there as similar concern for metal or PAH concentrations as there is for organochlorine compounds?

other ideas??

Timeframe/Budget

1) Gather and review existing data on site specific studies that support the exclusion criteria for the LCR. Estimated time: 3-4 weeks, depending on availability of data??

2) Evaluate any existing studies regarding total organic carbon, fine particulates, and contaminant relations within the LCR (or even similar areas if available). Estimated time: 3-4 weeks.

3) Identify bed sediment samples collected outside the main navigation channel which were collected for the purpose of dredge evaluation and for nondredge-related reasons and review results for patterns in contaminant/particulate associations. Estimated time: 8 weeks.

4) Explore the need to gather additional bed sediment samples in the LCR to further investigate contaminant and grain size relationships specific to the LCR. Estimated time: 4 weeks to 1 year.

REFERENCES

DMEF. 1998. Dredged Material Evaluation Framework-Lower Columbia River Management Area. U.S. Environmental Protection Agency Region 10, U.S. Army Corps of Engineers Northwestern Division (Portland and Seattle District), Washington State Department of Ecology, Oregon Department of Environmental Quality, and Washington State Department of Natural Resources.

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