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**DREDGED MATERIAL  
EVALUATION FRAMEWORK**

**Lower Columbia River Management Area**

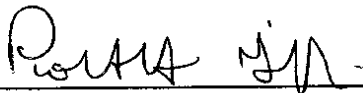
**NOVEMBER 1998**

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# DREDGED MATERIAL EVALUATION FRAMEWORK

## LOWER COLUMBIA RIVER MANAGEMENT AREA

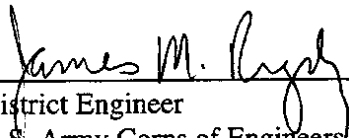
The program established by this document becomes effective upon signature by the agency heads listed below. Each agency will carry out its roles and responsibilities for program implementation under existing authorities. Programmatic changes will be made in conjunction with an annual review process, and any major plan changes will be subject to the approval of the agencies.



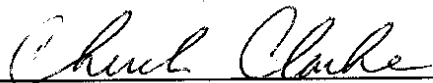
Division Commander  
U.S. Army Corps of Engineers, Northwestern Division



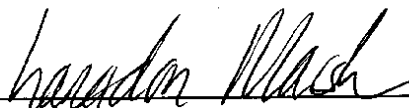
District Engineer  
U.S. Army Corps of Engineers, Portland District



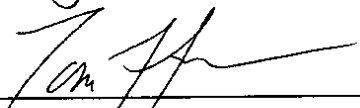
District Engineer  
U.S. Army Corps of Engineers, Seattle District



Regional Administrator  
U.S. Environmental Protection Agency, Region 10



Director  
Oregon Department of Environmental Quality



Director  
Washington Department of Ecology



Commissioner of Public Lands  
Washington Department of Natural Resources

**DREDGED MATERIAL EVALUATION FRAMEWORK**  
**Lower Columbia River Management Area**

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## **PREFACE**

The U.S. Army Corps of Engineers (Corps) and the U.S. Environmental Protection Agency (EPA) share the responsibility of regulating dredged material management activities under the Marine Protection, Research, and Sanctuaries Act (MPRSA), and the Federal Water Pollution Control Act Amendments of 1972, also called the Clean Water Act (CWA). Such management activities must also comply with the applicable requirements of the National Environmental Policy Act (NEPA). Several state agencies in Oregon and Washington have responsibility for assuring that dredging and disposal activities which take place in state waters comply with applicable state regulations. This framework provides a consistent set of procedures for determining sediment quality for these activities.

The area covered by this document is called the Lower Columbia River Management Area (LCRMA). The LCRMA includes the following water bodies: (1) the Lower Columbia River from its mouth near Ilwaco, Washington to Bonneville Dam at river mile (CRM) 148; (2) the segment of the mid-Columbia River extending from Bonneville Dam upstream to McNary Dam; (3) the Willamette River from its confluence with the Lower Columbia River upstream to its headwaters, and (4) all side channel and tributaries branching from the lower and mid-Columbia River and Willamette River.

This document provides a consistent technical framework to follow in identifying environmentally acceptable alternatives for the management of dredged material. The framework is consistent with and meets the substantive and procedural requirements of NEPA, CWA, and MPRSA and is applicable to dredged material management alternatives. Application of this framework will enhance consistency and coordination in Corps/EPA and state agency decision-making in accordance with Federal and State environmental statutes regulating dredged material management.

This document represents the best available knowledge regarding dredged material assessment at the time of preparation. This is a living document and will be updated as new information and new technologies become available. Recipients of the final document will receive notice of any updates.

This manual was prepared by a joint Federal/State work group consisting of the following members: Rick Vining, Washington Department of Ecology, Ted Benson, Washington Department of Natural Resources, Gene Foster and Tom Rosetta, Oregon Department of Environmental Quality; Jim Reese, U.S. Army Engineer Division, Northwestern; Mark Siipola, Eric Braun and Sheryl Carrubba, U.S. Army Engineer District, Portland; Stephanie Stirling, U.S. Army Engineer District, Seattle; and John Malek, EPA, Region 10.

## **DEFINITIONS**



**Acid volatile sulfide:** (AVS): The sulfides removed from sediment by cold acid extraction, consisting mainly of H<sub>2</sub>S and FeS. AVS is a possible predictive tool for divalent metal sediment toxicity.

**Acute toxicity:** Short-term toxicity to organism(s) that have been affected by the properties of a substance, such as contaminated sediment. The acute toxicity of a sediment is generally determined by quantifying the mortality of appropriately sensitive organisms that are exposed to the sediment, under either field or laboratory conditions, for a specified period. .

**Adjacent:** Bordering, contiguous or neighboring. Wetlands separated from other waters of the United States by man-made dikes or barriers, natural river berms, beach dunes and the like are adjacent wetlands.

**Aquatic disposal:** Placement of dredged material in rivers, lakes, estuaries, or oceans via pipeline or surface release from hopper dredges or barges.

**Aquatic environment:** The geochemical environment in which dredged material is submerged under water and remains water saturated after disposal is completed.

**Aquatic ecosystem:** Bodies of water, including wetlands, that serve as the habitat for interrelated and interacting communities and populations of plants and animals.

**Atterberg limits:** Consistency limits, including the liquid limit, the plastic limit, and the shrinkage limit, which define the three stages of fine-grained material.

**Bathymetry:** Physical configuration of the sea bed; the measurement of depths of water in oceans, seas, and lakes; also information derived from such measurements.

**Benchmark organism:** Test organism designated by Corps and EPA as appropriately sensitive and useful for determining biological data applicable to the real world. Test protocols with such organisms are published, reproducible and standardized.

**Beneficial use:** Placement or use of dredged material for some productive use.

**Beneficial uses:** Placement or use of dredged material for some productive purpose. Beneficial uses may involve either the dredged material or the placement site as the integral component of the beneficial use.

**Berm:** Narrow shelf of ground left undisturbed; usually at the base of a levee.

**Bioaccumulation:** The accumulation of contaminants in the tissues of organisms through any route, including respiration, ingestion, or direct contact with contaminated water, sediment, or dredged material.

**Bioaccumulation factor:** The degree to which an organism accumulates a chemical compared to the source. It is a dimensionless number or factor derived by dividing the concentration in the

organism by that in the source.

**Bioassay:** A bioassay is a test using a biological system. It involves exposing an organism to a test material and determining a response. There are two major types of bioassays differentiated by response: toxicity tests which measure an effect (e.g., acute toxicity, sublethal/chronic toxicity) and bioaccumulation tests which measure a phenomenon (e.g., the uptake of contaminants into tissues).

**Biomagnification:** Bioaccumulation up the food chain, e.g., the route of accumulation is solely through food. Organisms at higher trophic levels will have higher body burdens than those at lower trophic levels.

**Biota sediment accumulation factor (BSAF):** Relative concentration of a substance in the tissues of an organism compared to the concentration of the same substance in the sediment.

**Bulk sediment chemistry:** Results of chemical analyses of whole sediments (in terms of wet or dry weight), without normalization (e.g., to organic carbon, grain-size, acid volatile sulfide).

**Capping:** The controlled, accurate placement of contaminated material at an open-water site, followed by a covering or cap of clean isolating material.

**Chemical of concern:** A chemical present in a given sediment thought to have the potential for unacceptable adverse environmental impact due to a proposed discharge.

**Chronic:** Involving a stimulus that is lingering or which continues for a long time.

**Clay:** Soil particle having a grain size of less than 2 micrometers.

**Coastal zone:** Includes coastal waters and the adjacent shorelands designated by a State as being included within its approved coastal zone management program. The coastal zone may include open waters, estuaries, bays, inlets, lagoons, marshes, swamps, mangroves, beaches, dunes, bluffs, and coastal uplands. Coastal-zone uses can include housing, recreation, wildlife habitat, resource extraction, fishing, aquaculture, transportation, energy generation, commercial development, and waste disposal.

**Comparability:** The confidence with which one data set can be compared to others and the expression of results consistent with other organizations reporting similar data. Comparability of procedures also implies using methodologies that produce results comparable in terms of precision and bias.

**Confined disposal:** A disposal method that isolates the dredged material from the environment.

**Confined disposal facility (CDF):** An engineered structure for containment of dredged material consisting of dikes or other structures that enclose a disposal area above any adjacent water surface, isolating the dredged material from adjacent waters during placement. Other terms used for CDFs that appear in the literature include confined disposal area, confined disposal site, and

dredged material containment area.

**Constituents:** Chemical substances, solids, liquids, organic matter, and organisms associated with or contained in or on dredged material.

**Contained aquatic disposal:** Form of capping which includes the added provision of some form of lateral containment (for example, placement of the contaminated and capping materials in bottom depressions or behind subaqueous berms) to minimize spread of the materials on the bottom.

**Contaminant:** Chemical or biological substance in a form that can be incorporated into, onto, or be ingested by and is harmful to aquatic organisms, consumers of aquatic organisms, or users of the aquatic environment.

**Contaminated sediment:** Sediment that has been demonstrated to cause an unacceptable adverse effect on human health or the environment.

**Control sediment:** A sediment essentially free of contaminants and which is used routinely to assess the acceptability of a test. Control sediment may be the sediment from which the test organisms are collected or a laboratory sediment, provided the organisms meet control standards. The grain-size of the control sediment should be similar to that of the dredged material. Test procedures are conducted with the control sediment in the same way as the reference sediment and dredged material. The purpose of the control sediment is to confirm the biological acceptability of the test conditions and to help verify the health of the organisms during the test. Excessive mortality in the control sediment indicates a problem with the test conditions or organisms, and can invalidate the results of the corresponding dredged material test.

**Data quality indicators:** Quantitative statistics and qualitative descriptors which are used to interpret the degree of acceptability or utility of data to the user; include bias (systematic error), precision, accuracy, comparability, completeness, representativeness and statistical confidence.

**Disposal site:** That portion of the waters of the United States where specific disposal- activities are permitted and consist of a bottom surface area and any overlying volume of water. In the case of wetlands on which surface water is not present, the disposal site consists of the wetland surface area

**Dredged material:** Material excavated from inland or ocean waters.

**EC50:** The median effective concentration. The concentration of a substance that causes a specified effect (generally sublethal rather than acutely lethal) in 50% of the organisms tested in a laboratory toxicity test of specified duration.

**Ecosystem:** A system made up of a community of animals, plants, and bacteria and its interrelated physical and chemical environment.

**Effluent:** Water that is discharged from a confined disposal facility during and as a result of the filling or placement of dredged material.

**Elutriate:** Material prepared from the sediment dilution water and used for chemical analyses and toxicity testing. Different types of elutriates are prepared for two different procedures as noted in this manual.

**Emergency:** In the context of dredging operations, emergency is defined in 33 CFR Part 335.7 as a situation which would result in an unacceptable hazard to life or navigation, a significant loss of property, or an immediate and unforeseen significant economic hardship if corrective action is not taken within a time period of less than the normal time needed under standard procedures.

**Evaluation:** The process of judging data in order to reach a decision.

**Factual determination:** A determination in writing of the potential short-term or long-term effects of a proposed discharge of dredged or fill material on the physical, chemical and biological components of the aquatic environment.

**Grain-size effects:** Mortality or other effects in laboratory toxicity tests due to sediment granulometry, not chemical toxicity.

**Gravel:** A loose mixture of pebbles and rock fragments coarser than sand, often mixed with clay, etc.

**Habitat:** The specific area or environment in which a particular type of plant or animal lives. An organism's habitat provides all of the basic requirements for the maintenance of life. Typical coastal habitats include beaches, marshes, rocky shores, bottom sediments, mudflats, and the water itself.

**LC50:** The median lethal concentration. The concentration of a substance that kills 50% of the organisms tested in a laboratory toxicity test of specified duration.

**Leachate:** Water or any other liquid that may contain dissolved (leached) soluble materials, such as organic salts and mineral salts, derived from a solid material. For example, rainwater that percolates through a confined disposal facility and picks up dissolved contaminants is considered leachate.

**Leaching:** a process which causes a liquid to filter down through another material.

**Level bottom capping:** A form of capping in which the contaminated material is placed on the bottom in a mounded configuration.

**Loading density:** The ratio of organism biomass or numbers to the volume of test solution in an exposure chamber.

**Management actions:** Those actions considered necessary to rapidly render harmless the material proposed for discharge (e.g., non-toxic, non-bioaccumulative) and which may include containment in or out of the waters of the US (see 40 CFR Subpart H). Management actions are employed to reduce adverse impacts of proposed discharges of dredged material.

**Management unit:** A manageable, dredgeable unit of sediment which can be differentiated by sampling and which can be separately dredged and disposed within a larger dredging area. Management units are not differentiated solely on physical or other measures or tests but are also based on site and project-specific considerations.

**Method detection limit (MDL):** The minimum concentration of a substance which can be identified, measured, and reported with 99% confidence that the analyte concentration is greater than zero.

**Pathway:** In the case of bioavailable contaminants, the route of exposure (e.g., water, food).

**Practicable:** Available and capable of being done after taking into consideration cost, existing-technology, and logistics in light of overall project purposes.

**QA:** Quality assurance, the total integrated program for assuring the reliability of data. A system for integrating the quality planning, quality control, quality assessment, and quality improvement efforts to meet user requirements and defined standards of quality with a stated level of confidence.

**QC:** Quality control, the overall system of technical activities for obtaining prescribed standards of performance in the monitoring and measurement process to meet user requirements.

**Reason to believe:** Subpart G of the CWA 404(b) (1) guidelines requires the use of available information to make a preliminary determination concerning the need for testing of the material proposed for dredging. This principle is commonly known as “reason to believe” and is used in Tier I evaluations to determine acceptability of the material for discharge without testing. The decision to not perform additional testing based on prior information must be documented, in order to provide a reasonable assurance that the proposed discharge material is not a carrier of contaminants.

**Reference sediment:** A whole sediment used to assess sediment conditions exclusive of the material(s) of interest, that is as similar as practicable to the grain size and total organic carbon (TOC) of the dredged material and the sediment at the disposal site, and that reflects the conditions that would exist in the vicinity of the disposal site had no dredged-material disposal ever taken place, but had all other influences on sediment condition taken place. The reference

sediment serves as a point of comparison to identify potential effects of contaminants in the dredged material.

**Reference site:** The location from which reference sediment is obtained.

**Representativeness:** The degree to which sample data depict an existing environmental condition; a measure of the total variability associated with sampling and measuring that includes the two major error components: systematic error (bias) and random error. Sampling representativeness is accomplished through proper selection of sampling locations and sampling techniques, collection of sufficient number of samples, and use of appropriate subsampling and handling techniques.

**Salinity:** Salt content, usually expressed in grams of salt per kilogram of water.

**Sand:** Soil particles having a grain size ranging between about 63 micrometers and 2,000 micrometers.

**Sediment:** Material, such as sand, silt, or clay, suspended in or settled on the bottom of a water body. Sediment input to a body of water comes from natural sources, such as erosion of soils and weathering of rock, or as the result of anthropogenic activities such as forest or agricultural practices, or construction activities. The term dredged material refers to material which has been dredged from a water body, while the term sediment refers to material in a water body prior to the dredging process.

**Silt:** soil having a grain size ranging between about 2 micrometers and 63 micrometers.

**Sublethal (chronic) toxicity:** Biological tests which use such factors as abnormal development, growth and reproduction, rather than solely lethality, as end-points. These tests involve all or at least an important, sensitive portion of an organism's life-history. A sublethal endpoint may result either from short-term or long-term (chronic) exposures.

**Suspended solids:** Organic or inorganic particles that are suspended in water. The term includes sand, silt, and clay particles as well as other solids, such as biological material, suspended in the water column.

**Tiered approach:** A structured, hierarchical procedure for determining data needs relative to decision-making, which involves a series of tiers or levels of intensity of investigation. Typically, tiered testing involves decreased uncertainty and increased available information with increasing tiers. This approach is intended to ensure the maintenance and protection of environmental quality, as well as the optimal use of resources. Specifically, least effort is required in situations where clear determinations can be made of whether (or not) unacceptable adverse impacts are likely to occur based on available information. Most effort is required where clear determinations cannot be made with available information.

**Toxicity:** Level of mortality or other end point demonstrated by a group of organisms that have been affected by the properties of a substance, such as contaminated water, sediment, or dredged material.

**Toxicity test:** A bioassay which measures an effect (e.g., acute toxicity, sublethal/chronic toxicity). Not a bioaccumulation test (see definition of bioassay).

**Turbidity:** An optical measure of the amount of material suspended in the water. Increasing the turbidity of the water decreases the amount of light that penetrates the water column. Very high levels of turbidity can be harmful to aquatic life.

**Upland environment:** The geochemical environment in which dredged material may become unsaturated, dried out, and oxidized.

**Water quality certification:** A state certification, pursuant to Section 401 of the Clean Water Act, that the proposed discharge of dredged material will comply with the applicable provisions of Sections 301, 303, 306 and 307 of the Clean Water Act and relevant State laws. Typically this certification is provided by the affected State. In instances where the State lacks jurisdiction (e.g., Tribal Lands), such certification is provided by EPA or the Tribe (with an approved certification program).

**Waters of the US:** In general, all waters landward of the baseline of the territorial sea and the territorial sea. Specifically, all waters defined in the CWA 404(b)(1) guidelines.

**Whole sediment:** The sediment and interstitial waters of the proposed dredged material or reference sediment that have had minimal manipulation. For purposes of this manual, press-sieving to remove organisms from test sediments, homogenization of test sediments, compositing of sediment samples, and additions of small amounts of water to facilitate homogenizing or compositing sediments may be necessary to conducting bioassay tests. These procedures are considered unlikely to substantially alter chemical or toxicological properties of the respective whole sediments except in the case of AVS (acid volatile sulfide) measurements (EPA, 1991a) which are not presently required. Alternatively, wet sieving, elutriation, or freezing and thawing of sediments may alter chemical and/or toxicological properties, and sediment so processed should not be considered as whole sediment for bioassay purposes.

**ACRONYMS**

AMD	Advance Maintenance Dredging
BT	Bioaccumulation Trigger
CoC	Chemical of Concern
CRM	Columbia River Mile
CWA	Clean Water Act
CY	Cubic Yard
CZM	Coastal Zone Management
DAIS	Dredged Analysis Information System
DEQ	Oregon Department of Environmental Quality
DLCD	Oregon Dept. of Land Conservation and Development
DMMO	Dredged Material Management Office
DMMT	Dredged Material Management Team
DNR	Washington Department of Natural Resources
DSL	Oregon Division of State Lands
EPA	Environmental Protection Agency
FDA	Food and Drug Administration
ITM	Inland Testing Manual
LCR	Lower Columbia River
ML	Maximum Level
MPRSA	Marine Protection Research and Sanctuaries Act
NEPA	National Environmental Policy Act
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PSDDA	Puget Sound Dredged Disposal Analysis
QA/QC	Quality Assurance/Quality Control
RM	River Mile
RMT	Regional Management Team
SAP	Sampling and Analysis Plan
SL	Screening Level
SMS	Washington Sediment Management Standards
TBT	Tributyltin
TOC	Total Organic Carbon
TVS	Total Volatile Solids