SUSTAINABLE SEDIMENT MANAGEMENT AND DREDGING SEMINAR

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Chemical/Physical Characterization for In-Water Placement

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Introduction

- **Decision for placement of dredged materials requires an understanding of its composition and physical properties**
- **Must demonstrate that placement of dredge materials will not have an unacceptable adverse impact**
- **Characterization**
  - **applies to any sample matrix**
  - **chemical analyses, physical properties, supplemental analyses**
  - **must be of sufficient quality and quantity to support decision making**
  - **must be representative of the dredged material**

Regulatory Context

- **Performance standards for characterization are driven by the regulations governing where the material is to be placed**
- **Inland waters**
  - **40 CFR § 230.61 (chemical, biological and physical evaluation and testing)**
  - **Inland Disposal Testing Manual (ITM) (1998)**
- **Ocean waters**
  - **Section 103 of the Marine Protection, Research and Sanctuaries Act (MSPRSA), 40 CFR § 320-330 ad 335-338, 40 CFR 220-228**
  - **Regional Implementation Agreement (RIA) adapts the national procedures to regional situations**
  - **Evaluation of Dredged Material Proposed for Ocean Disposal (Green Book) (1991)**

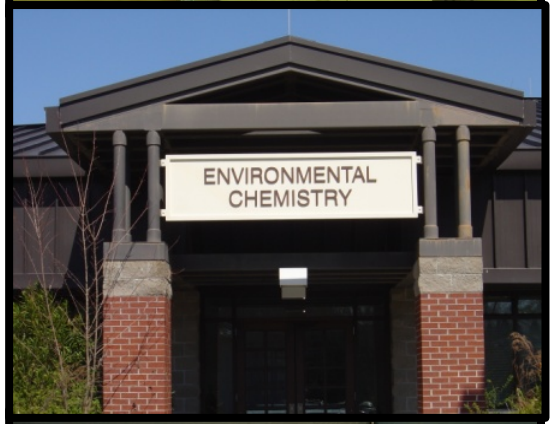
Chemical Characterization

General

- Identify Chemicals of Concern (COCs) that may be present in the dredged material
- Include COCs known/suspected in the vicinity of the dredging site
- Typically, suites of analytes typical of industrial or non-industrialized areas
- Target specific analytes associated with a recent or historical release
- May need to follow specific guidance (e.g. RIA, Table 2)
- Applies to all media → water, sediment, elutriate, tissue

Chemical Characterization

- **Method Selection**
  - **EPA SW-846 Compendium of Test Methods https://www.epa.gov/hw-sw846/sw-846-compendium**
  - **Compile performance standards (e.g. Water Quality Criteria (WQC), Target Detection Limits (TDLs))**
  - **Compare Reporting Limits (RLs) or Limits of Quantification (LOQs) to performance standards or test requirements**
  - **Ensure RLs/LOQs < performance standards BEFORE sampling**
  - **If RLs/LOQs are too high, review COCs for relevance to site**
  - **When in doubt, consult with the oversight Agency**



Chemical Characterization

- General Data Package Review
  - sample custody
  - laboratory QC within acceptance criteria (check case narrative in laboratory reports)
  - if outside of acceptance criteria evaluate bias
- Review data qualifiers
  - ensure “U” qualified data are not associated with elevated RLs
  - sample cleanup instead of dilution will keep RLs low
- Electronic Data Deliverables (EDDs) - Get them!!!
  - specify the fields/info you want
  - sortable Excel or Acces data file
  - PDF of a report is NOT an EDD

Data Quality and Data Qualifiers - Example

- Data reporting with only qualifers
- U = “not detected”
- Might conclude that all COCs were not present because they are reported “U”

- Data reported with number & qualifier
- Assume all COCs have a reporting limit of 0.011 ug/L
- Some samples needed to be diluted (*)
- 3 samples OK; 2 need more evaluation

COC	WQC (ug/L)	#1 (ug/L)	#2 (ug/L)	#3 (ug/L)
COC #1	0.005	U	U	U
COC #2	0.010	U	U	U
COC #3	1.00	U	U	U
COC #4	5.00	U	U	U
COC #5	50.0	U	U	U

COC	WQC (ug/L)	#1 (ug/L)	#2 (ug/L)	#3 (ug/L)
COC #1	0.005	0.011 U	0.011 U	0.011 U
COC #2	0.011	0.011 U	0.011 U	0.011 U
COC #3 *	1.00	0.022 U	0.055 U	0.088 U
COC #4	5.00	0.011 U	0.011 U	0.011 U
COC #5 *	50.0	100 U	100 U	250 U

Physical Characterization

- Provides general information on the physical characteristics of the dredged material
- can assist in assessing the impact of disposal on the benthic environment and the water column at the disposal site
- Primary analyses are:
  - grain size
  - total solids
  - specific gravity
  - total organic carbon

Physical Characterization

- **Grain-size analysis**
  - **distribution of the size ranges of the particles that make up the sediment (gravel, sand, silt, and clay)**
  - **to get CLAY and SILT reported MUST specify grain size by sieve and hydrometer**
  - **used for textural matching**
  - **used qualitatively to infer bioavailability**

Physical Characterization

- **Total Solids**
  - gravimetric determination of the organic/inorganic material remaining in a sample after it has been dried at a specific temperature
  - generally used to convert concentrations of the chemical parameters from a wet-weight to a dry-weight basis

- **Specific Gravity**
  - ratio of the mass of a volume of material to an equal volume of distilled water at the same temperature
  - usually obtained along with total-solids as it can be used to help to predict the dispersal and settling characteristics of dredged material upon ocean disposal

Physical Characterization

- **Total Organic Carbon (TOC)**
  - **measure of the total amount of oxidizable organic material in a sample**
  - **used qualitatively to evaluate chemical binding and/or bioavailability**
  - **used to evaluate samples for biological testing (e.g. organisms need a minimum level of TOC)**

Supplemental Characterization

- **Miscellaneous parameters**
- **Project or medium specific (e.g. percent lipids for tissue testing)**

Exclusion Criteria

Inland Waters (40 CFR § 230.60)

- Prior results may make new testing unnecessary
  1) Composed primarily of sand, gravel or other naturally occurring inert material
  2) Found in areas of high current or wave energy; **BUT**
  3) Further inquiry is needed if such material is suspected to be contaminated (e.g. discolored, odor)

Ocean placement 40 CFR § 227.13(b)

- Information collected in Tier 1 on the proposed dredged material is compared to the three exclusionary criteria in paragraph 227.13(b).
  1) Composed predominantly of sand, gravel, rock or other material with particles larger than silt AND is found in areas of high current or wave energy; **OR**
  2) Is for beach nourishment or restoration and is composed predominantly of sand, gravel or shell with particles compatible with receiving beaches; **OR**
  3) When: (i) material is substantially the same as the substrate at the placement site **AND** (ii) the material site is removed from known existing or historical sources of contamination

Sediments Meet Exclusion Criteria – Based Upon Grain Size

Exclusion Criteria

#1: **Composed predominantly of sand, gravel, rock or other material with particles larger than silt (EPA > 90%)**

→ **Corpus Christi: Grain size indicted 95.8% sand and gravel-sized particles**

#2: **Found in areas of high current or wave energy (EPA > 0.3 m/s)**

→ **Corpus Christi: 1.79 knots (1.00 m/s)**

- **Sediments met exclusion criteria**
- **No further testing**

Examples of Grain Size

Data Quality Objectives and Data Quality Control

- **Data Quality Objectives (DQOs)**
  - Essential to ensure data meet acceptable criteria for precision and accuracy
  - Data must be representative spatially and chemically
  - Number of samples → spatial representative
  - Quality analyses → chemically representative
  - Data must meet performance standards
  - Evaluate data qualifers to ensure RLs are not elevated due to unusual sample handling (e.g. dilutions, matrix effects etc.)

- **Data Quality Control**
  - Field Quality Control: evaluate the need for and number of field blanks, duplicates, trip blanks (VOCs) etc.

Data Quality Objectives and Data Quality Control

- **Laboratory Quality Control**
  - **Method blanks, laboratory control samples, MS/MSDs, surrogates, instrument performance, laboratory standards, QC limits etc.**
  - **Get a good case narrative (summary) from the laboratory**
  - **Semi-annual laboratory performance evaluation will document these**
  - **Laboratory accreditation (NELAC – National Environmental Laboratory Accrediation Certification)**

Conclusions

- Type and amount of testing is determined by the placement option under evaluation
- Look at the regulatory context and determine performance criteria
- Develop a Sampling and Analysis Plan (SAP)
- Ensure Data Quality Objectives (DQOs) are developed at the outset
- SW-846 methods (RLs/LOQs < criteria or performance standard)
- Include field and laboratory QC
- Use appropriately certified laboratories
- Perform data quality review prior to data evaluation and decision making