U.S. Environmental Protection Agency
Region 6

US Army Corps of Engineers
Galveston District
New Orleans District

OCEAN DREDGED MATERIAL DISPOSAL PROGRAM

REGIONAL IMPLEMENTATION AGREEMENT

FOR
TESTING AND REPORTING REQUIREMENTS
FOR OCEAN DISPOSAL OF DREDGED MATERIAL
OFF THE LOUISIANA AND TEXAS COASTS
UNDER SECTION 103 OF
THE MARINE PROTECTION, RESEARCH AND SANCTUARIES ACT

July, 2003

PREFACE

This Regional Implementation Agreement (RIA) was prepared cooperatively by the U.S. Army Corps of Engineers (USACE), New Orleans District and Galveston District, and the U.S. Environmental Protection Agency, Region 6 (EPA). The RIA provides guidance for applicants, permittees, and USACE and EPA staff working on ocean dredged material disposal projects in Louisiana and Texas. The RIA is necessary to adapt the national procedures, contained in the 1991 *Evaluation of Dredged Material Proposed for Ocean Disposal - Testing Manual*, to Regional situations and ensure compliance with the ocean dumping regulations.

This RIA is designed to specify sampling, testing, and reporting procedures for dredged materials proposed for ocean disposal in the Gulf of Mexico off the Louisiana and Texas coasts. In addition, this RIA establishes administrative, coordination, and documentation procedures that will be followed by the USACE, New Orleans District and Galveston District, and EPA Region 6. This RIA revises and combines the existing RIAs for the Ocean Dumping Program in Louisiana and Texas, finalized in 1992. This RIA will supercede the 1992 RIAs upon finalization.

This RIA has undergone review by the USACE Engineer Research and Development Center, EPA National Health & Environmental Effects Research Laboratory, EPA Office of Wetlands, Oceans and Watersheds, U.S. National Marine Fisheries Service, U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration, Louisiana Department of Environmental Quality, Louisiana Department of Natural Resources, Louisiana Department of Wildlife and Fisheries, Texas Natural Resource Conservation Commission, Texas General Land Office, and the Texas Parks and Wildlife Department. Comment letters received are included in Appendix F. In addition, the following individuals have reviewed this document through a formal peer review process: Mr. Martin Arhelger, PBS&J; Dr. Barry A. Vittor, Barry A. Vittor and Associates, Inc.; Mr. James Reese, USACE, Northwestern Division; and Mr. Walter Berry, USEPA Environmental Effects Research Laboratory.

This RIA has been approved by the following officials of U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers, and goes into effect upon the date of the last signature.

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GLOSSARY OF TERMS

Acute Toxicity:

Short-term toxicity to organism(s) that have been affected by the properties of one or more chemical substances contained in water or sediment. The acute toxicity of contaminated sediment is generally determined by quantifying the mortality of appropriately sensitive organisms that are put into contact with the sediment, under either field or laboratory conditions, for a specified period.

Bioaccumulation:

The accumulation of contaminants in the tissue of organisms through any route, including respiration, ingestion, or direct contact with contaminated water, sediment, or pore water.

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).

Contaminant of Concern (COC):

A contaminant present in a given sediment thought to have the potential for unacceptable adverse environmental impact due to a proposed discharge. A contaminant is defined as a chemical substance in a form that can be toxic to or bioaccumulate in aquatic organisms, consumers of aquatic organisms, or users of the aquatic environment, and includes but is not limited to the substances listed on the 307(a)(1) list of toxic pollutants promulgated on January 31, 1978 (43 FR 4109).

Data Quality Objectives (DQO):

Qualitative and quantitative statements that clarify study objectives, define appropriate types of data and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions. DQOs provide the framework for planning environmental data operations consistent with the data user's needs.

Dissolved Fraction or Liquid Phase:

The dissolved fraction of the elutriate process is that portion of the elutriate supernatant that has been filtered through a 0.45 Φm filter (or centrifuged and then filtered).

Dredged Material Elutriate:

The dredged material elutriate preparation (see Section 10.1.2 of the Green Book) involves mixing the dredged material with dredging site water in a sediment-to-water ratio of 1:4 and allowing the mixture to settle. The suspended particulate phase is the supernatant from the dredged material elutriate preparation and is used for water column bioassays. The liquid phase is the supernatant from the dredged material elutriate preparation that has been centrifuged and/or filtered and is used for EPA WQC/state WQS screening.

EPA Risk Levels:

Levels of contaminant concentrations in an exposure medium that pose a potential carcinogenic risk (10^{-5} or a 1 in 100,000 incremental incidence of cancer over a 70 year period) and/or noncancer hazard (i.e. exceeds

a reference dose). Screening levels for contaminants are used in this RIA to estimate human health risk associated with the consumption of chemically contaminated fish.

Equilibrium Partitioning (EqP) Approach:

Approach used to relate the dry-weight sediment concentration of a particular chemical that causes an adverse biological effect to the equivalent free chemical concentration in pore water and to that concentration sorbed to sediment organic carbon or bound to sulfide. Based on the theory that the partitioning of a nonionic organic chemical between organic carbon and pore water and the partitioning of a divalent metal between the solid and solution phases are at equilibrium.

Exclusionary Criteria:

Should the dredged material meet at least one of the criteria listed in Section 227.13(a) of the ocean dumping regulations, no additional testing is required of the sediment and the material is considered to be compliant with the regulations.

Green Book:

Evaluation of Dredged Material Proposed for Ocean Disposal - Testing Manual (EPA-503/8-91/001), or the "Green Book" is the technical guidance manual for determining suitability of dredged material for ocean disposal through chemical, physical, and biological evaluations. The Green Book is intended for use in evaluating dredged-material compliance with the EPA ocean dumping regulations.

Initial Mixing:

That dispersion or diffusion of liquid, suspended particulate, and solid phases of dredged material that occurs within 4 hours after dumping. The limiting permissible concentration (LPC) shall not be exceeded beyond the boundaries of the disposal site during initial mixing and shall not be exceeded at any point in the marine environment after initial mixing.

Inland Testing Manual (ITM):

Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Testing Manual (EPA-823-B-98-004), or the Inland Testing Manual, is the technical guidance manual for determining the potential for contaminant-related impacts associated with the discharge of dredged material in waters regulated under Section 404 of the Clean Water Act (inland waters, near coastal waters, and surrounding environs – all waters other than the ocean and territorial sea regulated pursuant to Section 404 of CWA) through chemical, physical, and biological evaluations.

K_{ow} :

Log octanol/water partition coefficient, the ratio of the chemical concentration in octanol divided by the concentration in water. The octanol/water partition coefficient has been shown to correlate with bioconcentration factors in aquatic organisms and adsorption to soil and sediment.

LC_{50}:

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

Limiting Permissible Concentration (LPC):

The liquid phase LPC [40 CFR 227.27(a)] is the concentration of the constituent that, after allowing for initial mixing, does not exceed the acute marine water quality criteria (WQC) for that constituent and/or a

toxicity threshold of 0.01 of the acutely toxic concentration of the dredged material. The LPC of the suspended particulate phase and solid phases is the concentration which will not cause unreasonable toxicity and which will not cause bioaccumulation of contaminants of concern in the human food chain (SPP bioaccumulation testing is not required) [40 CFR 227.27(b)].

Liquid Phase or Dissolved Fraction (LP):

For dredged material, the liquid phase is considered to be the centrifuged and/or 0.45 Φm filtered supernatant from the dredged material elutriate preparation [See also 40 CFR 227.32(b)(1)].

Marine Protection Research and Sanctuaries Act (MPRSA):

Enacted by Congress in 1972, MPRSA regulates the transportation for the purpose of dumping and dumping of all materials into the ocean. It establishes a system for permitting the disposal of materials and prohibits the dumping of particular materials. It implements the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, or the London Convention of 1972. Also known as the Ocean Dumping Act.

Minimum Quantification Level (MQL):

The lowest concentration that can be reliably quantified with specified limits of precision and accuracy during routine laboratory operating conditions.

Ocean Waters:

Those waters of the open seas lying seaward of the baseline from which the territorial sea is measured (see also paragraph 220.2(c) of the ocean dumping regulations).

Ocean Dredged Material Disposal Site (ODMDS):

A precise geographical area within which ocean disposal of dredged material is permitted under conditions specified in permits issued under §103 of the MPRSA. Such sites are identified by boundaries established by (1) coordinates of latitude and longitude for each corner or by (2) coordinates of latitude and longitude for the center point and a radius in nautical miles from that point.

Ocean Dumping Regulations:

Procedures and concepts published in 40 CFR 220-228 for evaluating proposals for dumping dredged material in the ocean.

Reference Sediment:

A sediment, substantially free of contaminants, that is as similar as practicable to the grain size of the dredged material and the sediment at the disposal site. In addition, the reference sediment reflects 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.

Solid Phase (SP):

According to the regulation, the solid phase is considered to be all the material settling to the bottom after one hour settling of the dredged material elutriate [See also 40 CFR 227.32(b)(1)]. For the purposes of this RIA, solid phase refers to the whole sediment as defined in the Green Book, which includes the sediment that would settle in one hour.

Suspended Particulate Phase (SPP):

The SPP is the supernatant as obtained from the dredged material elutriate preparation. [See also 40 CFR 227.32(b)(1)].

Target Detection Limit (TDL):

A performance goal set between the lowest, technically feasible, detection limit for routine analytical methods and available regulatory criteria or guidelines for evaluating dredged material. The target detection limit is, therefore, equal to or greater than the lowest amount of a chemical that can be reliably detected based on the variability of the blank response of routine analytical methods. However, the reliability of a chemical measurement generally increases as the concentration increases. Analytical costs may also be lower at higher detection limits. For these reasons, a target detection limit is typically set at not less than 10 times lower than available sediment guidelines.

Tiered Testing:

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 Test:

A bioassay which measures an effect (e.g. acute toxicity, sublethal/chronic toxicity). Not a bioaccumulation test.

Water Quality Criteria (WQC):

Nationally recommended water quality levels by EPA for the protection of aquatic organisms and their uses. The criteria are developed under Section 304(a) of the Clean Water Act and are based solely on data and scientific judgements on the relationship between pollutant concentrations and environmental and human health effects. They provide guidance to the States in adopting water quality standards that ultimately provide a basis for controlling discharges or releases of pollutants.

Water Quality Standard:

A law or regulation that consists of the beneficial designated use or uses of a water body, the numeric and narrative water quality criteria that are necessary to protect the use or uses of that particular water body, and an anti-degradation statement. Nationally recommended water quality criteria provide guidance for the States in adopting water quality standards.

LIST OF ACRONYMS

ASTM - American Society for Testing and Materials
CFR - Code of Federal Regulations
COC - Contaminant(s) of Concern
CWA - Clean Water Act
DQO - Data Quality Objectives
EIS - Environmental Impact Statement
EPA - Environmental Protection Agency
FR - Federal Register
GC/MS - Gas Chromatograph/Mass Spectrometry
GIS - Geographic information system
ITM - Inland Testing Manual
LPC - Limiting Permissible Concentration
MPRSA - Marine, Protection, Research and Sanctuaries Act
MQL - Minimum Quantification Level
ODMDS - Ocean Dredged Material Disposal Site
PAH - Polynuclear Aromatic Hydrocarbons
PCB - Polychlorinated Biphenyl
QA - Quality Assurance
QAP - Quality Assurance Plan
QC - Quality Control
RIA - Regional Implementation Agreement
SAP - Sampling and Analysis Plan
SPP - Suspended Particulate Phase
SP - Solid Phase
TDL - Target Detection Limit
USACE - U.S. Army Corps of Engineers
U.S.C. - United States Code
WQC - Water Quality Criteria
WQS - Water Quality Standards

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1. INTRODUCTION

1.1 Background. Section 103 of the Marine Protection, Research and Sanctuaries Act (MPRSA) (33 U.S.C. §1401 et. seq.), specifies that all proposed operations involving the transportation and disposal of dredged material into ocean waters must be evaluated to determine the potential environmental impact of such activities. Environmental evaluations must be in accordance with the ocean dumping regulations in 40 CFR 220-228, and with permitting and dredging regulations in 33 CFR 320-330 and 335-338. National implementation guidance was developed jointly by the U.S. Army Corps of Engineers (USACE) and the Environmental Protection Agency (EPA) to define technical procedures for testing dredged material. The national guidance manual was first issued in 1977 and an updated version entitled, *Evaluation Of Dredged Material Proposed for Ocean Disposal - Testing Manual*, (the Green Book) was issued in February 1991 (EPA/USACE, 1991).

1.2 Purpose. Regional guidance is necessary to adapt the national procedures to regional situations and to adhere to ocean dumping regulations at 40 CFR 220-228. This Regional Implementation Agreement (RIA) is designed to specify sampling, testing, and reporting procedures for dredged materials proposed for ocean disposal in the Gulf of Mexico off the Louisiana and Texas coasts. In addition, this RIA establishes administrative, coordination, and documentation procedures that will be followed by the USACE, New Orleans District and Galveston District and EPA, Region 6. This RIA revises and combines the existing RIAs for the Ocean Dumping Program in Louisiana and Texas, finalized in 1992 (EPA/USACE 1992a & 1992b). This RIA will supercede the 1992 RIAs upon finalization.

In 1998, EPA and the USACE jointly issued national guidance defining technical procedures under Section 404 of the Clean Water Act (CWA) for evaluating proposed discharges of dredged material into waters of the U.S associated with navigational dredging projects. It is intended that the document, *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Testing Manual*, (EPA/USACE, 1998), the Inland Testing Manual or ITM, serve as a counterpart to the Green Book, and in many technical aspects is more up-to-date. Thus for the purposes of this RIA, references are made to relevant technical sections of the ITM as well as the Green Book.

1.3 Modifications. New and more advanced testing procedures are continually being developed and refined by the research and development laboratories of the EPA and USACE, as well as by the academic community. Monitoring of the designated Ocean Dredged Material Disposal Sites (ODMDS) off the Louisiana and Texas coasts will provide effects-based feedback that will enable EPA Region 6 and the USACE, New Orleans District and Galveston District to make more refined and environmentally sensitive decisions concerning the ocean disposal of dredged materials. For these reasons, this RIA will be reviewed periodically and revised as necessary to incorporate modifications to the testing and reporting requirements. Modifications will be made only upon mutual agreement by the USACE, New Orleans District and Galveston District and EPA Region 6 and will be subject to public review.

1.4 Issue Resolution. Early coordination and communication is essential for avoiding disagreements. Disagreements between the USACE, New Orleans District or the Galveston District and EPA Region 6 regarding the characterization of dredged material proposed for ocean disposal will be discussed and, when possible, resolved at the staff level. If, however, the issue cannot be resolved at the staff level, then the issue will be elevated to District and Regional Managers. If necessary, consultation with the USACE Engineer Research and Development Center and USACE Headquarters and with the EPA Environmental Research Laboratories and EPA Headquarters will be the responsibility of the respective agency.

1.5 Contacts. Questions regarding any aspects of this RIA should be directed to:

U.S. Army Corps of Engineers
New Orleans District
Operations Division, Technical Support Branch CEMVN-OD-T
P.O. Box 60267
New Orleans, LA 70160-0267

U.S. Army Corps of Engineers
Galveston District
Environmental Section CESWG-PE-PR
P.O. Box 1229
Galveston, TX 77553-1229

U.S. Environmental Protection Agency
Region 6
Water Quality Protection Division
Marine & Wetlands Section 6WQ-EM
1445 Ross Avenue, Suite 12000
Dallas, TX 75202-2733

2. APPLICABILITY

This document applies to all activities involving the transportation of dredged material for the purpose of disposing it in ocean waters and is applicable to dredging activities permitted by the USACE and navigational projects constructed and maintained by the USACE.

3. ADMINISTRATIVE PROCESS

The Ocean Dumping Program is jointly administered by EPA, Region 6 and the USACE, New Orleans District and Galveston District. In accordance with Section 103 of MPRSA, the USACE is the permitting authority for dredged material disposal, subject to EPA review and concurrence. Navigational projects constructed and maintained by the USACE are subject to the same Federal environmental laws and regulations as the general public even though the USACE does not issue a permit document to authorize its own activities. Prior to disposal of dredged material at any

designated ODMDS, both EPA and the USACE are charged with making independent evaluations of all proposed dredged material disposal actions (40 CFR 225). Figure 1 shows a flowchart overview of the review process.

3.1 MPRSA Section 103 Permits. Applications for MPRSA Section 103 permits must be submitted to the USACE, New Orleans District or Galveston District. Section 103 applications must comply with USACE permitting regulations at 33 CFR Parts 320-330. In addition, Clean Water Act Section 401 water quality certification will be required. Applicants are strongly encouraged to arrange pre-application meetings with the USACE, New Orleans District or Galveston District and EPA, Region 6 in order to determine the need for testing and for additional information on the permitting process.

Once the USACE, New Orleans District or Galveston District receives a completed permit application, the information will be published for review in a public notice. The information required for the public notice is specified in 33 CFR 325.3. The information provided in the public notice and other information requested by the USACE Districts or EPA, Region 6 shall be used in making evaluations and determining suitability of dredged material for ocean disposal and compliance with 40 CFR 220-228. The types of information necessary to conduct evaluations are listed in Appendix A. In addition, the "evaluator worksheets" (Appendix E), used by EPA in evaluating the proposed dredged material, also provide a listing of information needed for adequate evaluations.

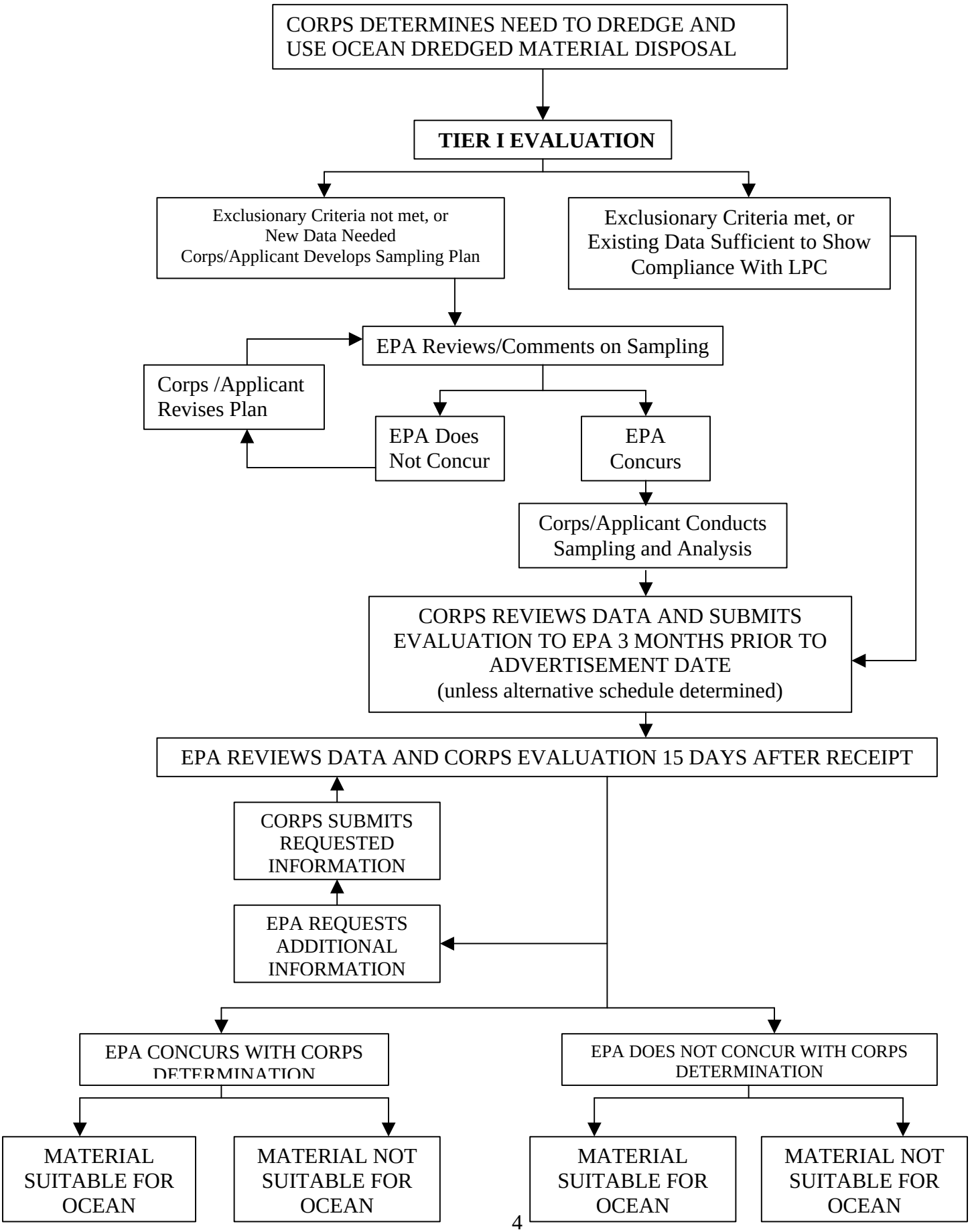
3.2 Navigational Projects Constructed and/or Maintained by the USACE. The USACE, New Orleans District and Galveston District must provide the same information as required for a Section 103 permit and are subject to the same review process (33 CFR Parts 335-338). The types of information necessary to conduct evaluations are listed in Appendix A. In addition, the "evaluator worksheets" (Appendix E), used by EPA in evaluating the proposed dredged material, also provide a listing of information needed for adequate evaluations.

To date, the USACE, New Orleans District and Galveston District, respectively, are the only users of the eight (8) MPRSA 102(c) Ocean Dredged Material Disposal Sites (ODMDS) off the coast of Louisiana and the ten (10) MPRSA 102(c) ODMDS off the coast of Texas.

Advance notice and coordination for USACE navigational projects occurs during the New Orleans District's annual Environmental Dredging Conference and the Galveston District's annual Dredging Conference where the USACE Districts present the proposed maintenance dredging projects for the upcoming fiscal year.

3.3 USACE Review. All Section 103 permit applications and USACE navigational project authorizations for ocean disposal of dredged material are evaluated by the USACE, New Orleans

FIGURE 1. Overview of Review Process



District or Galveston District in accordance with applicable ocean dumping criteria in 40 CFR 220-228. The evaluation consists of characterization of the dredged material and determination of compliance with the applicable regulations. The types of information necessary to complete the review and required to be submitted to EPA, Region 6 by the USACE, New Orleans District and Galveston District are listed in Appendix A.

A Tier I evaluation must be conducted, at a minimum, for all dredged material disposal projects, both those requiring 103 permits and all USACE navigational projects as part of the dredged material characterization. The purpose of the Tier I evaluation is to determine whether a decision on environmental acceptability can be made on the basis of existing information (See Section 4 of this RIA). If it is determined by the USACE, New Orleans District or Galveston District and/or EPA, Region 6 that the existing information is inadequate, it will be necessary to collect new sediment samples and conduct appropriate analyses to characterize the dredged material and determine environmental acceptability.

3.4 Information submitted to EPA. The following information, required for evaluation of dredged materials proposed for ocean disposal, shall be provided to EPA, Region 6, by the USACE, New Orleans District and Galveston District in written format for each dredging project: 1) dredging project information; 2) dredged material characterization/evaluation; and 3) regulatory compliance evaluation. Appendix A offers a more detailed listing of the required information to be submitted.

For USACE navigational projects, the USACE, New Orleans District or Galveston District shall submit its evaluation to EPA, Region 6 at least 3 months before the advertisement date for any dredging work. This should allow adequate time to acquire additional information (e.g. perform sampling and analysis of the dredged material) that EPA may request. In some cases this time frame may not be achievable, specifically for those USACE navigational projects that are maintained on an annual or more frequent basis. For these special cases, a schedule shall be created for the submittal of the dredged material evaluation to ensure that all data will be available for review with adequate time to make a determination.

3.5 EPA Review. The intent of the EPA review is to evaluate the environmental effects of dredged material disposal and to ensure that compliance with the ocean dumping criteria at 40 CFR 220-228 has been demonstrated. EPA, Region 6 will utilize "evaluator worksheets" or checklists to assist in the review of the dredged material characterization of proposed ocean dumping projects. These worksheets, as provided in the EPA document, *Guidance Manual for the Review of Permitted and Civil Works Projects for the Ocean Disposal of Dredged Material* (EPA, 1992c), summarize the relevant information necessary to accurately assess the adequacy of a project's sediment and water sampling; physical, chemical, and biological test procedures; modeling (if applicable); technical and statistical analysis; and quality assurance considerations. This will also ensure that all relevant documentation is contained in the project's administrative record. These checklists, provided in Appendix E, are currently under revision by EPA and will be replaced when finalized.

Within 15 days of receipt of the USACE dredged material evaluation, EPA may request additional information deemed appropriate or necessary to evaluate the proposed disposal [40 CFR 225.2(b)]. After receiving all information, EPA, Region 6 will make an independent review of the data to determine whether the proposed dredged material is suitable for ocean disposal [40 CFR 225.2(c)]. After EPA, Region 6 receives all information, an evaluation will be made within 15 working days. Partial approval based on incomplete or draft information will not be given except in unusual circumstances (e.g., emergencies).

EPA, Region 6 will inform the USACE, New Orleans District or Galveston District in writing whether the material complies with the ocean dumping criteria and regulatory requirements and explain why it does or does not. If EPA, Region 6 determines that the material does not comply with the criteria, then the ocean disposal of that material is prohibited. The USACE, New Orleans District or Galveston District and EPA, Region 6 shall then evaluate management actions outside the scope of this RIA. In these cases, procedures for invoking economic impact [40 CFR 225.3] may be followed and the District Engineer may request that the Regional Administrator of the EPA, Region 6 grant a waiver of the criteria pursuant to 40 CFR 225.4.

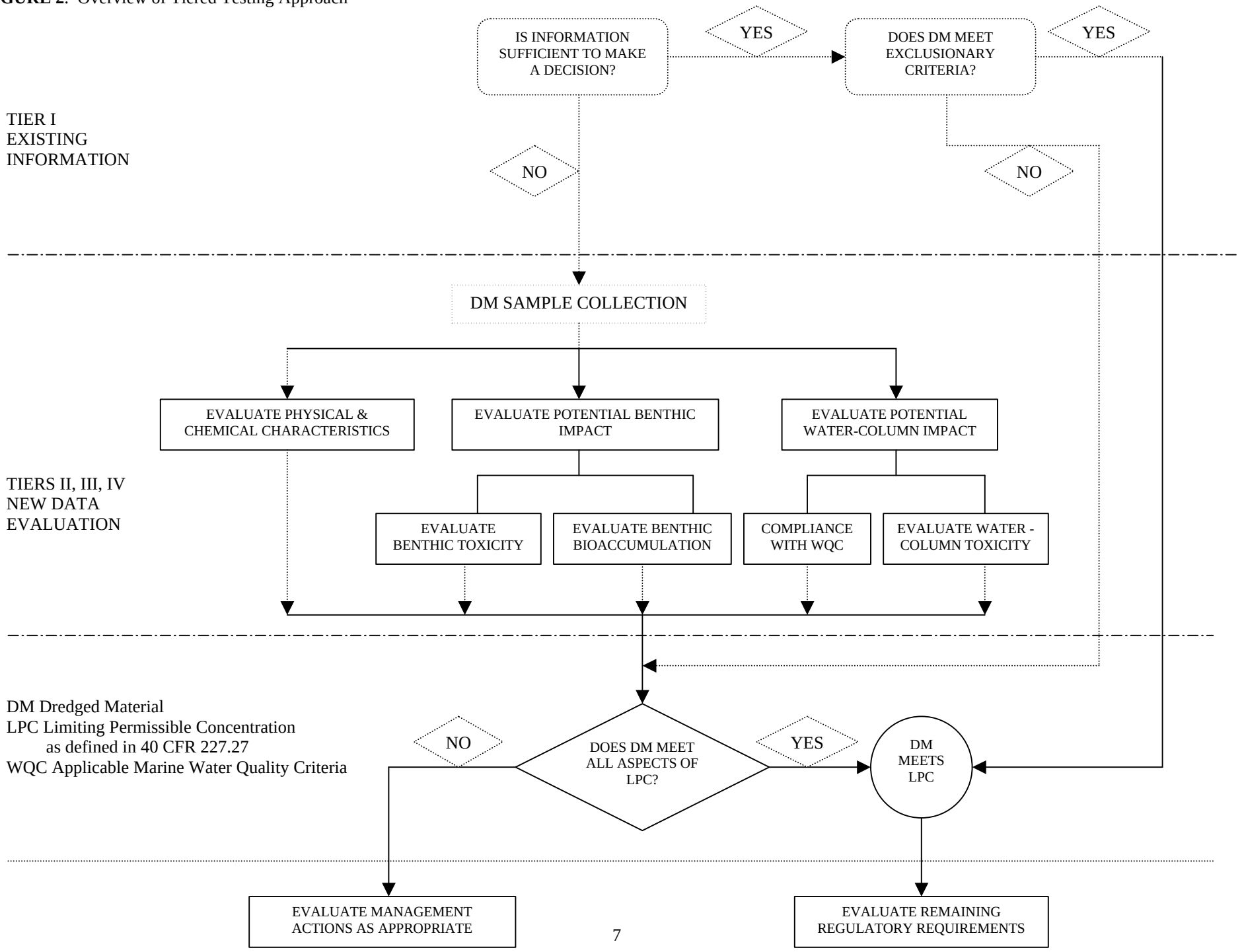
4. TIERED TESTING APPROACH

4.1 Overview. The EPA and the USACE implement a "tiered" testing approach to evaluate benthic and water column impacts of dredged material proposed for ocean disposal. This approach is designed to aid in generating only enough information to characterize the dredged material and make a regulatory compliance decision. This allows optimal use of resources by focusing the least effort on dredging operations where impacts are clear, and expending the most effort on operations requiring more extensive investigations to determine the potential for impacts. It is necessary to proceed through the tiers only until information sufficient to demonstrate compliance with or noncompliance with 40 CFR 227.6 and 227.13 has been obtained. Figure 2 presents a flowchart overview of the "tiered" approach to dredged material evaluation described in this RIA.

4.2 Limiting Permissible Concentration. Compliance with the ocean dumping regulations is determined by demonstrating that the Limiting Permissible Concentration (LPC) has been met for each of the three phases which dredged material may impact through disposal into ocean waters. The LPC for the liquid phase [40 CFR 227.27(a)] is the concentration of the constituent that, after allowing for initial mixing, does not exceed the acute marine water quality criteria (WQC) for that constituent and/or a toxicity threshold of 0.01 of the acutely toxic concentration of the dredged material. The LPC of the suspended particulate phase and solid phases is the concentration which will not cause unreasonable toxicity and which will not cause bioaccumulation of contaminants of concern in the human food chain (SPP bioaccumulation testing is not required) [40 CFR 227.27(b)].

4.3 Tier I-Existing Information. At a minimum, a Tier I evaluation shall be conducted for each proposed dredging project. Tier I is a comprehensive analysis of all existing and readily available, assembled, and interpreted information on the proposed dredging project. This may

FIGURE 2. Overview of Tiered Testing Approach



include, but is not limited to all previously collected physical, chemical and bioassay data; new and existing activities within the area (e.g. industry, navigation, significant sources of point source and non-point source pollution, etc.); and available data on spills that may have occurred after the last sediment characterization, discharges, and existing sediment quality. ***If no bioassay data exists for a proposed dredging project, which does not meet the exclusionary criteria, Tier III bioassay tests will be conducted.*** Data used to make a decision in Tier I must meet the current testing requirements as discussed in this document (i.e. species used, target detection limits). For existing data, quality assurance/quality control information should be verifiable. Tier I evaluations are described in detail in Section 4.0 of the Green Book.

The EPA, Region 6 and the USACE, New Orleans District and Galveston District have determined that biological and chemical data greater than 5 years old may not be adequate to conduct evaluations. Best professional judgment will be exercised by the USACE, New Orleans District and Galveston District and EPA, Region 6 in deciding when new chemical and biological data are needed more frequently than every 5 years. Factors that will be considered will include frequency of dredging, proximity to existing and historical pollution sources, and age of historical data results.

4.4 Tier I-Exclusionary Criteria. Based on acceptable existing information, the dredged materials may be excluded from further testing if they meet one of the exclusionary criteria at 40 CFR 227.13(b). Information on the proposed dredging site, sediment grain size, sediment chemistry and potential for contamination may be needed in determining exclusion from further testing. A conclusive written evaluation must be presented to show that the proposed dredged material meets the exclusionary criteria. Appendix A lists the information that shall be used by the USACE, New Orleans District and Galveston District and EPA, Region 6 in determining if the material meets the exclusionary criteria.

The exclusionary criteria are as follows:

1) Dredged material is composed predominantly of sand, gravel, rock or any other naturally occurring bottom material with particle sizes larger than silt, AND the material is found in areas of high current or wave energy such as streams with large bed loads or coastal areas with shifting bars and channels; OR

2) Dredged material is for beach nourishment or restoration AND is composed predominantly of sand, gravel or shell with particle sizes compatible with material on the receiving beaches; OR

3) i) When the material proposed for dumping is substantially the same as the substrate at the proposed disposal site, AND ii) the site from which the material proposed for

dumping is far removed from known existing and historical sources of pollution so as to provide reasonable assurance that such material has not been contaminated by such pollution.

4.5. Tier I-Compliance Decisions. Once the existing information has been collected and analyzed as part of the Tier I evaluation, one of the following decisions can be made on the proposed project (See also Figure 2):

1) The dredged material meets the exclusionary criteria at 40 CFR 227.13(b). No further testing is required and the material meets the limiting permissible concentration (LPC) for the liquid, suspended particulate and solid phases (40 CFR 227.27). The analyses required by other applicable provisions of the regulations including (40 CFR Part 227 Subparts B, C, D, E, and G and section 228.4(e)) must be performed.

2) The existing information is sufficient to make a decision on environmental acceptability of the dredged material ***AND*** the dredged material does ***not*** meet the exclusionary criteria at 40 CFR 227.13(b). The dredged material is then evaluated using existing information to determine compliance with the LPC for the liquid, suspended particulate and solid phases (40 CFR 227.27).

- If it is determined from the existing information that the dredged material meets the LPC for all phases, no further testing is required and the material is compliant with 40 CFR 227.6 and 227.13(c). The analyses required by other applicable provisions of the regulations including (40 CFR Part 227 Subparts B, C, D, E, and G and section 228.4(e)) must be performed.

- If it is determined from the existing information that the dredged material does not meet the LPC for all phases, it is not compliant with 40 CFR 227.6 and 227.13. Disposal of the material at a designated ODMDS is not supported. The USACE, New Orleans District or Galveston District and EPA, Region 6 shall then evaluate management actions outside the scope of this RIA.

3) The existing information is inadequate to make a compliance decision (e.g. no biological effects-based tests, age of data, new known sources of contamination, etc.). It will be necessary to collect new sediment samples and conduct appropriate analyses to characterize the dredged material and determine compliance with the 40 CFR 227.6 and 227.13. This requires development of a sampling plan (see Section 5 of this RIA) and analysis of the dredged material at a higher tier.

4.6 Tiers II & III-New Data Evaluation. Dredged material evaluations at Tier II and Tier III involve sampling and physical, chemical and biological testing of the proposed dredged material to determine environmental acceptability.

Sediment from the proposed dredging project and from the reference area shall be collected according to an approved sampling and analysis plan or according to the terms and conditions of the USACE, New Orleans District or Galveston District scope of services and/or delivery orders for their contract laboratory. The sequence of analyses and the sampling approach taken for the project depend largely on time and resources. Section 5 of this RIA provides additional guidance on sample design and approach.

Physical and chemical evaluations of the dredged material shall be conducted to characterize the sediment. Physical analysis of the sediment provides general information on the physical characteristics of the dredged material and can assist in assessing the impact of disposal on the benthic environment and the water column at the disposal site. Chemical analysis of the sediment shall be conducted to identify the constituents present in the dredged material and contaminants of concern (COC). Contaminants of concern (COC) include compounds known or suspected of contaminating the dredging site and the list of compounds identified as COC (See Table 2 in Section 8). Physical and chemical analyses are described further in Section 8 of this RIA, and can also be found in Section 9 of the Green Book.

Water column evaluations include determination of compliance of the liquid phase of the dredged material elutriate with applicable Federal Marine Water Quality Criteria (WQC) and/or state Water Quality Standards (WQS) [40 CFR 227.6(c)(1), 227.13(c)(2)(i-ii)] (Tier II). If WQC or WQS have not been established for all COC detected in the sediments or if synergistic effects are possible, further biological testing is required. Suspended-particulate phase bioassay (Tier III) [40 CFR 227.6(c)(2), 227.13(c)(3)] considers the effects, after allowance for initial mixing, of dissolved contaminants plus those associated with suspended particulates on water-column organisms. Section 9 of this RIA and Sections 5, 6, 10 and 11 of the Green Book provide additional information on water column evaluations.

Benthic evaluations include solid phase bioassays [40 CFR 227.6(c)(3), 227.13(c)(3)] that provide an assessment of toxicity of the dredged material to appropriate sensitive benthic marine organisms and an evaluation of the bioaccumulation potential of the COC in the proposed dredged material (Tier III). An initial screen of the dredged material may be performed for estimating the potential of non-polar organics to bioaccumulate using a theoretical bioaccumulation potential calculation (Tier II). The initial screen will not be used to make regulatory decisions in absence of bioassay tests, however, it may be used to aid in re-evaluating the need for ocean disposal in an effort to avoid Tier III bioassay costs. Section 10 of this RIA and Sections 5, 6, 10 and 11 of the Green Book provide additional information on benthic evaluations.

4.7 Tiers II & III-Compliance Decisions. After Tier II and/or Tier III analyses are completed, one of three specific decisions can be made:

(1) The information is sufficient to determine that the dredged material meets the LPC for any one or more of the phases (40 CFR 227.27) and is compliant with 40 CFR 227.6 and 227.13. The analyses required by other applicable provisions of the regulations including (40 CFR Part 227 Subparts B, C, D, E, and G and section 228.4(e)) must be performed;

(2) The information is sufficient to determine that dredged material does ***not*** meet the LPC for the liquid, suspended particulate and/or solid phases (40 CFR 227.27) and thus is not compliant with 40 CFR 227.6 and 227.13. Disposal of the material at a designated ODMDS is not supported. The USACE, New Orleans District or Galveston District and EPA, Region 6 shall then evaluate management actions outside the scope of this RIA; or

3) The information is insufficient to make a compliance determination and further analyses are required at a higher tier.

4.7 Tier IV-Case-by-Case Analyses. When a decision regarding toxicity or bioaccumulation cannot be reached at earlier tiers or when circumstances warrant, case-by-case evaluations shall be used to determine compliance with the ocean dumping regulations. Tests at this level should be selected to address specific project issues for a specific dredging operation that could not be fully evaluated in the earlier tiers. If the information is insufficient to determine compliance after completing Tier I, II, or III, further testing is not required if noncompliance with the LPC is assumed. This level of testing is intended for exceptional circumstances only; it should not be routinely applied. Section 7.0 of the Green Book provides additional information on Tier IV evaluations.

5. SAMPLING AND ANALYSIS PLAN

5.1 Sampling and Analysis Plan. The development of a project-specific sampling and analysis plan (SAP) is the next step in the project evaluation process for those projects found to have inadequate information to make a regulatory decision on suitability of dredged material disposal following a Tier I evaluation. The SAP is the main source of information about the proposed dredging project's sampling design/approach and quality assurance/quality control (QA/QC) measures associated with sample collection and dredged material analyses. ***This RIA recommends including all project-specific sampling, testing and QA/QC components in the project SAP***.

Sampling and testing must be coordinated far enough in advance of dredging to allow time for testing and data review. The guidance document, *QA/QC Guidance for Sampling and Analysis*

of Sediments, Water, and Tissues for Dredged Material Evaluations (EPA/USACE, 1995), and Appendix G of the ITM should be used when preparing a project SAP. Section 8 of both the Green Book and the ITM also address sample collection, however, the guidance provided in the ITM is more technically advanced and should be used as reference for preparing a SAP.

The USACE, New Orleans District and Galveston District, and EPA, Region 6 plan to prepare a Dredged Material Evaluation Quality Assurance Plan (QAP), which will address basic QA/QC issues associated with dredged material sampling and evaluations. The QAP will include all general QA/QC information and requirements that apply across all dredging projects including field sampling and clean techniques, laboratory testing, data validation and reporting, and other QA/QC procedures. While basic/general sampling and analysis protocols will be addressed in the QAP, the individual project sampling design and project-specific QA/QC issues should be addressed in the project SAP. Once the QAP is finalized it will be included as an appendix to this RIA. Section 6 of this RIA contains additional information on QA/QC.

The USACE, New Orleans District and Galveston District shall provide EPA, Region 6 the opportunity to review all project SAPs submitted by a permitee for individual projects or to be submitted to the contractor for USACE navigational projects before work is initiated. Applicants are strongly encouraged to arrange pre-application meetings with the USACE, New Orleans District or Galveston District and EPA, Region 6 to prepare appropriate sampling and analysis plans, if necessary. Advance coordination for USACE navigational projects occurs during the New Orleans District's annual Environmental Dredging Conference and the Galveston District's annual Dredging Conference where the USACE Districts present the proposed maintenance dredging projects for the upcoming fiscal year.

The SAP should contain, at a minimum, the following general categories of information in as much detail as possible.

1) **Summary Information**: Tier I information, including dredging site history and location, identification of potential sources of contamination, and proposed list of contaminants of concern.

2) **Project Description**: a plan view of the site (if available), the estimated type and volume of sediment to be dredged, the depth and physical nature of the sediments, practicable widths and depths of dredging, and dredging methods and equipment.

3) **Sampling Design and Approach**: number of samples, distribution/location of samples, reference area location, number of replicates, sample compositing, sample depth, sample volume, tests to be conducted for each sample station (e.g. sediment chemistry or bioassays).

4) **Personnel Responsibilities**: individual roles and responsibilities, project planning and coordination, field sampling, chemical and biological testing, QA/QC management, and final report preparation.

5) **QA/QC Requirements**: project-specific testing and/or sampling QA/QC issues (may include laboratory specific standard operating procedures, equipment decontamination, sample handling protocols including clean techniques, sample transport and chain of custody). Certain QA/QC requirements may be addressed in contract laboratory quality management plans/documents and should be referenced or included in the SAP.

5.2 Sampling Design. An appropriate and defensible sampling design should be used as the basis for data collection for use in compliance decisions. The choice of a sampling design depends on several factors including but not limited to, the decision to be made with the data, frequency of dredging, historical or known location of shoaling, historical or known volumes of materials dredged, and cost of sampling and analysis. Chapter 8 of both the Green Book and ITM, should be used for detailed guidance for developing the sampling strategy, however, the guidance provided in the ITM is more technically advanced and should be used as reference for preparing a sampling strategy. Plumb (1981) provides additional guidance on sample design.

When possible, a survey of the proposed dredging project should be conducted prior to initiation of the contracting process to obtain pertinent information on shoaling volumes and locations. When it is not possible to conduct a survey in adequate time, the best option will be to design a sampling approach based on estimated volumes and to collect a range of samples from areas of historical shoaling.

Through design optimization, the sampling effort can be distributed spatially in such a way as to maximize the amount of information obtained within the area to be sampled. Many dredging projects can be subdivided into project segments (horizontal and/or vertical) which can be treated as separate management units or dredged material management units. Each project segment is an area expected to have relatively consistent characteristics that differ substantially from the characteristics of adjacent segments. It is recommended that this approach be used whenever possible in developing a sampling design for a specific project. Section 8 of both the Green Book and ITM provide additional guidance on the subdivision of the dredging area, however, the guidance provided in the ITM is more technically advanced and should be used as reference for subdivision of the dredging area.

The method of dredging, volume of material to be dredged, areal extent of the dredging project, the horizontal and vertical heterogeneity of the sediment, and proximity to known sources of contamination are key to determining station locations and the number of samples to be collected for the total dredging operation and for each project segment or dredged material management unit. Section 8 of both the Green Book and ITM provide additional guidance on selection of

sampling locations and number of samples, however, the guidance provided in the ITM is more technically advanced and should be used as reference for determining sample location and number.

Samples may be composited, when appropriate, prior to analysis. The number of samples and proper use of compositing should be determined for each proposed project on a case-by-case basis. Each dredged material sampling station should be sampled as a composite of several samples at an area proposed for dredging within the channel. Section 8 of both the Green Book and ITM provide additional guidance on sample compositing, however, the guidance provided in the ITM is more technically advanced and should be used as reference for sample compositing.

5.3 Sampling Approach. Once a sampling design is developed, the sampling approach should be determined in order to ensure that enough sediment is collected for the appropriate tests to be conducted. Sufficient sediment and water should be collected to conduct all physical, chemical and biological tests to ensure that all sediments are collected at the same time in order to meaningfully compare the biological and chemical data. Sediments to be used for biological testing may be archived pending results of the chemical analyses. However, given the relatively short holding times for archived sediments to be used to conduct biological testing, unless quick turn-around on chemical analyses of sediments is assured, it is recommended that the chemical and biological tests be run concurrently. Appendix B of this RIA provides a summary of recommended procedures for sample collection, preservation and storage. Table 1 provides guidance on the types of samples that may be required to be collected in the field to conduct dredged material evaluation tests.

5.4 Sample Collection. An accurate assessment of the physical, chemical and biological characteristics of sediment proposed for dredging is dependent upon the collection of representative samples. Steps must be taken during the sampling process to ensure that samples accurately represent the area to be dredged (see above discussion on sample design and approach). In general, the sampling areas should be located within areas of proposed dredging where the largest amounts of sediments are planned for removal or in areas of known or suspected contamination. Sampling should generally be to the project depth (including advance maintenance and allowable over-depth) unless the sediments are known to be vertically homogeneous. Homogeneous sediments are sediments that appear the same in physical characteristics throughout the depth of the area to be dredged, and lack obvious color striations, layering, or sorting of grain size. For areas which are dredged frequently or new projects which involve the dredging of native material, the entire dredging prism may be considered homogeneous.

Appendix B (reproduced from the ITM) of this RIA presents recommended sampling methods and volumes. Any deviation from the recommendations in Appendix B shall be submitted to EPA, Region 6 and the USACE, New Orleans District and Galveston District for review and approval prior to the sampling effort. If the recommendations in Appendix B are not followed,

analytical results may be rejected as being unacceptable. Table 1 provides guidance on the types of samples that may be required to be collected in the field to conduct dredged material evaluation tests. ***EPA recommends that clean techniques (EPA 1600 series methods) be used for collection and analysis of metals in water.***

Most of the navigational projects constructed and maintained by the USACE New Orleans District and Galveston District are in areas that have frequent ship traffic and from which sediments are dredged at short intervals. In these cases, grab samples can be representative of the mixed sediment column, and corers should only be necessary if excavation of infrequently disturbed sediments below the mixed layer is planned.

Accurate positioning of sampling stations is essential in investigations of sediment characteristics. All samples should be obtained as close as possible to the target locations provided in the project sampling plan. All sediment sampling locations should be recorded to a horizontal accuracy of ±2 meters (or as approved in the sampling and analysis plan). Such accuracy can be obtained by survey landmarks and a variety of positioning hardware. If sampling locations are referenced to a local coordinate grid, the local grid should be tied to the North American Datum (NAD 1983) to allow conversion to latitudes and longitudes. The use of a standard horizontal datum will allow dredging data to be accurately mapped, including display and analysis using geographic information system (GIS) software.

5.5 Reference and Control Sediments. It is important to distinguish clearly between reference and control sediments in the context of benthic impact. Test procedures are conducted on the control and reference sediments in the same way as on the dredged material proposed for ocean dumping.

Reference Sediment

Reference sediment is defined in the Green Book as a sediment, "substantially free of contaminants, that is as similar as practicable to the grain size 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.***

This RIA requires that the reference area approach be used rather than the reference point approach. In the reference area approach, the reference location is viewed not as a single station or point, but as the entire area in the environs of the disposal site, excluding the disposal site itself. Rather than characterize the reference area by sampling at a single point, it is characterized by a number of samples taken throughout the reference area and composited according to methods described in the Green Book.

Table 1. Sample Collection Requirements

This table contains general guidance on the type of samples that may be required to be collected in the field to conduct dredged material evaluation tests.

Tests	Water Samples			Sediment Samples			Purpose
	Disposal Site	Dredging Site	Control	Dredging Site	Reference Site	Control	
Tier II							
Water Column Screen	●			●			Chemical analyses of disposal site water and dredging site sediments are required for model inputs.
Elutriate	●	●		●			Dredging site water and sediments are used for elutriate preparation. Chemical analysis of the liquid phase of the dredged material elutriate is used to determine compliance with WQC/WQS. Chemical analysis of disposal site water and liquid phase of the elutriate is required for model inputs.
Tier II							
Benthic				●	●		Chemical and physical analyses of dredging site sediment samples and reference site sediment samples are required for TBP calculations.
Tier III							
Water Column SPP Toxicity Test	●	●	●	●			Organisms are exposed to dilution water, control water and the dredged material dilution series. Dredging site water and sediments are used for elutriate preparation. Disposal site water or artificial sea water may be used for dilutions. Control water is required for bioassay test acceptance.
Tier III							
Benthic Solid Phase Toxicity Test and Bioaccumulation Test	●			●	●	●	Organisms are exposed to dredging site sediments, reference sediment and control sediment for toxicity and bioaccumulation bioassays. Control sediment is required for bioassay test acceptance. Chemical analyses of organism tissues are required for bioaccumulation tests. Disposal site water, clean sea water or artificial sea water may be used to conduct bioassays.

The reference areas are located within 2 - 5 nautical miles of the ODMDS and at a location opposite the direction of net transport. The reference area sediment sample for a given project must be a composite comprised of a minimum of three samples. See Appendix D for reference area locations for ODMDS in Texas and Louisiana. Reference areas for Section 103 permit applicants will be determined on a case-by-case basis.

Control Sediment

Control sediment is distinguished from the reference sediment because it is collected from the site where the test species were collected or an area known to be free of contaminants, or it is the sediment that the organisms are cultured in the laboratory. The control sediment is used to confirm the health of the test organism during bioassay tests, and to validate the test protocol as part of the laboratory QA/QC program. The control sediment should have previously been demonstrated to result in good survival and growth of test organisms.

Excessive mortality in the control sediment indicates a problem with testing conditions or organisms and can invalidate the corresponding test results. It may also indicate that test species are overly sensitive to the different grain sizes. This RIA recommends that if mortality is greater than 10% in the control treatment for a particular test species (30% mortality/abnormality for zooplankton in the water column bioassay), the causes of the failure should be identified (e.g. grain size sensitivity, pH, ammonia, etc.) and the bioassay repeated.

6. QUALITY ASSURANCE/QUALITY CONTROL

An effective quality control program must be an integral part of the dredging evaluation from the initiation of field collection. The importance of a quality assurance (QA) program is to ensure that the data collected in order to make regulatory decisions is of known and documented quality, as well as to ensure that quality control (QC) procedures have been implemented and documented. QA programs set standards for personnel qualifications, facilities, equipment, services, data generation, record-keeping, and data-quality assessments. QC procedures for the general characterization of sediments are necessary to ensure that the data meet acceptable criteria for precision and accuracy.

The USACE, New Orleans District and Galveston District, and EPA, Region 6 plan to prepare a Dredged Material Evaluation Quality Assurance Plan (QAP), which will address basic QA/QC issues associated with dredged material sampling and evaluations. The QAP will include all general QA/QC information and requirements that apply across all dredging projects including field sampling and clean techniques, laboratory testing, data validation and reporting, and other QA/QC procedures.

While basic/general sampling and analysis protocols will be addressed in the QAP, the individual project sampling design and project-specific QA/QC issues should be addressed in the project SAP. Certain QA/QC requirements may be addressed in contract laboratory quality management plans/documents and should be referenced or included in the SAP. Once the QAP is finalized it will be included as an appendix to this RIA.

The Dredged Material Evaluation QAP will be prepared using the following guidance documents: *QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations* (EPA/USACE, 1995), and *EPA Requirements for a QA Project Plan – QA/R-5* (EPA, 2001a; www.epa.gov/quality1). Additional guidance may also be obtained from the Green Book and the ITM, however the guidance provided in the ITM (Appendix G) is more technically advanced and should be used as reference for general QA/QC considerations. Until the Dredged Material Evaluation QAP is prepared, the guidance provided in the EPA/USACE (1995) QA/QC guidance document and in Appendix G of the ITM will be utilized.

The USACE, New Orleans and Galveston District will consult the Dredged Material Evaluation QAP, when finalized, when negotiating contracts for dredged material evaluations to assure all QA/QC measures are addressed. EPA will also assist in QC oversight activities including inter-laboratory comparisons and routine inspections. QA/QC requirements may be addressed in contract laboratory quality management plans/documents and should be reviewed to ensure that the requirements of the QAP, once finalized, are met.

7. DREDGED MATERIAL EVALUATION

Under 40 CFR 227.13(c), evaluation of dredged material to determine environmental acceptability focuses on biological effects rather than the presence/absence of contaminants. The Green Book and the ocean dumping regulations stress the use of effects-based bioassays as evaluative tools necessary to determine the potential impact of the dredged material on both the benthic environment and water column. Bioassays are used to predict environmental effects because they are regarded as the best methods available for integrating the effects of multiple contaminants and for comparing the relative impacts of different dredged materials. Test organisms integrate and quantify the effects of chemical and physical constituents of a dredged material. Contaminant-based effects of the sediment can then be assessed in a holistic manner.

The biological effect of the dredged material is evaluated using new or historical data. If no acceptable biological effects-based data exist for a proposed dredging project and it does not meet the exclusionary criteria then biological effects-based bioassays will be conducted to determine regulatory compliance. For most projects, the impact of the solid phase on the benthic environment deserves the most rigorous evaluation, because the dredged material that is deposited on the sea floor usually causes greater long-term impact than the fraction of the dredged material that is temporarily suspended in the water column.

The ocean dumping regulations [40 CFR 227.27(b)] require that both acute and chronic toxicity effects of dredged material placement should be measured. Chronic methods are important for assessing long-term effects, including reproduction and growth of benthic organisms. EPA has developed a standard method for assessing chronic toxicity to the amphipod *Leptocheirus plumulosus* (EPA, 2001b) which can be accessed online at www.epa.gov/waterscience.

8. PHYSICAL AND CHEMICAL EVALUATIONS

8.1 Physical Analysis. Physical analysis of the dredged material provides general information on the physical characteristics of the dredged material and can assist in assessing the impact of disposal on the benthic environment and the water column at the disposal site. Physical analysis of the reference sediment is required for Tier II TBP calculations, if conducted. The conventional parameters to be analyzed for physical characterization of sediment include the following, at a minimum: grain size distribution, total organic carbon (TOC), total petroleum hydrocarbons (TPH), ammonia, and percent solids. A comprehensive listing of appropriate analytical methods for the conventional parameter analyses of sediments is provided in Table 3 of the *QA/QC Guidance for Sampling and Analysis of Sediments, Water and Tissues for Dredged Material Evaluations* (EPA/USACE, 1995). Target Detection Limits (TDLs) for conventional parameter analyses in sediment, tissue and water (where applicable) are provided in Appendix C. Table 1 provides guidance on the types of analyses required to conduct dredged material evaluation tests for various field collected samples. Additional QA/QC guidance is provided in Appendix G of the ITM and in *QA/QC Guidance for Sampling and Analysis of Sediments, Water and Tissues for Dredged Material Evaluations* (EPA/USACE, 1995).

8.2 Chemical Analysis. Chemical analysis of the dredged material provides information about the contaminants present in the dredged material that, if biologically available, could cause toxicity and/or be accumulated in tissues. Chemical analysis of disposal site water is required for Tier II water column effects modeling. Chemical analysis of the reference sediment is required for Tier II TBP calculations, if conducted. Sediment-chemistry data alone should not be directly used to make decisions regarding the acceptability of dredged material for ocean disposal. Section 9 of the Green Book also addresses chemical analyses. A comprehensive listing of appropriate analytical methods for determining contaminants in sediments is provided in Table 3 of the *QA/QC Guidance for Sampling and Analysis of Sediments, Water and Tissues for Dredged Material Evaluations* (EPA/USACE, 1995). Table 1 provides guidance on the types of analyses required to conduct dredged material evaluation tests for various field collected samples. Additional QA/QC guidance is provided in Appendix G of the ITM and in *QA/QC Guidance for Sampling and Analysis of Sediments, Water and Tissues for Dredged Material Evaluations* (EPA/USACE, 1995).

Contaminants of Concern

Table 2 lists potential contaminants of concern (COCs) and additional optional contaminants for

dredged material evaluation. The COCs listed in Table 2 are EPA priority pollutants and have been published in the Federal Register, "National Recommended Water Quality Criteria; Republication" (EPA, 1998). Target Detection Limits (TDLs) for the parameters listed in Table 2 plus other potential contaminants for sediment, tissue and water analyses are provided in Appendix C. Generally, if one or more COCs are detected in the sediments, synergistic effects are possible and Tier III level bioassays shall be conducted for evaluation of benthic and water column impacts.

If no sediment chemistry data exist for a dredging project, analysis for the complete list of COCs in Table 2 will be performed. Where sediment chemistry data exist and contaminants of concern are known for a specific project, the basic COC list for that project may be reduced or supplemented by mutual agreement of the USACE, New Orleans District or Galveston District and EPA, Region 6.

For example, if a pulp and paper mill or organic chemical plant discharges to a channel proposed for dredging, dioxin may be added to the list of contaminants of concern. Similarly, if a ship maintenance dock or boat marina is proposed to be dredged, tributyltin may be included. Conversely, if a particular COC has not historically been detected in the sediments from a specific project and no new sources of the COC in question are identified, that COC may be removed from the list of COCs for that specific project. Contaminants detected on gas chromatograms or reconstructed ion chromatograms that are not listed in Table 2 should be noted in the final project evaluation.

9. WATER COLUMN EVALUATIONS

Water column evaluations are required to determine compliance with the LPC of both the liquid (40 CFR 227.27(a)) and suspended particulate phases (40 CFR 227.27(b)) of the dredged material. These evaluations include determination of compliance with applicable EPA marine Water Quality Criteria (WQC) and/or state Water Quality Standards (WQS) and potential impacts of the suspended particulate phase of the dredged material elutriate on appropriate sensitive marine organisms.

9.1 Dredged Material Elutriate Preparation. The dredged material elutriate preparation (Section 10.1.2 of the Green Book) involves mixing the dredged material with dredging site water in a sediment-to-water ratio of 1:4 and allowing the mixture to settle for one hour. The portion of the dredged material that is considered to have the potential to impact the water column is the supernatant remaining after undisturbed settling. The ***suspended particulate phase*** is the supernatant from the dredged material elutriate preparation and is used for water column bioassays. The ***liquid phase*** is the supernatant from the dredged material elutriate preparation that has been centrifuged or filtered and is used for EPA WQC/state WQS screening. When analyzing for metals, filtration of the supernatant through a 0.45 μm filter is required (centrifugation optional). ***EPA recommends that clean techniques (EPA 1600 series methods) be used for collection and analysis of metals in water/liquid phase.*** When analyzing for

TABLE 2
Contaminants of Concern (COC) and Conventional Parameters

METALS AND CYANIDE	LPAH Compounds	PESTICIDES
Antimony (Total)	Acenaphthene	Aldrin
Arsenic (Total)	Acenaphthylene	Alpha-BHC
Beryllium (Total)	Anthracene	Beta-BHC
Cadmium (Total)	Fluorene	Gamma-BHC (Lindane)
Chromium (Total)	Naphthalene	Delta-BHC
Chromium (+3)	Phenanthrene	Chlordane
Chromium (+6)		4,4'-DDT
Copper (Total)	HPAH Compounds	4,4'-DDE
Lead (Total)	Benzo(a)anthracene	4,4'-DDD
Mercury (Total)	Benzo(a)pyrene	Dieldrin
Nickel (Total)	Benzo(ghi)perylene	Alpha-endosulfan
Selenium (Total)	Benzo(b & k)fluoranthene	Beta-endosulfan
Silver (Total)	Chrysene	Endosulfan sulfate
Thallium (Total)	Dibenzo (a,h) anthracene	Endrin
Zinc (Total)	Fluoranthene	Endrin aldehyde
Cyanide (Total)	Indeno (1,2,3-cd) pyrene [2,3-o-phenylene pyrene]	Heptachlor
		Heptachlor epoxide (BHC-hexachlorocyclohexane)
CONVENTIONAL PARAMETERS	Pyrene	Toxaphene
Grain Size		
TOC	Chlorinated Hydrocarbons	PCBs
TPH	1,2-Dichlorobenzene	Total PCBs
Ammonia	1,3-Dichlorobenzene	*PCB Congeners**
Percent Solids/Total Solids	1,4-Dichlorobenzene	PCB-1242
	2-Chloronapthalene	PCB-1254
ORGANIC COMPOUNDS	Hexachlorobenzene	PCB-1221
Phenols/Substituted Phenols	Hexachlorobutadiene	PCB-1232
2-Chlorophenol	Hexachlorocyclopentadiene	PCB-1248
2,4-Dichlorophenol	Hexachloroethane	PCB-1260
2,4-Dimethylphenol	1,2,4-Trichlorobenzene	PCB-1016
4,6-Dinitro-o-Cresol [2 methyl 4,6-dinitrophenol	Phthalate Esters	
2,4-Dinitrophenol	Bis(2-ethylhexyl) phthalate	Organonitrogen Compounds
2-Nitrophenol	Butyl benzyl phthalate	Benzidine
4-Nitrophenol	Diethyl Phthalate	3,3'-Dichlorobenzidine
p-Chloro-m-Cresol [4 chloro-3-methylphenol]	Dimethyl Phthalate	2,4-Dinitrotoluene
	Di-n-Butyl Phthalate	2,6-Dinitrotoluene
Pentachlorophenol	Di-n-octyl Phthalate	1,2-Diphenylhydrazine
Phenol		Nitrobenzene
2,4,6-Trichlorophenol	Halogenated Ethers	N-nitrosodimethylamine
	Bis(2-chloroethoxy) methane	N-nitrosodi-n-propylamine
MISCELLANEOUS	Bis(2-chloroethyl) ether	N-nitrosodiphenylamine
Isophorone	Bis(2-chloroisopropyl) ether	
	4-Bromophenyl phenyl ether	
	4-Chlorophenyl phenyl ether	*Optional to analyze

organics, the supernatant should only be centrifuged.

9.2 Water Quality Criteria/Standards Evaluation Using the Liquid Phase–Tier II. To determine compliance or noncompliance with applicable EPA WQC or state WQS, the potential release of dissolved contaminants from the dredged material shall be analyzed using the liquid phase of the dredged material elutriate. Chemical analysis of liquid phase allows a direct comparison to applicable EPA marine WQC and state WQS. A comprehensive listing of appropriate analytical methods for evaluating the liquid phase of the dredged material elutriate is provided in Table 3 of the *QA/QC Guidance for Sampling and Analysis of Sediments, Water and Tissues for Dredged Material Evaluations* (EPA/USACE, 1995). ***EPA recommends that clean techniques (EPA 1600 series methods) be used for collection and analysis of metals in water/liquid phase.*** Additional QA/QC guidance is provided in Appendix G of the ITM and in *QA/QC Guidance for Sampling and Analysis of Sediments, Water and Tissues for Dredged Material Evaluations* (EPA/USACE, 1995).

The EPA WQC for priority pollutants and nonpriority pollutants have been published in the Federal Register, "National Recommended Water Quality Criteria; Republication" (EPA, 1998), and all subsequent updates should be utilized. Louisiana Numerical Criteria for Specific Toxic Substances and Texas Surface Water Quality Standards may also be applied in those instances where the state's criteria are more stringent or where no EPA marine WQC exist.

The following points shall be considered when making comparisons of the liquid phase COC concentration with the WQC/WQS:

- If WQC and/or WQS have not been established for all COC detected in the sediments or if synergistic effects are possible due to detection of one or more contaminants, further biological testing of the suspended particulate phase is required (40 CFR 227.13(c)(2)(i)), see Section 9.3 below. The water column analyses alone are not sufficient for determining suitability of the dredged material for ocean disposal; evaluation of the benthic impacts (solid phase bioassay and bioaccumulation potential) ***must*** also be conducted. In addition, the analyses required by other applicable provisions of the regulations including (40 CFR Part 227 Subparts B, C, D, E, and G and section 228.4(e)) must be performed.

- If WQC and/or WQS have been established for all COC detected in the liquid phase and they are not exceeded, the LPC for the liquid phase is met. If one or more contaminants are detected in the sediments, synergistic effects are possible and further biological testing of the suspended particulate phase is required (40 CFR 227.13(c)(2)(i)), see Section 9.3 below. The water column analyses alone are not sufficient for determining suitability of the dredged material for ocean disposal; evaluation of the benthic impacts (solid phase bioassay and bioaccumulation potential) ***must*** also be conducted. In addition, the analyses required by other applicable provisions of the regulations including (40 CFR Part 227 Subparts B, C, D, E, and G and section 228.4(e)) must be performed.

- If applicable WQC and/or WQS are exceeded in the liquid phase, the models as described in

- the Green Book may be used for further analysis. Chemical analyses of the liquid phase and disposal site water are required for model inputs. Appendix B of the Green Book provides guidance on which numerical computer model should be applied.

    - If the model predicts the WQC and/or WQS are not exceeded after allowance for initial mixing, the LPC for the liquid phase is met. If multiple contaminants are detected in the sediments, synergistic effects are possible and further biological testing of the suspended particulate phase is required (40 CFR 227.13(c)(2)(i)), see Section 9.3 below. The water column analyses alone are not sufficient for determining suitability of the dredged material for ocean disposal; evaluation of the benthic impacts (solid phase bioassay and bioaccumulation potential) ***must*** also be conducted. In addition, the analyses required by other applicable provisions of the regulations including (40 CFR Part 227 Subparts B, C, D, E, and G and section 228.4(e)) must be performed.

    - If the model predicts that WQC and/or WQS will be exceeded after allowance for initial mixing, the LPC for the liquid phase is ***not*** met and disposal of the dredged material without appropriate management is not supported. The USACE, New Orleans District or Galveston District and EPA, Region 6 shall then evaluate management actions outside the scope of this RIA.

9.3 Water Column Bioassay Using the Suspended Particulate Phase–Tier III.

9.3.1 Suspended Particulate Phase Toxicity Test. The suspended particulate phase (SPP) bioassay considers the effects, after allowance for initial mixing, of dissolved contaminants plus those associated with suspended particulates on water-column organisms. This bioassay involves exposing test organisms to a dilution series consisting of at least three concentrations (100%, 50% and 10% are recommended) of the suspended particulate phase of the dredged-material elutriate. The dredged material elutriate preparation for this bioassay (Section 11.1.4 of the Green Book) involves mixing the dredged material with dredging site water in a sediment-to-water ratio of 1:4 and allowing the mixture to settle for one hour.

Disposal site water or artificial seawater should be used for dilutions. In addition, a control treatment should be run using water of the type in which the animals were held prior to testing, typically conditioned artificial seawater or natural seawater. Toxicity of the dilution water should also be determined by conducting 100% dilution water treatment. Section 11.1 of the Green Book contains further guidance on the suspended particulate phase toxicity test procedure. Table 1 provides guidance on the types of samples that may be required to be collected in the field to conduct the suspended phase toxicity test.

As described in Appendix G.2.10.5.2 of the ITM, reference toxicant tests should be performed on all organisms used in dredged material testing to determine the health and sensitivity of the

organisms. Additional QA/QC guidance is provided in Appendix G of the ITM and in *QA/QC Guidance for Sampling and Analysis of Sediments, Water and Tissues for Dredged Material Evaluations* (EPA/USACE, 1995).

9.3.2 Test Organisms. Bioassay tests shall be conducted on appropriately sensitive marine water-column organisms exposed to dilution water, control water, and dredged material dilution series according to EPA methods (EPA, 1991) and American Society for Testing and Materials protocols (ASTM, 1994a, or most recent editions thereof). Appendix E of the ITM provides summaries of test conditions and test acceptability criteria for conducting water column bioassays for the organisms listed below. Any proposed variation to the methodologies must be technically valid and mutually agreed upon by EPA, Region 6 and the USACE, New Orleans District and Galveston District before the bioassay tests are started.

Paragraph 227.27(c) of the ocean dumping regulations defines appropriate sensitive water-column marine organism to mean at least one species each representative of phytoplankton or zooplankton; crustacean or mollusc; and fish. Water-column bioassays must be conducted using at least three organisms selected from the following list of test species:

Water column toxicity bioassay organisms

(* indicates recommended species)

Zooplankton

Copepod, *Acartia sp.*

Postlarval mysid shrimp, *Americamysis bahia**

Crustacean

Mysid shrimp, *Americamysis bahia**

Grass shrimp, *Paleomonetes sp.*

Fish

Inland or Atlantic Silversides, *Menidia sp.**

Sheepshead minnow, *Cyprinodon variegatus*

9.3.3 Data Analysis

- If mortality is greater than 10% in the control treatment or in the dilution water treatment for a particular test species (30% mortality/abnormality for zooplankton), the test should be rejected and the bioassay repeated. If mortality is greater than 10% in the dilution water treatment using disposal site water, the bioassay should be repeated using artificial seawater.

- If survival in all of the dredged material treatments is greater than, or equal to, survival in the dilution water treatment, the LPC for water column toxicity/suspended particulate phase has been met. The water column analyses alone are not sufficient for determining suitability of the dredged material for ocean disposal; evaluation of the benthic impacts (solid phase

- bioassay and bioaccumulation potential) ***must*** also be conducted. In addition, the analyses required by other applicable provisions of the regulations including (40 CFR Part 227 Subparts B, C, D, E, and G and section 228.4(e)) must be performed.

- If survival in the dredged material treatments is less than survival in the dilution water treatment, but the difference does not exceed 10%, the LPC for water column toxicity/suspended particulate phase has been met. The water column analyses alone are not sufficient for determining suitability of the dredged material for ocean disposal; evaluation of the benthic impacts (solid phase bioassay and bioaccumulation potential) ***must*** also be conducted. In addition, the analyses required by other applicable provisions of the regulations including (40 CFR Part 227 Subparts B, C, D, E, and G and section 228.4(e)) must be performed.

- If survival in the 100% dredged material elutriate treatment is less than survival in the dilution water treatment, and the difference is greater than 10%, statistical analyses are required to determine if the dredged material suspension is significantly more toxic than the dilution water (i.e. the difference is statistically significant). Statistical procedures recommended for analyzing test data are described in detail in Section 13 of the Green Book and Appendix D of the ITM, however, the guidance provided in the ITM is more technically advanced and should be used as reference for appropriate statistical methods.

    - If the 100% dredged material elutriate treatment is not statistically different from the dilution water, the dredged material is ***not*** predicted to be acutely toxic to water column organisms and the LPC for water column toxicity/suspended particulate phase has been met. The water column analyses alone are not sufficient for determining suitability of the dredged material for ocean disposal; evaluation of the benthic impacts (solid phase bioassay and bioaccumulation potential) ***must*** also be conducted. In addition, the analyses required by other applicable provisions of the regulations including (40 CFR Part 227 Subparts B, C, D, E, and G and section 228.4(e)) must be performed.

    - If the 100% dredged material elutriate treatment is statistically different from the dilution water, it is necessary to run a numerical model to determine compliance with the LPC.

Appendix B of the Green Book provides guidance on the appropriate numerical computer model that should be applied. The key parameters derived from the model for evaluating water-column toxicity are: 1) the maximum concentration of dredged material in the water column outside the boundary of the disposal site during the 4-hour initial mixing period, and 2) the maximum concentration in the water column in the marine environment after the 4-hour mixing period. The modeled concentrations of the dredged material are compared with the LPC, as determined by 0.01 of the 48- or 96-hour LC_{50}, to determine compliance.

The following points shall be considered when making modeled concentrations comparisons with the LPC:

- The LC_{50} is the concentration of the suspended particulate phase that is lethal to 50% of the organisms.

- If greater than 50% mortality occurs in at least one of the serial dilutions of the dredged material treatments, it may be possible to calculate an LC_{50} value.

- If less than 50% mortality occurs in all of the dredged material treatments, it is not possible to calculate an LC_{50}. In such cases, the LC_{50} is assumed to be ≥100%.

- If the conditions are highly toxic, such that the 10% dredged material treatment has greater than 50% mortality, further dilution must be made (new treatments of less than 10% dredged material) to attain a survival of greater than 50% and determine the LC_{50} by interpolation.

- If both modeled concentrations are less than the 0.01 of the $LC_{50,}$ the LPC for water column toxicity/suspended particulate phase is met. The water column analyses alone are not sufficient for determining suitability of the dredged material for ocean disposal; evaluation of the benthic impacts (solid phase bioassay and bioaccumulation potential) ***must*** also be conducted. In addition, the analyses required by other applicable provisions of the regulations including (40 CFR Part 227 Subparts B, C, D, E, and G and section 228.4(e)) must be performed.

- If either of the modeled concentrations exceeds 0.01 of the LC_{50}, the discharge does ***not*** meet the LPC for water column toxicity/suspended particulate phase and disposal of the dredged material without appropriate management is not supported. The USACE, New Orleans District or Galveston District and EPA, Region 6 shall evaluate management actions outside the scope of this RIA.

10. BENTHIC EVALUATIONS

Benthic evaluations are required to determine compliance with the LPC of the solid phase (40 CFR 227.27(b)) of the dredged material. These evaluations include assessment of toxicity of the dredged material to appropriate sensitive benthic marine organisms and an evaluation of the bioaccumulation potential of the COC in the proposed dredged material. An initial screen of the dredged material is included in Tier II of the Green Book and may be performed for estimating the potential of non-polar organics to bioaccumulate using a theoretical bioaccumulation potential calculation. However, compliance with LPC of the solid phase will be based on benthic bioassays, including solid phase toxicity and bioaccumulation tests. The initial screen will not be used to make regulatory decisions in absence of bioassay tests, however, it may be

used to aid in re-evaluating the need for ocean disposal in an effort to avoid Tier III bioassay costs.

10.1 Benthic Bioassay–Tier III.

10.1.1 Solid Phase Toxicity Test. Solid phase bioassays are conducted to evaluate potential impacts to benthic marine organisms. Solid phase bioassay treatments should be comprised of exposure to sediment from the dredging site, reference sediment, and control sediment. Disposal site water, clean seawater or artificial seawater may be used to conduct the bioassay. Table 1 provides guidance on the types of samples that may be required to be collected in the field to conduct the solid phase toxicity test.

Section 11.2 of the Green Book contains guidance on experimental procedures. As described in Appendix G.2.10.5.2 of the ITM, reference toxicant tests should be performed on all organisms used in dredged material testing to determine the relative health of the organisms. Reference toxicant tests will be conducted for 96 hours. Additional QA/QC guidance is provided in Appendix G of the ITM and in *QA/QC Guidance for Sampling and Analysis of Sediments, Water and Tissues for Dredged Material Evaluations* (EPA/USACE, 1995).

10.1.2 Test Organisms. Bioassay tests shall be conducted on appropriately sensitive benthic marine organisms [40 CFR 227.27(d)] exposed to reference area, control site, and proposed dredging site sediment samples according to EPA methods (EPA, 1994; EPA, 1995a) and ASTM protocols (ASTM, 1994b, c, d, or most recent editions thereof). Appendix E of the ITM provides summaries of test conditions and test acceptability criteria for conducting solid phase bioassays for the organisms listed below. Any proposed variation to the methodologies must be technically valid and mutually agreed upon by EPA, Region 6 and the USACE, New Orleans District and Galveston District before the bioassay tests are started.

The benthic species should represent filter-feeding, deposit-feeding, and burrowing species. These categories of species are broad and overlapping. At least two different species listed below that together cover the three feeding strategies identified in the regulations should be used to evaluate a disposal project. Both the Green Book and the ITM recommend that a sensitive infaunal amphipod be used in solid phase toxicity evaluations. This RIA recommends using either the amphipods *Ampelisca abdita* or *Leptocheirus plumulosus* in benthic toxicity evaluations, however, alternative amphipod species may be substituted at the approval of EPA and the USACE. Guidance on available testing procedures provided by EPA (1994) and ASTM (1994b, c) may be followed and modified to conduct a 10-day mysid test.

Solid Phase Toxicity Bioassay Organisms

(* indicates recommended species)

Filter-feeding

Mysid shrimp, *Americamysis bahia**

Juvenile Bivalves (clams), dwarf surf clam, *Mulinia lateralis*

Deposit-feeding

Infaunal amphipod, *Ampelisca abdita**

Amphipod, *Leptocheirus plumulosus**

Polychaete, *Neanthes succinea, Nereis virens*

Grass shrimp, *Paleomonetes sp.*

Burrowing

Infaunal amphipod, *Ampelisca abdita**

Amphipod, *Leptocheirus plumulosus*

Polychaete, *Neanthes succinea, Nereis virens*

10.1.3 Data Analysis.

- If greater than 10% mean mortality occurs in the control sediment, the test should be repeated.

- If survival in the dredged material treatments is greater than, or equal to, survival in the reference sediment treatments, the LPC for benthic toxicity has been met. The benthic toxicity analyses alone are not sufficient for determining suitability of the dredged material for ocean disposal; evaluation of the water column impacts and the bioaccumulation potential of the solid phase ***must*** also be conducted. In addition, the analyses required by other applicable provisions of the regulations including (40 CFR Part 227 Subparts B, C, D, E, and G and section 228.4(e)) must be performed.

- If survival in the dredged material treatments is less than survival in the reference sediment treatments, but the difference does not exceed 10% (20% for amphipods), the LPC for benthic toxicity has been met. The benthic toxicity analyses alone are not sufficient for determining suitability of the dredged material for ocean disposal; evaluation of the water column impacts and the bioaccumulation potential of the solid phase ***must*** also be conducted. In addition, the analyses required by other applicable provisions of the regulations including (40 CFR Part 227 Subparts B, C, D, E, and G and section 228.4(e)) must be performed.

- If survival in the dredged material treatments is less than survival in the reference sediment treatments, and the difference is greater than 10% (20% for amphipods), then statistical analyses are required to determine if the dredged material is significantly more toxic than the reference sediment. Statistical procedures recommended for analyzing test data are described in detail in Section 13 of the Green Book and Appendix D of the ITM, however, the guidance

provided in the ITM is more technically advanced and should be used as reference for appropriate statistical methods.

- If mortality of organisms exposed to sediment from the dredging is not statistically greater than the mortality of organisms exposed to the reference sediment, then the LPC for the solid phase is met. The benthic toxicity analyses alone are not sufficient for determining suitability of the dredged material for ocean disposal; evaluation of the water column impacts and the bioaccumulation potential of the solid phase ***must*** also be conducted. In addition, the analyses required by other applicable provisions of the regulations including (40 CFR Part 227 Subparts B, C, D, E, and G and section 228.4(e)) must be performed.

- If bioassay organism mortality is statistically greater than in the reference sediment, then the dredged material does ***not*** meet the LPC for the solid phase and disposal of the dredged material without appropriate management is not supported. The USACE, New Orleans District or Galveston District and EPA, Region 6 shall then evaluate management actions outside the scope of this RIA.

10.2 Bioaccumulation Testing-Tier III. Bioaccumulation tests are conducted to determine the bioavailability of contaminants through 28-day exposure tests. The tests are designed to evaluate the potential of benthic organisms to bioaccumulate COC from the dredged material. Section 12 of the Green Book contains guidance on bioaccumulation testing protocols. Bioaccumulation treatments should include exposure to sediment from the dredging site, reference sediment and control sediment. Disposal site water, clean natural seawater or artificial seawater may be used to conduct the bioassay. Table 1 provides guidance on the types of samples that may be required to be collected in the field to conduct the bioaccumulation test.

Section 12 of the Green Book contains guidance on experimental procedures. Additional QA/QC guidance is provided in Appendix G of the ITM and in *QA/QC Guidance for Sampling and Analysis of Sediments, Water and Tissues for Dredged Material Evaluations* (EPA/USACE, 1995).

10.2.1 Test Organisms. Bioassay tests shall be conducted on appropriately sensitive benthic marine organisms [40 CFR 227.27(d)] exposed to reference area, control site, and proposed dredging site sediments according to EPA methods (EPA, 1994). Appendix E of the ITM provides summaries of test conditions and test acceptability criteria for conducting bioaccumulation tests for the organisms listed below. Any proposed variation to the methodologies must be technically valid and mutually agreed upon by EPA, Region 6 and the USACE, New Orleans District and Galveston District before the bioassay tests are started.

Only organisms in a given replicate chamber may be composited for chemical analysis; therefore, sufficient biomass must be obtained from each repliate to run analyses on the tissue. The benthic species should represent filter-feeding, deposit-feeding, and burrowing species.

These categories of species are broad and overlapping. At least two different species listed below that together cover the three feeding strategies identified in the regulations should be used to evaluate a disposal project.

Bioaccumulation Test Organisms
(* indicates recommended species)

Filter-feeding
Mollusk, *Macoma nasuta*
Quahog, *Mercenaria sp.**
Deposit-feeding
Polychaete, *Neanthes succinea, Nereis virens*
Commercial shrimp, *Penaeus aztecus**
Burrowing
Polychaete, *Neanthes succinea, Nereis virens**
Other
Blue crab, *Callinectes sapidus*
Red Drum, *Sciaenops ocellatus*

10.2.2 Chemical Analysis of Tissues. Tissues of appropriate benthic organisms exposed to the dredged material shall be analyzed for classes of COCs detected in the sediments. Ordinarily, only those compounds detected in the sediment need be analyzed for in the tissue. In some cases, however, it may be desirable to analyze tissues for compounds not detected in the sediments. The detection limits listed in Appendix B will be used when conducting evaluations of tissues from bioaccumulation tests. A comprehensive listing of appropriate analytical methods for evaluating tissues is provided in Table 3 of the *QA/QC Guidance for Sampling and Analysis of Sediments, Water and Tissues for Dredged Material Evaluations* (EPA/USACE, 1995). Additional QA/QC guidance is provided in Appendix G of the ITM and in *QA/QC Guidance for Sampling and Analysis of Sediments, Water and Tissues for Dredged Material Evaluations* (EPA/USACE, 1995).

The basic strategy for selecting contaminants for tissue analysis should include three considerations:

- The target analyte is a COC and is present in the sediment as determined by sediment chemical analyses.
- The target analyte has a high potential to accumulate and persist in tissues.
- The target analyte is of toxicological concern

Generally, the relative potential for bioaccumulation of organic compounds can be estimated from the K_{ow} of the compounds. As stated in the Green Book and ITM, EPA recommends that compounds for which the log K_{ow} is greater than 3.5 be considered for further evaluation of bioaccumulation potential. The bioaccumulation potential of inorganic compounds can be based on calculated bioconcentration factors (BCF). Contaminants with BCFs greater than 1000 (log

BCF>3) should be further evaluated for bioaccumulation potential. Appropriate application of these values along with consideration of the factors above will assist in selecting COC for bioaccumulation analysis by providing a general indication of the relative potential for various chemicals to accumulate in tissues. Section 9.5.1 in both the Green Book and ITM provide additional guidance on identifying organic and inorganic COC for bioaccumulation analyses and should be consulted when conducting this evaluation.

Both wet weight and dry weight tissue concentrations should be determined and reported. Wet weight tissue concentrations should be used in comparison to action level values or advisories reported as wet weight concentrations, such as Food and Drug Administration (FDA) Action Levels, or for use in risk modeling that makes assumptions of dose coming from consumption of "fresh" material, not dried matter. Dry weight tissue concentrations should be used to statistically evaluate bioaccumulation potential of COC detected in the tissues of organisms exposed to sediment from the dredging site. This provides a more accurate assessment of statistical significance by removing any variability in the data associated with moisture or water contents in tissues, which can be influenced by how tissues were prepared in the laboratory or other factors. Using dry weight data for statistical comparisons removes this variable. Statistical procedures recommended for analyzing test data are described in detail in Section 13 of the Green Book and Appendix D of the ITM however, the guidance provided in the ITM is more technically advanced and should be used as reference for appropriate statistical methods.

Tissue concentrations of test organisms should be measured prior to exposure to the sediment from the dredging site, reference sediment and control sediment. This will add perspective to the magnitude of uptake during the exposure period, and in some cases may show elevated body burdens were not due to exposure to dredged material or reference sediment but were already present in the organisms at the start of the test. If tissue concentrations are not measured prior to the initiation of the tests, some of the organisms must be archived (frozen). If test results are suspect, then the archived organisms should be analyzed.

10.2.3 Bioaccumulation Evaluations. Concentrations of contaminants of concern in tissues of benthic organisms exposed to the test sediments/dredged material are compared initially against applicable FDA Action Levels when such levels have been set. These levels are based on human health and economic considerations and do not include the potential for impact on the ecosystem. FDA Action Levels are presented in table format in Appendix D of EPA's sediment quality survey, *The Incidence and Severity of Sediment Contamination in Surface Waters of the U.S., Volume I: National Sediment Quality Survey* (EPA, 1997b), and subsequent updates. The appendix can be accessed on-line at www.epa.gov/OST/cs/vol1/appdx_d.pdf.

- If the concentrations of one or more contaminants of concern in tissues exposed to sediment from the dredging site are statistically greater than the FDA levels, then the dredged material does ***not*** meet the LPC for the solid phase and disposal of the dredged material without

appropriate management is not supported. The USACE, New Orleans District or Galveston District and EPA, Region 6 shall then evaluate management actions outside the scope of this RIA.

- If the tissue concentrations of all COCs are not statistically greater than FDA levels ***or*** there are no FDA levels for the COCs, then the concentrations of COCs in tissues exposed to sediment from the dredging site are compared to the contaminant concentrations in the tissues exposed to the reference sediment.

- If the contaminant concentrations in tissues exposed to sediment from the dredging site do not statistically exceed the contaminant concentrations in tissues exposed to the reference sediment, the bioaccumulation LPC for the solid phase is met. No adverse effects are likely if the concentration in the dredged material-exposed tissue is less than the reference material-exposed tissue. The bioaccumulation analyses alone are not sufficient for determining suitability of the dredged material for ocean disposal; evaluation of the water column impacts and the toxicity of the solid phase ***must*** also be conducted. In addition, the analyses required by other applicable provisions of the regulations including (40 CFR Part 227 Subparts B, C, D, E, and G and section 228.4(e)) must be performed.

- A statistically greater tissue residue in organisms exposed to sediment from the dredging site than in organisms exposed to the reference sediment does not necessarily indicate increased environmental hazard or human health risk. Conversely, the lack of statistically greater tissue residues in sediment from the dredging site compared to reference sediment would be strong evidence that the sediment from the dredging site would not result in increased environmental hazard or human health risk for the pollutants tested. Therefore, the following factors ***will*** be assessed to evaluate LPC compliance when the contaminant concentration in tissues exposed to the sediment from the dredging site statistically exceeds the contaminant concentrations in tissues exposed to the reference sediment. The factors and their order of evaluation are as follows:

    1. Statistical significance of the results from tests on sediment from the dredging site when compared to reference sediment results.

    2. Magnitude by which bioaccumulation in organisms exposed to sediment from the dredging site exceeds bioaccumulation in organisms exposed to the reference sediment.

    3. Number of contaminants for which bioaccumulation in organisms exposed to sediment from the dredging site is statistically greater than bioaccumulation in organisms exposed to the reference sediment.

    4. Number of species in which bioaccumulation in organisms exposed to sediment from the dredging site is statistically greater than bioaccumulation in organisms exposed to the reference sediment.

5. Toxicological importance of the contaminants whose bioaccumulation in organisms exposed to sediment from the dredging site statistically exceeds that from the reference sediment.

6. Phylogenetic diversity of the species in which bioaccumulation in organisms exposed to sediment from the dredging site statistically exceeds bioaccumulation in organisms exposed to the reference sediment.

7. Propensity for the contaminants with statistically significant bioaccumulation to biomagnify within aquatic food webs.

8. Magnitude of toxicity and number and phylogenetic diversity of species exhibiting greater mortality in the sediment from the dredging site than in the reference sediment.

If a compliance decision still cannot be reached, a sampling plan will be developed and agreed upon by both the EPA and the USACE to evaluate factor 9.

9. Magnitude by which contaminants whose bioaccumulation in organisms exposed to sediment from the dredging site exceeds that of organisms exposed to the reference sediment also exceed the concentrations found in comparable species living in the vicinity of the proposed disposal site.

11. RISK-BASED EVALUATIVE TOOLS

In addition to the above analytical evaluations, risk-based evaluations may also be applied to assess the potential ecological and human health effects of the tissue concentrations. Examples of guidance documents, databases, and evaluative tools that may be used to aid EPA and the USACE in interpretation of bioaccumulation data are presented in this section.

The USACE has developed guidance for conducting human health and ecological risk assessments to evaluate the potential impacts associated with aquatic placement of dredged material, *Ecological and Human Health Risk Assessment Guidance for Aquatic Environments* (USACE, 1999). The guidance includes an overview of ecological and human health risk assessment and recommendations on proper application of risk assessment within the dredging program. Sources of additional information on risk assessment applications, toxicity profiles, and other tools used in risk assessment are provided. The report can be accessed at www.wes.army.mil/el/dots.

EPA has developed a status and needs summary document that describes the existing knowledge on the use of bioaccumulation data as part of sediment quality assessments, *Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assurance-Status and Needs*

(EPA, 2000). The document provides a summary of existing knowledge on bioaccumulation, including a compilation of exposure and effects data for persistent, bioaccumulative chemicals; factors that affect the bioavailability of sediment-associated sediments; and issues and research needs for interpreting bioaccumulation data. The document contains appendix tables that summarize information on chemical characteristics; human health concerns; wildlife and aquatic organism partitioning factors; and food chain multipliers. The document can be accessed online at www.epa.gov/OST.

Human Health Risk-Based Evaluations. Human health risk-based evaluations focus on carcinogenic and non-carcinogenic risk to humans from potential exposure. For example, EPA human health risk-based screening levels can be used to determine levels of contamination in tissue that might result in a 10^{-5} cancer risk (1×10^{-5} or 1 in 100,000 incidence of cancer over a 70 year period) or noncancer hazard in humans. The contaminant concentrations in the tissue of the organisms exposed to the test sediment/dredged material are compared with EPA fish tissue screening levels which are available for numerous priority pollutants. The procedures for estimating human health risks are based on EPA guidance document, *Guidance for Assessing Chemical Contaminant Data for use in Fish Advisories, Volume I, 2nd Edition, Fish Sampling and Analysis* (EPA, 1995b). These screening levels, along with FDA Action Levels, are presented in table format in Appendix D of EPA's sediment quality survey, *The Incidence and Severity of Sediment Contamination in Surface Waters of the U.S., Volume I: National Sediment Quality Survey* (EPA, 1997b), and subsequent updates. The appendix can be accessed on-line at www.epa.gov/OST/cs/vol1/appdx_d.pdf.

Ecological Risk-Based Evaluations. Ecological risk-based evaluations focus on potential risk to non-human biota likely to occur at the disposal site. For example, an evaluation of potential ecological effects of the bioaccumulation of PAHs can be made by direct comparison of total PAH tissue residues with the Critical Body Residue (CBR) as described by McCarty, *et al.* (1992) and Dillion and Gibson (1992). The CBR is the value above which an adverse effect would be expected and is represented as the ratio of the mass of the chemical/toxicant to the mass of the organism (i.e. Φmol/g). The acknowledged mode of toxicity for PAHs is narcosis, e.g. lethargy, unconsciousness and death in extreme narcosis. According to McCarty *et al.* (1992), CBRs of PAHs ranging from 2 to 8 Φmol/g can produce acute narcotic response and CBRs of PAHs ranging from 0.2 to 0.8 Φmol/g can produce chronic narcotic response.

Environmental Residue Effects Database. The USACE Engineer Research and Development Center and EPA have developed a database, the Environmental Residue Effects Database (ERED), that contains over 2000 records/references including information on more than 200 contaminants and 100 aquatic species. The database is a compilation of data, taken from the literature, where biological effects (e.g., reduced survival, growth, etc.) and tissue contaminant concentrations were simultaneously measured in the same organism. Currently, the database is limited to those instances where biological effects observed in an organism are linked to a specific contaminant within its tissues. The USACE Engineer Research and Development Center have published a Dredging Research Technical Note, EEDP-04-30, *Interpreting Bioaccumulation Data with the Environmental Residue-Effects Database* (Bridges et al., 1999), which provides information on the use of the ERED to interpret bioaccumulation data collected during environmental assessment of dredged material. The Technical Note can be found online

at www.wes.army.mil/el/dots/eedptn.html. The database can be found online at www.wes.army.mil/el/ered.

Integrated Risk Information System (IRIS). EPA prepared and maintains the IRIS, an electronic database containing information on human health effects that may result from exposure to various chemicals in the environment. The database files on individual chemicals contain descriptive and quantitative information. A basic discussion on risk assessment is included in the introduction. www.epa.gov/ngispgm3/iris.

12. EMERGENCY PROCEDURES

In some instances, the USACE, New Orleans District or Galveston District may deem it necessary to utilize the existing 102(c) ODMDSs for emergency disposal of dredged materials from other than the reach for which the ODMDSs are designated by invoking the emergency procedures as provided in the USACE Regulations at 33 CFR 337.7. In these cases, early and timely coordination between the District and EPA Region 6 is essential. To better assist with the coordination effort, the USACE and EPA have developed the following procedures to address emergency situations.

- The District shall notify EPA within 24 hours of the emergency and the proposed use of the ODMDS.

- A complete Tier I evaluation of the activity shall be submitted to EPA as soon as possible. The information included in the evaluation shall include a description of the emergency project, any maintenance disposal activity at ODMDS at the time of the emergency (if applicable), dredged material characterization/evaluation, and the remaining regulatory evaluation of relevant subparts of 40 CFR 227.

- If no bioassay evaluations of the dredged material to be removed during the emergency event and placed at the ODMDS have been done within the last 5 years according to the procedures and protocols outlined in this RIA and the Green Book, then the dredged material ***shall be sampled prior to removal*** and analyzed to determine potential environmental impacts. The sampling plan shall be provided to EPA for review and comment prior to sampling.

- Adequate records shall be maintained and be provided to EPA of all disposal activities, including precise location of disposal, volumes disposed, dates and number of trips.

- EPA and the USACE will determine what actions are appropriate to address any concerns raised by the dredging and disposal activity. This may include any remediation or mitigation prompted by analysis of the dredged material test results, additional site specific monitoring at the ODMDS, as well as any actions necessary to address concerns related to impacts of future hurricanes and any other issues identified by EPA, the USACE and/or the public.

- In order to ensure that all potential impacts as a result of the emergency disposal event at the ODMDS have been adequately addressed in the NEPA documentation, EPA recommends

that the ocean dumping evaluation as required by the regulations under 40 CFR 227 be included as an appendix to the EA/EIS for emergency action.

13. REFERENCES

ASTM. 1994a. *Standard Guide for Conducting Static Acute Toxicity Tests with Fishes, Macroinvertebrates, and Amphibians.* Method E 729-88. In: Annual Book of ASTM Standards, Water and Environmental Technology, Volume 11.04. American Society for Testing and Materials, Philadelphia, PA.

ASTM. 1994b. *Standard Guide for Conducting 10-day Static Sediment Toxicity Tests with Marine and Estuarine Amphipods.* Method E1367-92. In: Annual Book of ASTM Standards, Water and Environmental Technology, Volume 11.04. American Society for Testing and Materials, Philadelphia, PA.

ASTM. 1994c. Standard Guide for Designing Biological Tests with Sediments. Method E1525-94. In: Annual Book of ASTM Standards, Water and Environmental Technology, Volume 11.04. American Society for Testing and Materials, Philadelphia, PA.

ASTM. 1994d. Standard Guide for Conducting Sediment Toxicity Tests with Marine and Estuarine Polychaetous Annelids. Method E1611-94. In: Annual Book of ASTM Standards, Water and Environmental Technology, Volume 11.04. American Society for Testing and Materials, Philadelphia, PA.

Bridges, T.S. and C.H. Lutz. 1999. Interpreting Bioaccumulation Data with the Environmental Residue-Effects Database. Dredging Research Technical Note. EEDP-04-30, USACE Engineer Research and Development Center, Vicksburg, MS.

Dillon, T.M. and A.Gibson. 1992. Critical Body Residue (CBR) approach for interpreting the consequences of bioaccumulation of neutral organic contaminants. Environmental Effects of Dredging Technical Notes. EEDP-04-17, USACE Waterways Experiment Station, Vicksburg, MS.

EPA. 1987. *Quality Assurance/Quality Control (QA/QC) for 301(h) Monitoring Programs: Guidance on Field and Laboratory Methods*. EPA 430/9-86-004. Prepared by Tetra Tech, Inc., Bellevue WA, for the U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection. NTIS Number PB87-221164.

EPA. 1990. *Specifications and Guidance for Obtaining Contaminant-Free Sampling Containers*. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Directive #9240.0-05, April 1990.

EPA. 1991. *Methods for Measuring Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, 4th ed.* EPA/600/4-90/027.

EPA. 1992a. *Sediment Classification Methods Compendium*. EPA 823-R-92-006. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

EPA. 1992c. *Guidance Manual for the Review of Permitted and Civil Works Projects of Permitted and Civil Works Projects for the Ocean Disposal of Dredged Material*. EPA 842-B-92-007. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

EPA. 1993. *Technical basis for deriving sediment quality criteria for nonionic organic contaminants for the protection of benthic organisms by using equilibrium partitioning*. Draft EPA 822-R-93-011. U.S. Environmental Protection Agency, Office of Science and Technology, Health Ecological Criteria Division, Washington, DC.

EPA. 1994. *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Marine Invertebrates*. EPA 600/R-94/025. U.S. Environmental Protection Agency, Duluth, MN.

EPA. 1995a. *Draft Method for Assessing the Toxicity of Sediment-Associated Contaminants with the Bivalve, Mulinia Lateralis*. Office of Research and Development, Atlantic Ecology Division. U.S. Environmental Protection Agency, Narragansett, RI. 125pp.

EPA. 1995b. *Guidance for Assessing Chemical Contamination Data for Use in Fish Advisories, Volume I: 2nd Edition: Fish Sampling and Analysis*. EPA-823-R-95-007. U.S. Environmental Protection Agency, Office of Science and Technology, Washington, DC.

EPA. 1996. *Guidance for Data Quality Assessment - Practical Methods for Data Analysis, EPA QA/G-9*. EPA/600/R-96/084. U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC.

EPA. 1997a. *EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5*. U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC.

EPA. 1997b. *The Incidence and Severity of Sediment Contamination in Surface Waters of the United States, Volume I: National Sediment Quality Survey*. EPA 823-R-97-006. U.S. Environmental Protection Agency, Office of Science and Technology.

EPA. 1998. "National Recommended Water Quality Criteria; Republication". Federal Register 1998, Vol. 63, No. 237, 68354-68363. U.S. Environmental Protection Agency, Office of Science and Technology.

EPA. 2000. *Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assurance-Status and Needs*. EPA 823-R-00-001, Office of Water & Office of Solid Waste, Washington, D.C.

EPA. 2001a. *EPA Requirements for a QA Project Plan (QA/R-5)*. EPA/240/B-01/003, Office of Environmental Information, Washington, D.C.

EPA. 2001b. *Methods for Assessing the Chronic Toxicity of Marine and Estuarine Sediment-associated Contaminants with the Amphipod Leptocheirus plumulosus*. EPA-823-F-01-008, Office of Water, Washington, D.C.

EPA/USACE. 1991. *Evaluation of Dredged Material Proposed for Ocean Disposal - Testing Manual*. EPA-503/8-91/001, Washington, DC.

EPA/USACE. 1992a. *Ocean Dredged Material Disposal Program; Regional Implementation Agreement for Testing and Reporting Requirements for Ocean Disposal of Dredged Material off the Texas Coast Under Section 103 of the Marine Protection, Research and Sanctuaries Act.* U.S. Environmental Protection Agency, Region 6 and USACE, Galveston District.

EPA/USACE. 1992b. *Ocean Dredged Material Disposal Program; Regional Implementation Agreement for Testing and Reporting Requirements for Ocean Disposal of Dredged Material off the Louisiana Coast Under Section 103 of the Marine Protection, Research and Sanctuaries Act.* U.S. Environmental Protection Agency, Region 6 and USACE, New Orleans District.

EPA/USACE. 1992c. *Evaluating Environmental Effects of Dredged Material Management Alternatives-A Technical Framework*. EPA 842-B-92-008, Washington, D.C.

EPA/USACE. 1995. *QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations. Phase I - Chemical Evaluations*. EPA-823-B-95-001. Office of Water, Washington, DC.

EPA/USACE. 1998. *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Testing Manual*. EPA-823-B-98-004, Washington, DC.

Lee, H. III, B.L. Boese, J. Pelletier, M. Winsor, D.T. Sprecht, and R.C. Randall. 1989. Guidance Manual: Bedded Bioaccumulation Tests. ERL-N Contribution No. N111, EPA 600/X-89/302. Newport, OR.

Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. *Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments*. Enviro. Man. 19(1):81-97.

Long, E.R., and L.G. Morgan. 1990. The potential for biological effects of sediment-sorbed contaminants tested in the National Status and Trends Program. NOAA tech. mem. NOS OMA 52. National Oceanic and Atmospheric Administration, Seattle, WA.

McCarty, L.S., D.Mackay, A.D.Smith, G.W.Ozburn and D.G.Dixon. 1992. Residue-based interpretation of toxicity and bioconcentration QASRs from aquatic bioassays: neutral narcotic organics. Environ. Tox. Chem., 11:917-930.

NOAA. 1989. *Standard Analytical Procedure of the NOAA National Analytical Facility*. 2nd ed., NOAA Technical Memoranda NMFS F/NWC-92, 1986-89. NOAA National Status and Trends Program, NOAA N/OMA32, Rockville, MD.

Plumb, R.H., Jr. 1981. Procedures for handling and chemical analysis of sediment and water samples. Tech. Rept. EPA/CE-81-1 prepared by Great Lakes Laboratory, State University College at Buffalo, Buffalo, NY, for the U.S. Environmental Protection Agency/U.S. Army USACE of Engineers Technical Committee on Criteria for Dredged and Fill Material. Published by the U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Tetra Tech. 1986a. Analytical methods for U.S. EPA priority pollutants and 301(h) pesticides in estuarine and marine sediments. Final Report prepared by Tetra Tech, Inc., for U.S. Environmental Protection Agency under Contract No.69-01-6938.

Tetra Tech. 1986b. Bioaccumulation monitoring guidance: 4. Analytical methods for U.S. EPA priority pollutants and 301(h) pesticides in tissues from estuarine and marine organisms. Final Report prepared by Tetra Tech, Inc., for U.S. Environmental Protection Agency under Contract No. 68-01-6938.

USACE. 1999. Ecological and Human Health Risk Assessment Guidance for Aquatic Environments. Technical Report DOER-4, Dredging Operations and Environmental Research Program.

APPENDIX A

REQUIRED INFORMATION & DOCUMENTATION
FOR
EVALUATION OF DREDGED MATERIAL PROPOSED FOR OCEAN DISPOSAL

REQUIRED INFORMATION & DOCUMENTATION FOR
EVALUATION OF DREDGED MATERIAL PROPOSED FOR OCEAN DISPOSAL

The following information is required for the USACE and EPA to evaluate dredged materials proposed for ocean disposal.

A. Dredging project information,
B. Characterization of material from dredging site, and
C. Regulatory compliance evaluation

A. Dredging project information

The proposed dredging project will be described to include:

- large scale map showing the location of the project
- the project plan drawing, design depth, and advance maintenance and allowable over-depth
- estimated extent of shoaling
- interruption or changes in standard operations resulting from shoaling
- the anticipated type of dredging and disposal vessel
- anticipated start date and duration of the disposal operation
- estimated volume and area to be dredged
- estimated disposal quantities
- work details as described in the specifications of the dredging contract
- a short description of the last dredging performed (e.g. maintenance projects), including location of placement of material at the ODMDS

B. Characterization of material from dredging site

Existing Information, Tier I (Section 4.2). *At a minimum, a Tier I evaluation shall be conducted for every proposed dredging operation.* If regulatory compliance can be established using existing information, an assessment of the existing information shall accompany the compliance decision. For existing data, quality assurance/quality control information should be verifiable.

If using historical information, it may not be necessary to resubmit the test results that have been previously submitted to EPA. However, the following information should be provided and referenced: the date of the original submittal letter, title of the report, name of the consultant, date of the report and types of analyses performed (i.e. chemical, toxicity, bioaccumulation).

Other sources of data/information should be referenced and/or included with the Tier I evaluation, including any spill reports, sediment quality databases, research reports, point-source

discharge permit records, etc. (see Section 4.0 of the Green Book for a detailed listing of other sources of information).

Exclusionary Criteria, Tier I (Section 4.3). Information on the proposed dredging site, including sediment grain size, sediment chemistry and potential for contamination may be needed in determining exclusion from further testing.

- For this RIA, the term "predominantly sand", in 40 CFR 227.13(b)(1) and (b)(2), will be determined on a case-by-case basis by best professional judgment of both the USACE, New Orleans District and Galveston District and EPA, Region 6.

- The phrase "material proposed for dumping is substantially the same as the substrate at the proposed disposal site", in 40 CFR 227.13(b)(3)(i), is interpreted to mean the comparison of both physical and chemical characteristics of the proposed dredged material to the disposal site (i.e. "like on like").

- Information used in determining "areas of high current or wave energy" in 40 CFR 227.13(b)(1) may include area hydrology and available physical oceanographic data.

- Information used in determining "far removed from known existing and historical sources of pollution" in 40 CFR 227.13(b)(3)(ii) may include area hydrology, location of dredging site and proximity to sources of pollutants, quantities and types of pollutants discharged upstream of the proposed dredging area, and existing chemical and physical data on the dredged material.

If one or more of the exclusionary criteria can be satisfied using existing information, a conclusive written evaluation must be presented to show that the proposed dredged material meets the exclusionary criteria. An assessment of the existing information shall accompany the compliance decision. For existing data, quality assurance/quality control information should be verifiable.

If using historical information, it may not be necessary to resubmit the test results that have been previously submitted to EPA. However, the following information should be provided and referenced: the date of the original submittal letter, title of the report, name of the consultant, date of the report and types of analyses performed (i.e. chemical, toxicity, bioaccumulation).

New Data (Section 4.5). It may be necessary to collect new sediment samples and conduct appropriate analyses to determine compliance with the ocean dumping regulations. The following information shall be provided with submittal of new data:

1) A copy of the site-specific sampling and analysis plan (SAP) as discussed in Section 5 of this RIA.

2) A description of the sampling survey, including the following: dates, sampling devices used, compositing procedure, and the location of the sediment sampling stations for each dredging area and reference site station by a) latitude and longitude determined by Global Positioning System, and b) in general terms (e.g. by channel marker, buoy number or significant landmarks).

3) Copies of the test results conducted according to the site-specific sampling plan in a standard electronic format and/or report/hard-copy format. These test results include data for all tests at all tiers (physical, chemical, and/or biological), and the laboratory(s) performing the tests. Appendix H of *QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations* (EPA/USACE, 1995) contains a sediment testing report.

C. Regulatory compliance evaluation

The applicable subparts and sections of 40 CFR listed below must be evaluated to determine if the proposed dredged material is suitable for ocean disposal. A written discussion must address all the following:

1) Part 227 Subpart B - Environmental Impact
   a. 227.1 Applicability
   b. 227.4 Criteria for evaluating environmental impact
   c. 227.5 Prohibited materials
   d. 227.6 Constituents prohibited as other than trace contaminants
   e. 227.9 Limitations on quantities of waste materials
   f. 227.10 Hazards to fishing, navigation, shorelines or beaches
   g. 227.13 Dredged materials

2) Part 227 Subpart C - Need for Ocean Dumping (all sections)

3) Part 227 Subpart D - Impact of the Proposed Dumping on Aesthetic, Recreational and Economic Values (all sections)

4) Part 227 Subpart E - Impact of the Proposed Dumping on Other Uses of the Ocean (all sections)

5) Part 227 Subpart G - Definitions (all sections)

6) Part 228
   Section 228.4(e) - Dredged Material Permits

APPENDIX B

SAMPLE COLLECTION, PRESERVATION AND STORAGE

SUMMARY OF RECOMMENDED PROCEDURES FOR SAMPLE COLLECTION, PRESERVATION, AND STORAGE[a]

Analyses	Collection Method[b]	Amount Required[c]	Container[d]	Preservation Technique	Storage Conditions	Holding Times[e]
SEDIMENT						
Chemical/Physical Analyses						
Metals	Grab/corer	100 g	Precleaned polyethylene jar[f]	Dry ice[f] or freezer storage for extended storages; otherwise refrigerate	#4°C	Hg - 28 days Others - 6 months[g]
Organic Compounds (e.g., PCBs, pesticides, polycyclic aromatic hydrocarbons	Grab/corer	250 g	Solvent-rinsed glass jar with Teflon lid[f]	Dry ice[f] or freezer storage for extended storages; otherwise refrigerate	#4°C[f]/dark[g]	14 days[h]
Particle Size	Grab/corer	100g	Whirl-pac bag[f]	Refrigerate	<4°C	Undetermined
Total Organic Carbon (TOC)	Grab/corer	50 g	Heat treated glass vial with Teflon-lined lid[f]	Dry ice[f] or freezer storage for extended storages; otherwise refrigerate	#4°C[f]	14 days
Total solids/specific gravity	Grab/corer	50 g	Whirl-pac bag	Refrigerate	<4°C	Undetermined
Miscellaneous	Grab/corer	∃50g	Whirl-pac bag	Refrigerate	<4°C	Underermined
Sediment from which elutriate is prepared	Grab/corer	Depends on tests being performed	Glass with Teflon-lined lid	Completely fill and refrigerate	4°C/dark/airtight	14 days

Biological Tests						
Dredged material	Grab/corer	12-15 L per sample	Plastic bag or container[i]	Completely fill and refrigerate; sieve	4°C/dark/airtight	14 days[j]
Reference sediment	Grab/corer	45-50 L per test	Plastic bag or container[i]	Completely fill and refrigerate; sieve	4°C/dark/airtight	14 days[j]
Control sediment	Grab/corer	21-25 L per test	Plastic bag or container[i]	Completely fill and refrigerate; sieve	4°C/dark/airtight	14 days[j]
WATER AND ELUTRIATE						
Chemical/Physical Analyses						
Particulate analysis	Discrete sampler or pump	500- 2000 mL	Plastic or glass	Lugols solution and refrigerate	4°C	Undetermined
Metals	Discrete sampler or pump	1 L	Acid-rinsed polyethylene or glass jar[k]	pH <2 with HNO_3[k]; refrigerate	4°C 2°C[k]	Hg - 14 days Others - 6 months[l]
Total Kjeldahl nitrogen (TKN)	Discrete sampler or pump	100 - 200 mL	Plastic or glass[l]	H_2SO_4 to pH <2; refrigerate	4°C[l]	24 h[l]
Chemical oxygen demand (COD)	Discrete sampler or pump	200 mL	Plastic or glass[l]	H_2SO_4 to pH <2; refrigerate	4°C[l]	7 days[l]

Total organic carbon (TOC)	Discrete sampler or pump	100 mL	Plastic or glass[l]	H_2SO_4 to pH <2; refrigerate	4°C[l]	<48 h[l]
Total inorganic carbon (TIC)	Discrete sampler or pump	100 mL	Plastic or glass[l]	Airtight seal; refrigerate[h]	4°C[l]	6 months[l]
Phenolic compounds	Discrete sampler or pump	1 L	Glass[l]	0.1 - 1.0 g $CuSO_4$; H_2SO_4 to pH <2; refrigerate	4°C[l]	24 h[l]
Soluble reactive phosphates	Discrete sampler or pump	-	Plastic or glass[l]	Filter; refrigerate[h]	4°C[l]	24 h[l]
Extractable organic compounds (e.g., semivolatiles)	Discrete sampler or pump	4 L	Amber glass bottle[k]	pH <2, 6N HCL; airtight seal; refrigerate	4°C[k]	7 days for extraction; 40 days for extract analysis[k]
Volatile organic compounds	Discrete sampler or pump	80 mL	Glass vial[k]	pH <2 with 1:1 HCL; refrigerate in airtight, completely filled container[k]	4°C[k]	14 days for sample analysis if preserved[m]
Total phosphorus	Discrete sampler or pump	-	Plastic or glass[l]	H_2SO_4 to pH <2; refrigerate	4°C[l]	7 days[l]
Total solids	Discrete sampler or pump	200 mL	Plastic or glass[l]	Refrigerate	4°C[l]	7 days[l]
Sulfides	Discrete sampler or pump	-	Plastic or glass[l]	pH >9 NaOH (ZnAc); refrigerate	4°C[l]	24 h[l]

Volatile solids	Discrete sampler or pump	200 mL	Plastic or glass[l]	Refrigerate	4°C[l]	7 days[l]
Biological Tests						
Site water	Grab	Depends on tests being performed	Plastic carboy	Refrigerate	< 4°C	14 days
Dilution water	Grab or makeup	Depends on tests being performed	Plastic carboy	Refrigerate	< 4°C	14 days
TISSUE						
Metals	Trawl/Teflon-coated grab	5 - 10 g	Double Ziploc[f]	Handle with nonmetallic forceps; plastic gloves; dry ice[f]	#-20°C[f] or freezer storage	Hg - 28 days; Others - 6 months[n]
PCBs and chlorinated pesticides	Trawl/Teflon-coated grab	10 - 25 g	Hexane-rinsed double aluminum foil and double Ziploc[f]	Handle with hexane-rinsed stainless steel forceps; dry ice[f]	#-20°C[f] or freezer storage	14 days[h]
Volatile organic compounds	Trawl/Teflon-coated grab	10 - 25 g	Heat-cleaned aluminum foil and watertight plastic bag[m]	Covered ice chest[g]	#-20°C[h] or freezer storage	14 days[n]

Semivolatile organic compounds (e.g., PAH)	Trawl/Teflon -coated grab	10 - 25 g	Hexane-rinsed double aluminum foil and double Ziploc[f]	Handle with hexane-rinsed stainless steel forceps; dry ice[f]	#-20°C[f] or freezer storage	14 days[h]
Lipids	Trawl/Teflon -coated grab	part of organic analyses	Hexane-rinsed aluminum foil	Handle with hexane-rinsed stainless steel forceps; quick freeze	#-20°C or freezer storage	14 days[h]

[a] This table contains only a summary of collection, preservation, and storage procedures for samples. The cited references should be consulted for a more detailed description of these procedures. It was taken directly from the Inland Testing Manual, EPA-823-B-98-004.

[b] Collection method should include appropriate liners

[c] Amount of sample required by the laboratory to perform the analysis (wet weight or volume provided, as appropriate). Miscellaneous sample size for sediment should be increased if auxiliary analytes that cannot be included as part of the organic or metal analyses are added to the list. The amounts shown are not intended as firm values; more or less tissue may be required depending on the analytes, matrices, detection limits, and particular analytical laboratory.

[d] All containers should be certified as clean according to EPA (1990)

[e] These holding times are for sediment, water, and tissue based on guidance that is sometimes administrative rather than technical in nature. There are no promulgated, scientifically based holding time criteria for sediments, tissues, or elutriates. References should be consulted if holding times for sample extracts are desired. Holding times are from the time of sample collection.

[f] NOAA (1989)

[g] Tetra Tech (1986a)

[h] Sample may be held for up to one year if at -20°C.

[i] Polypropylene should be used if phthalate bioaccumulation is of concern.

[j] Two weeks is recommended; sediments must not be held for longer than 8 weeks prior to biological testing.

[k] EPA (1987); 40 CFR Part 136, Table III

[l] Plumb (1981)

[m] If samples are not preserved to pH<2, then aromatic compounds must be analyzed within 7 days.

[n] Tetra Tech (1986b)

APPENDIX C

TARGET DETECTION LIMITS
FOR ANALYSIS OF
SEDIMENT, TISSUE AND WATER

Target Detection Limits[a] (TDLs) for analysis of sediment, tissue and water

These values equate to Minimum Quantification Levels (MQLs). TDLs utilized in the analysis of samples should be adequate to satisfy the Data Quality Objectives (DQOs), to the extent practicable. Alternate TDLs may be proposed as long as DQOs are satisfied (e.g., for use in assessing water quality criteria or screening levels). Proposed TDLs should be contained in the sampling and analysis plan (SAP) for each project. Sediment values are reported as dry weight. Tissue values are reported as wet weight. ***Highlighted parameters are contaminants of concern and conventional parameters listed in Table 2.***

Chemical	**Sediment**	**Tissue**	**Water**
Metals	mg/kg	mg/kg	µg/l
Aluminum	10[b]	1	40
Antimony	2.5	0.1	3 (0.02)[c]
Arsenic	0.3[b]	0.1	1 (0.005)
Barium	2[b]	1[b]	10[b]
Beryllium	1[b]	0.1	0.2
Cadmium	0.1	0.1	1 (0.01)
Chromium (total)	1[b]	0.05[b]	1
Chromium (3+)	1	50	1
Chromium (6+)	1	50	1
Cobalt	0.1	0.1	4
Copper	1[b]	0.1	1 (0.1)
Iron	20[b]	10	10
Lead	0.3[b]	0.1	1 (0.02)
Manganese	1[b]	0.5	1
Mercury	0.2	0.01	0.2 (0.0002)
Nickel	0.5[b]	0.1	1 (0.1)
Selenium	0.5[b]	0.2	2
Silver	0.2	0.1	1 (0.1)
Thallium	0.2	0.1	1 (0.02)
Tin	0.5	0.1	5
Zinc	2[b]	0.1[b]	1 (0.5)
Organotin	0.01	0.01	0.01
Conventional/Ancillary Parameters	mg/kg	mg/kg	mg/l
Ammonia	0.1	-	0.03
Cyanides	2	1	0.1[e]
Total Organic Carbon	0.1%	-	0.1%
Total Petroleum Hydrocarbons	5	50[f]	0.1
Tot. Recov. Petr. Hydrocarbons	5	-	0.5
Total Phenols	1	10	0.05
Acid Volatile Sulfides	0.1 µmole/g	-	-
Total Sulfides	0.1	-	0.1
Grain Size	1%	-	-

Chemical	Sediment	Tissue	Water
Conventional/Ancillary Parameters, Continued	mg/kg	mg/kg	mg/l
Total Suspended Solids	0.1	-	1
Total Settleable Solids	-	-	0.05
Total Solids/Dry Weight	0.1%	-	-
Total Volatile Solids	0.1	-	-
Specific Gravity	0.01	-	-
pH	0.1 SU	-	-
Total Moisture Content	0.1%	0.1%	-
Total Lipid	-	0.1%[g]	-
Oil and Grease	20[f]	20[f]	2[f]
LPAH Compounds	µg/kg	µg/kg	µg/l
Napthalene	20	20	0.8[b]
Acenapthylene	20	20	1.0[b]
Acenapthene	20	20	0.75[b]
Fluorene	20	20	0.6[b]
Phenanthrene	20	20	0.5[b]
Anthracene	20	20	0.6[b]
Methylnapthalene	20	20	10
2-Methylnapthalene	20	20	0.9[b]
HPAH Compounds	µg/kg	µg/kg	µg/l
Fluoranthene	20	20	0.9[b]
Pyrene	20	20	1.5[b]
Benzo(a)anthracene	20	20	0.4[b]
Chrysene	20	20	0.3[b]
Benzo(b&k)fluoranthene	20	20	0.6[b]
Benzo(a)pyrene	20	20	0.3[b]
Ideno[1,2,3-c,d]pyrene	20	20	1.2[b]
Dibenzo[a,h]anthracene	20	20	1.3[b]
Benzo[g,h,i]perylene	20	20	1.2[b]
Organonitrogen Compounds	µg/kg	µg/kg	µg/l
Benzidine	5	5	1
3,3-Dichlorobenzidine	300[b]	-	3[b]
2,4-Dinitrotoluene	200[b]	-	2[b]
2,6-Dinitrotoluene	200[b]	-	2[b]
1,2-Diphenylhydrazine	10	100	1
Nitrobenzene	160[b]	-	0.9[b]
N-Nitrosodimethyl amine	-	-	3.1[b]
N-Nitrosodi-n-propylamine	150[b]	-	0.9[b]
N-Nitrosodiphenylamine	20	20	2.1[b]

Chemical	Sediment	Tissue	Water
Phthalate Esters	µg/kg	µg/kg	µg/l
Dimethyl Phthalate	50	20	1[b]
Diethyl Phthalate	50	20	1[b]
Di-n-butyl Phthalate	50	20	1[b]
Butyl Benzyl Phthalate	50	20	4[b]
Bis[2-ethylhexyl] Phthalate	50	20	2[b]
Di-n-octyl Phthalate	50	20	3[b]
Phenols/Substituted Phenols	µg/kg	µg/kg	µg/l
Phenol	100	20	10
2-Methylphenol	50	20	10
4-Methylphenol	100	20	10
2,4-Dimethylphenol	20	20	10
Pentachlorophenol	100	100	50
2,4,6-Trichlorophenol	140[b]	-	0.9[b]
4-Chloro-3-methylphenol	140[b]	-	0.7[b]
2-Nitrophenol	200[b]	-	2[b]
4-Nitrophenol	500[b]	-	5[b]
2,4-Dinitrophenol	500[b]	-	5[b]
4,6-Dinitrophenol	500[b]	-	5[b]
2-Chlorophenol	110[b]	-	0.9[b]
2,4-Dichlorophenol	120[b]	-	0.8[b]
4,6-Dinitro-o-cresol	600	20	10
Polychlorinated Dibenzo-p-dioxins	µg/kg	µg/kg	µg/l
2,3,7,8-TCDD	0.001	0.001	0.00001
Other Tetrachlorinated Dioxins	0.001	0.001	0.00001
Pentachlorinated Dioxins	0.0025	0.0025	0.000025
Hexachlorinated Dioxins	0.005	0.005	0.00005
Heptachlorinated Dioxins	0.005	0.005	0.00005
Octachlorinated Dioxins	0.01	0.01	0.0001
Polychlorinated Dibenzofurans	µg/kg	µg/kg	µg/l
Tetrachlorinated Furans	0.001	0.001	0.00001
Pentachlorinated Furans	0.0025	0.0025	0.000025
Hexachlorinated Furans	0.005	0.005	0.00005
Hepatachlorinated Furans	0.005	0.005	0.00005
Octachlorinated Furans	0.01	0.01	0.0001
Dibenzo Furan	50	20	0.7[b]
Polychlorinated Biphenyls	µg/kg	µg/kg	µg/l
PCB Congeners & Aroclors	1	2	0.01
Total PCB	1	2	0.01

Chemical	Sediment	Tissue	Water
Pesticides	µg/kg	µg/kg	µg/l
Aldrin	3[b]	6[b]	0.03[b]
Chlordane and Derivatives	3[b]	6[b]	0.03[b]
Dieldrin	5[b]	10	0.02
4,4'-DDD	5[b]	10	0.1
4,4'-DDE	5[b]	10	0.1
4,4'-DDT	5[b]	10	0.1
Endosulfan and Derivatives	5[b]	10	0.1
Endrin and Derivatives	5[b]	10	0.1
Heptachlor and Derivatives	3[b]	6[b]	0.1
Alpha-BHC	3[b]	6[b]	0.03
Beta-BHC	3[b]	6[b]	0.03
Delta-BHC	3[b]	6[b]	0.03
Gamma-BHC (Lindane)	3[b]	6[b]	0.1
Toxaphene	50	50	0.5
Methoxychlor	5[b]	10	0.5
Chlorbenside	2	2	0.002
Dacthal	2	2	0.03
Total Chlorinated Pesticides	20	20	0.02
Malathion	5	5	0.8
Parathion	6	6	0.8
Chlorinated Hydrocarbons	µg/kg	µg/kg	µg/l
1,3-Dichlorobenzene	20	20	0.9[b]
1,4-Dichlorobenzene	20	20	1[b]
1,2-Dichlorobenzene	20	20	0.8[b]
1,2,4-Trichlorobenzene	10	20	0.9[b]
Hexachlorobenzene	10	20	0.4[b]
2-Chloronapthalene	160[b]	-	0.8[b]
Hexachlorocyclopentadiene	300[b]	-	3.0[b]
Hexachloroethane	100	40	0.9[b]
Hexachlorobutadiene	20	40	0.9[b]
Volatile Organic Compounds	µg/kg	µg/kg	µg/l
Benzene	10	10	2[b]
Chloroform	10	10	2[b]
Ethylbenzene	10	10	5
Toluene	10	10	5
Trichloroethene	10	10	2[b]
Tetrachloroethene	10	10	2[b]
Total Xylenes	10	10	5
Halogenated Ethers	µg/kg	µg/kg	µg/l
Bis(2-chloroethyl)ether	130[b]	-	0.9[b]
4-chlorophenyl phenyl ether	170[b]	-	0.6[b]
4-Bromophenyl phenyl ether	160[b]	-	0.4[b]

Chemical	Sediment	Tissue	Water
Halogenated Ethers, Continued	µg/kg	µg/kg	µg/l
Bis(2-chloroisopropyl)ether	140[b]	-	0.7[b]
Bis(2-Chloroethoxy)methane	130[b]	-	1[b]
Miscellaneous	µg/kg	µg/kg	µg/l
Isophorone	10	100	1
Benzyl Alcohol	50	100	1.5[b]
Benzoic Acid	100	100	2.0[b]
Methyl Ethyl Keytone	20	20	50
Resin Acids and Guaiacols	10	-	-

[a]The primary source of these TDLs was EPA 823-B-95-001, *QA/QC Guidance for Sampling and Analysis of Sediments, Water and Tissues for Dredged Material Evaluations.*
[b]These values are based on recommendations from the EPA Region 6 Laboratory in Houston; these values were based on data or other technical basis.
[c]The values in parentheses are based on EPA "clean techniques", (EPA 1600 series methods) which are applicable in instances where other TDLs are inadequate to assess EPA water quality criteria.
[d]These values contained in Region 6 "Development of Minimum Quantification Levels" prepared by the EPA Region 6 Permits Branch.
[e]This value recommended by Houston Lab using colorimetric method.
[f]This value recommended by Houston Lab using method 1664.
[g]Lee et. al, 1989.

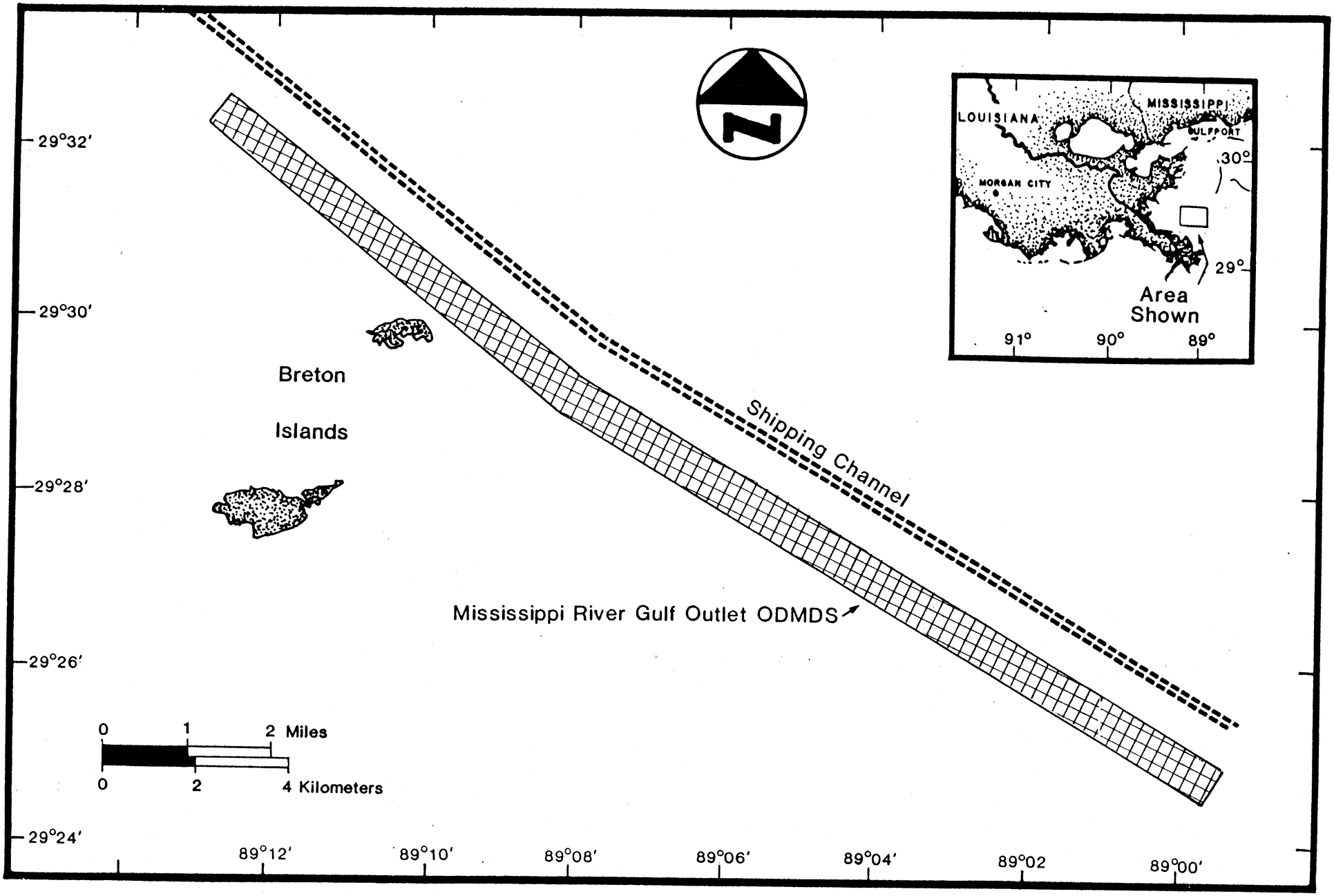
APPENDIX D

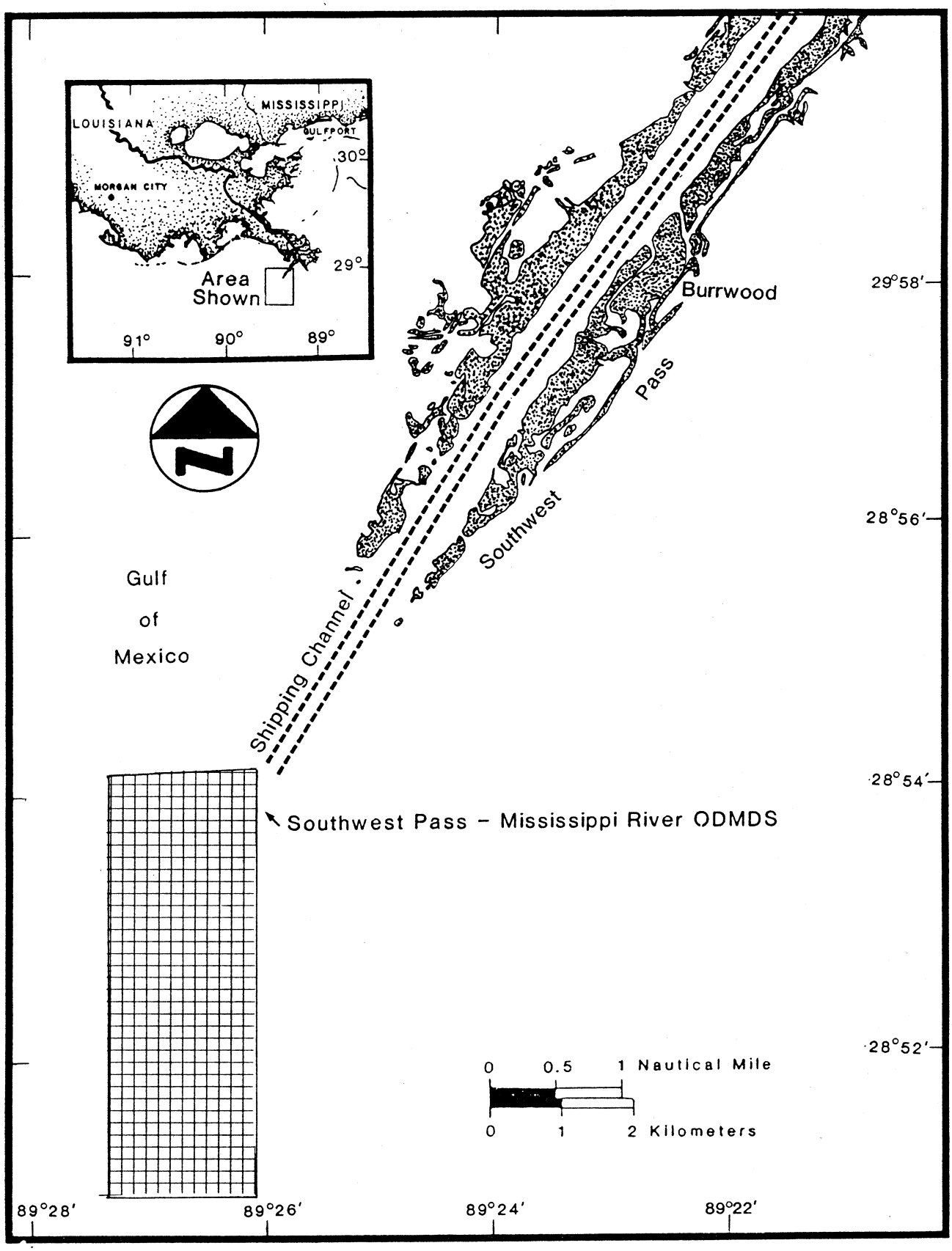
ODMDS AND REFERENCE AREA LOCATIONS

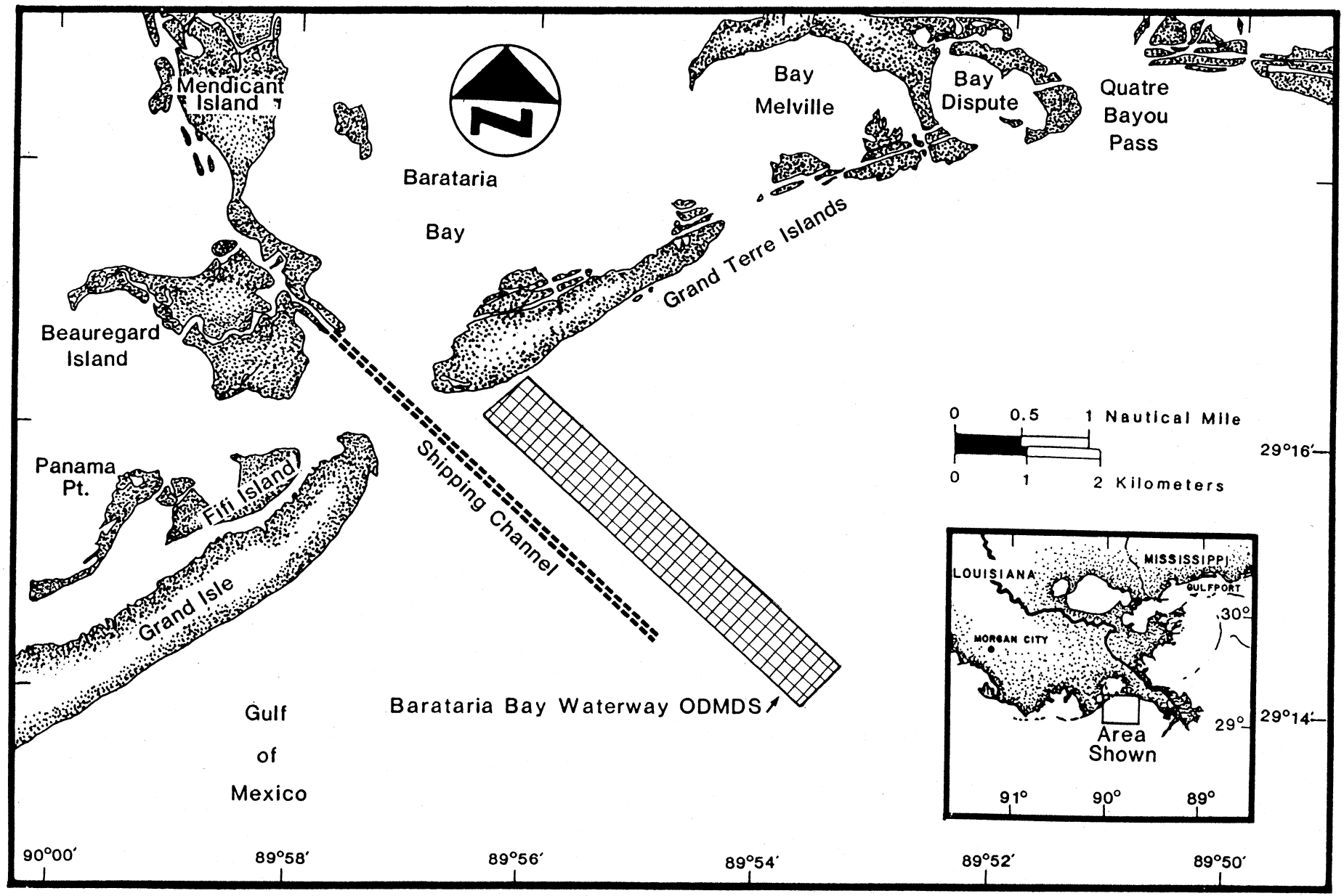
LOUISIANA

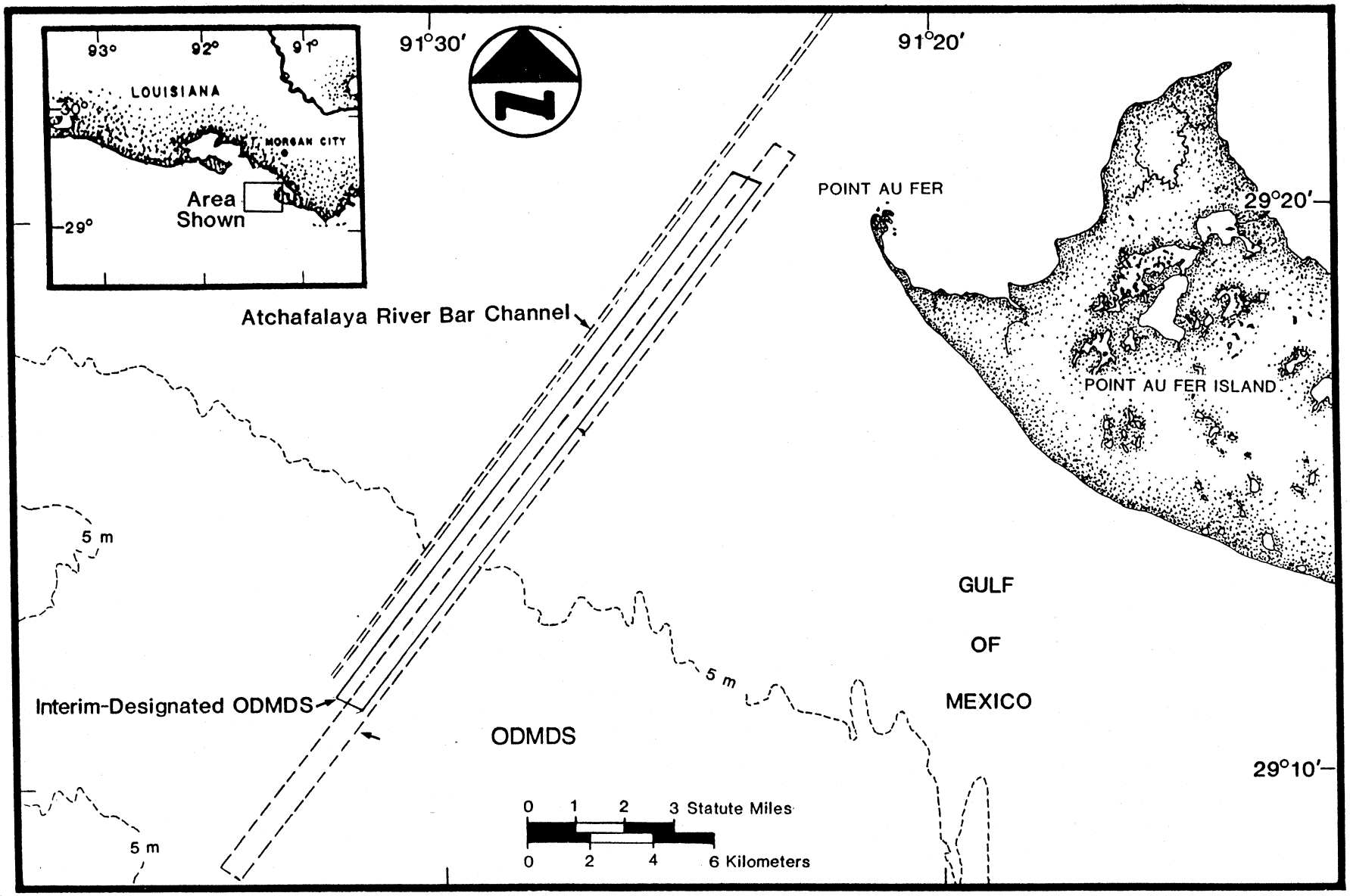
Reference Sample locations determined using Area Approach

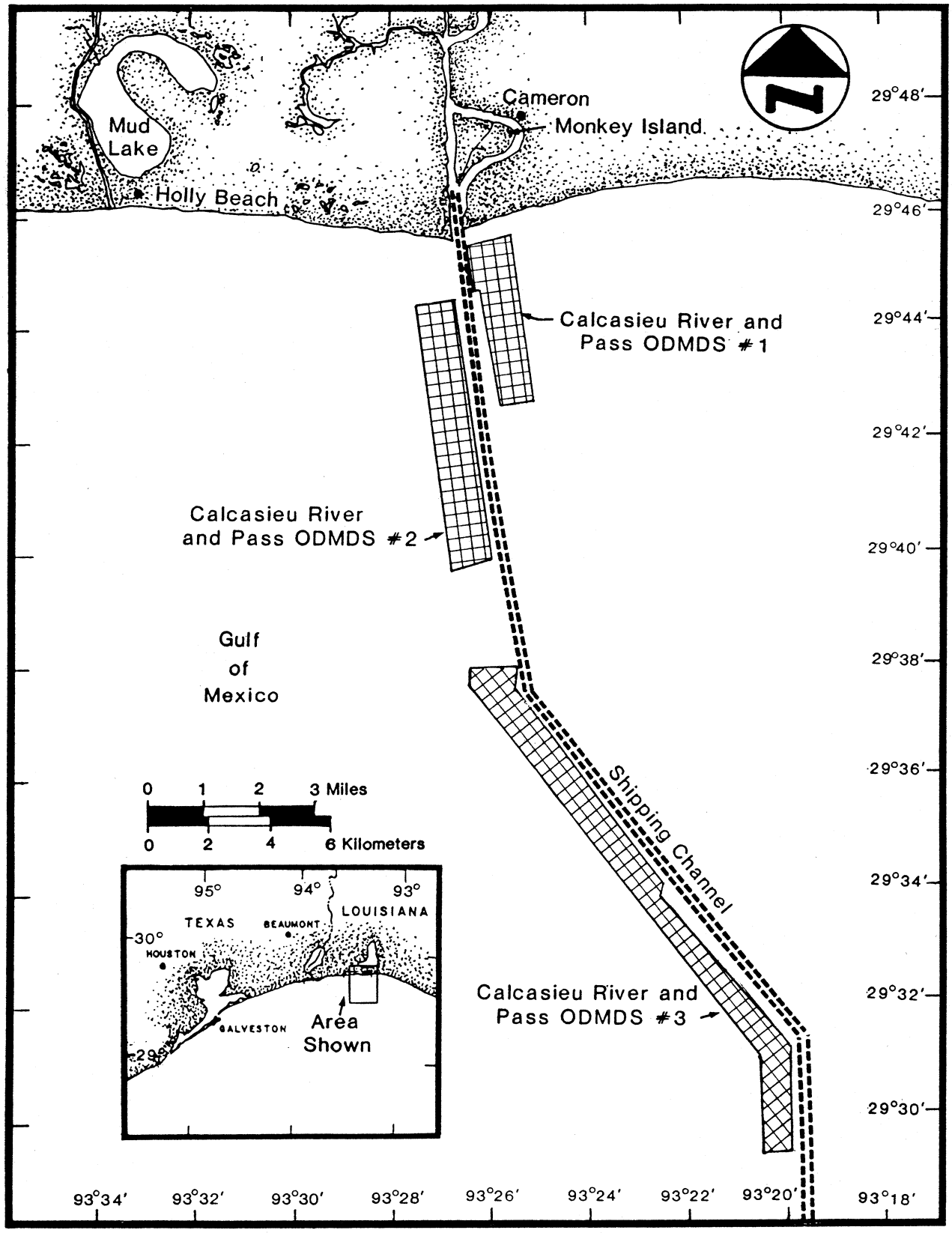
Mississippi River - Gulf Outlet ODMDS	29°22'00"N, 88°56'30"W 29°23'00"N, 88°54'30"W 29°24'30"N, 88°52'30"W
Mississippi River - Southwest Pass ODMDS	28°53'58"N, 89°25'31"W 28°53'45"N, 89°25'09"W 28°53'13"N, 89°25'28"W 28°53'11"N, 89°24'49"W
Barataria Bay Waterway ODMDS	29°13'30"N, 89°53'30"W 29°13'54"N, 89°53'48"W 29°14'21"N, 89°54'06"W
Atchafalaya Bar Channel ODMDS	29°07'00"N, 91°31'30"W 29°08'00"N, 91°29'00"W 29°09'00"N, 91°27'00"W
Calcasieu River & Pass ODMDS	29°30'00"N, 93°10'18"W 29°30'51"N, 93°10'00"W 29°30'00"N, 93°09'27"W
Houma Navigation Canal (Cat Island Pass) ODMDS	28°58'09"N, 90°29'30"W 28°58'57"N, 90°31'30"W 28°57'57"N, 90°31'54"W

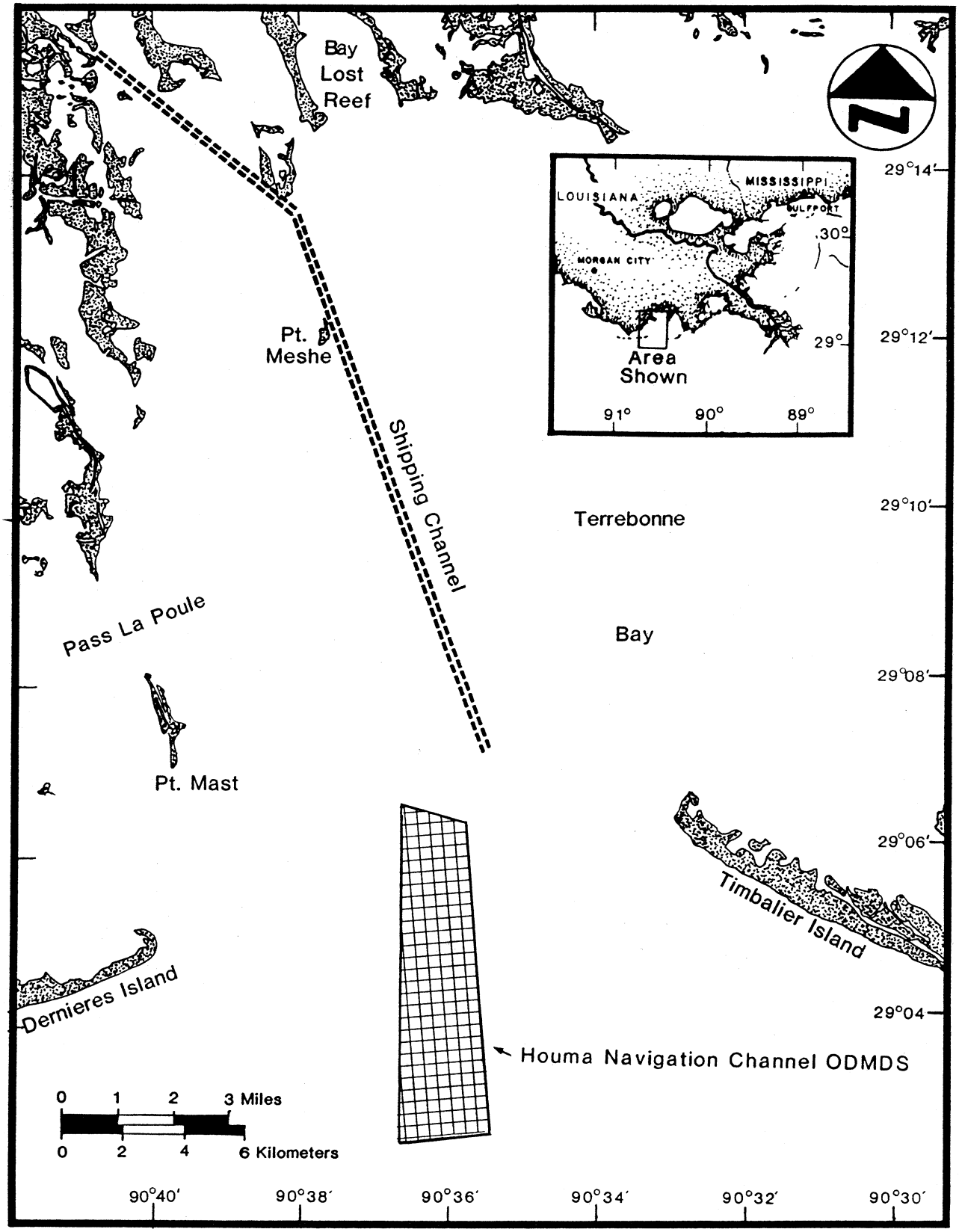

29°32'
29°30'
29°28'
29°26'
29°24'
89°12'
89°10'
89°08'
89°06'
89°04'
89°02
89°00'
Breton
Islands
Shipping Channel
Mississippi River Gulf Outlet ODMDS
0 1 2 Miles
0 2 4 Kilometers
LOUISIANA
MISSISSIPPI
GULFPORT
MORGAN CITY
30°
29°
Area
Shown
91°
90°
89°


LOUISIANA
MISSISSIPPI
GULFPORT
MORGAN CITY
30°
29°
Area Shown
91°
90°
89°
Burrwood
Pass
Southwest
Shipping Channel
Gulf of Mexico
Southwest Pass – Mississippi River ODMDS
29°58′
28°56′
28°54′
28°52′
0 0.5 1 Nautical Mile
0 1 2 Kilometers
89°28′
89°26′
89°24′
89°22′


Mendicant Island
Barataria Bay
Bay Melville
Bay Dispute
Quatre Bayou Pass
Grand Terre Islands
Beauregard Island
Panama Pt.
Fifi Island
Shipping Channel
Grand Isle
Gulf of Mexico
Barataria Bay Waterway ODMDS
0 0.5 1 Nautical Mile
0 1 2 Kilometers
LOUISIANA
MISSISSIPPI
GULFPORT
MORGAN CITY
30°
29°
Area Shown
91°
90°
89°
29°16′
29°14′
90°00′
89°58′
89°56′
89°54′
89°52′
89°50′


93°
92°
91°
LOUISIANA
30°
MORGAN CITY
Area
Shown
29°
91°30′
91°20′
POINT AU FER
29°20′
Atchafalaya River Bar Channel
POINT AU FER ISLAND
5 m
GULF
OF
MEXICO
Interim-Designated ODMDS
ODMDS
5 m
5 m
29°10′
0 1 2 3 Statute Miles
0 2 4 6 Kilometers

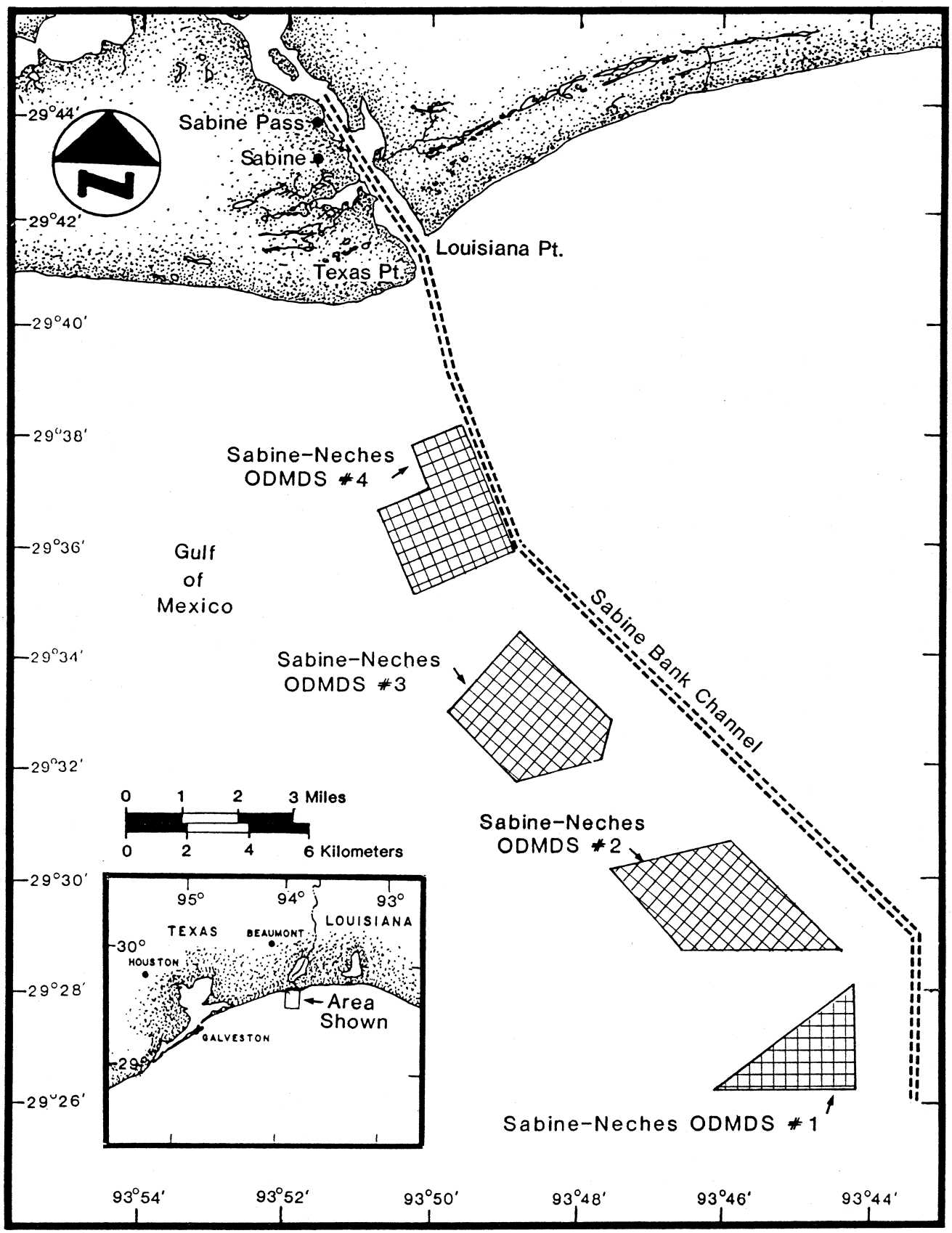

Mud Lake
Holly Beach
Cameron
Monkey Island
Calcasieu River and Pass ODMDS #1
Calcasieu River and Pass ODMDS #2
Gulf of Mexico
Shipping Channel
Calcasieu River and Pass ODMDS #3
0 1 2 3 Miles
0 2 4 6 Kilometers
95°
94°
93°
TEXAS
LOUISIANA
BEAUMONT
30°
HOUSTON
GALVESTON
29°
Area Shown
29°48′
29°46′
29°44′
29°42′
29°40′
29°38′
29°36′
29°34′
29°32′
29°30′
93°34′
93°32′
93°30′
93°28′
93°26′
93°24′
93°22′
93°20′
93°18′

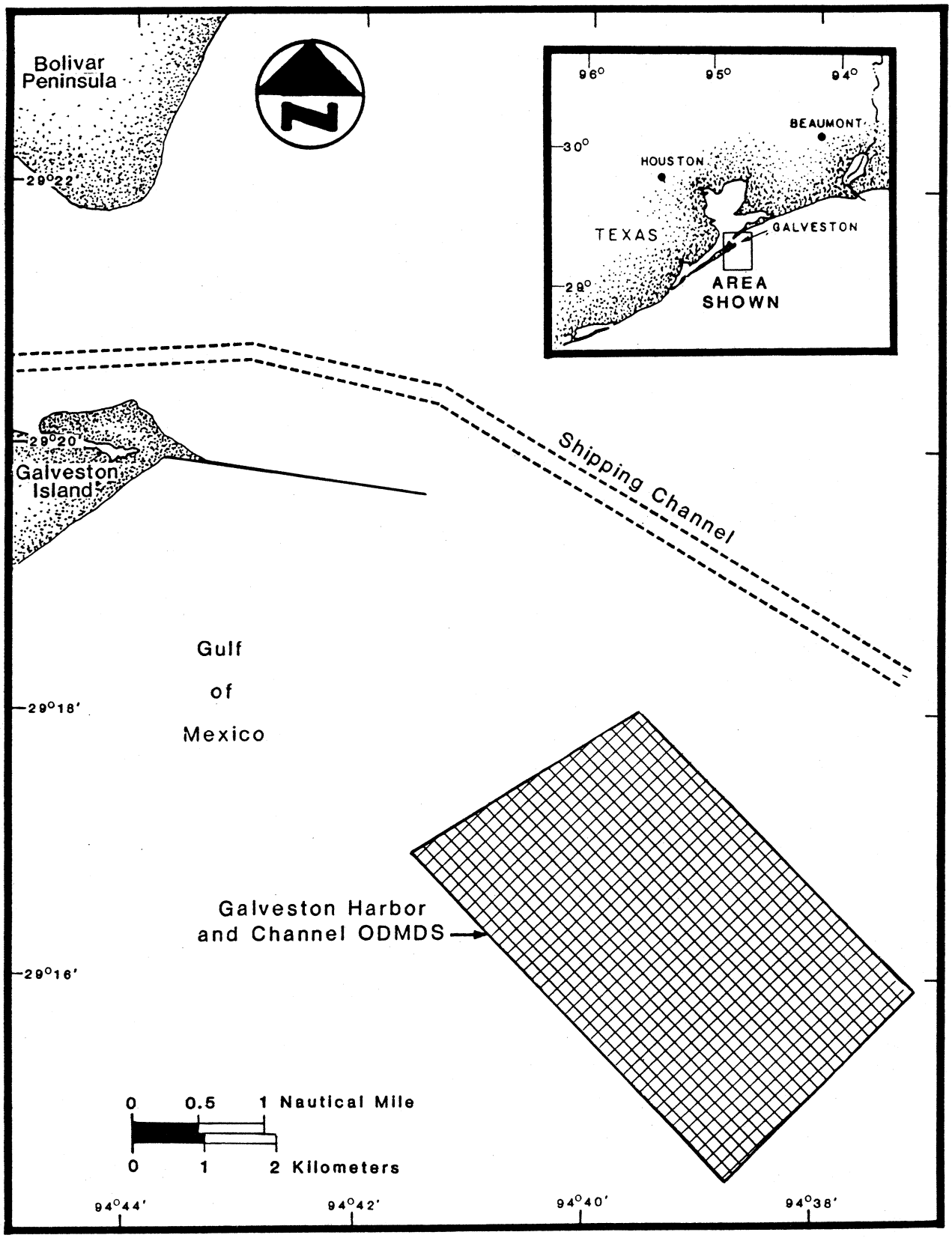

Bay
Lost
Reef
Pt.
Meshe
Shipping Channel
Pass La Poule
Pt. Mast
Terrebonne
Bay
Timbalier Island
Dernieres Island
Houma Navigation Channel ODMDS
LOUISIANA
MISSISSIPPI
GULFPORT
MORGAN CITY
30°
29°
Area
Shown
91°
90°
89°
29°14′
29°12′
29°10′
29°08′
29°06′
29°04′
0 1 2 3 Miles
0 2 4 6 Kilometers
90°40′
90°38′
90°36′
90°34′
90°32′
90°30′

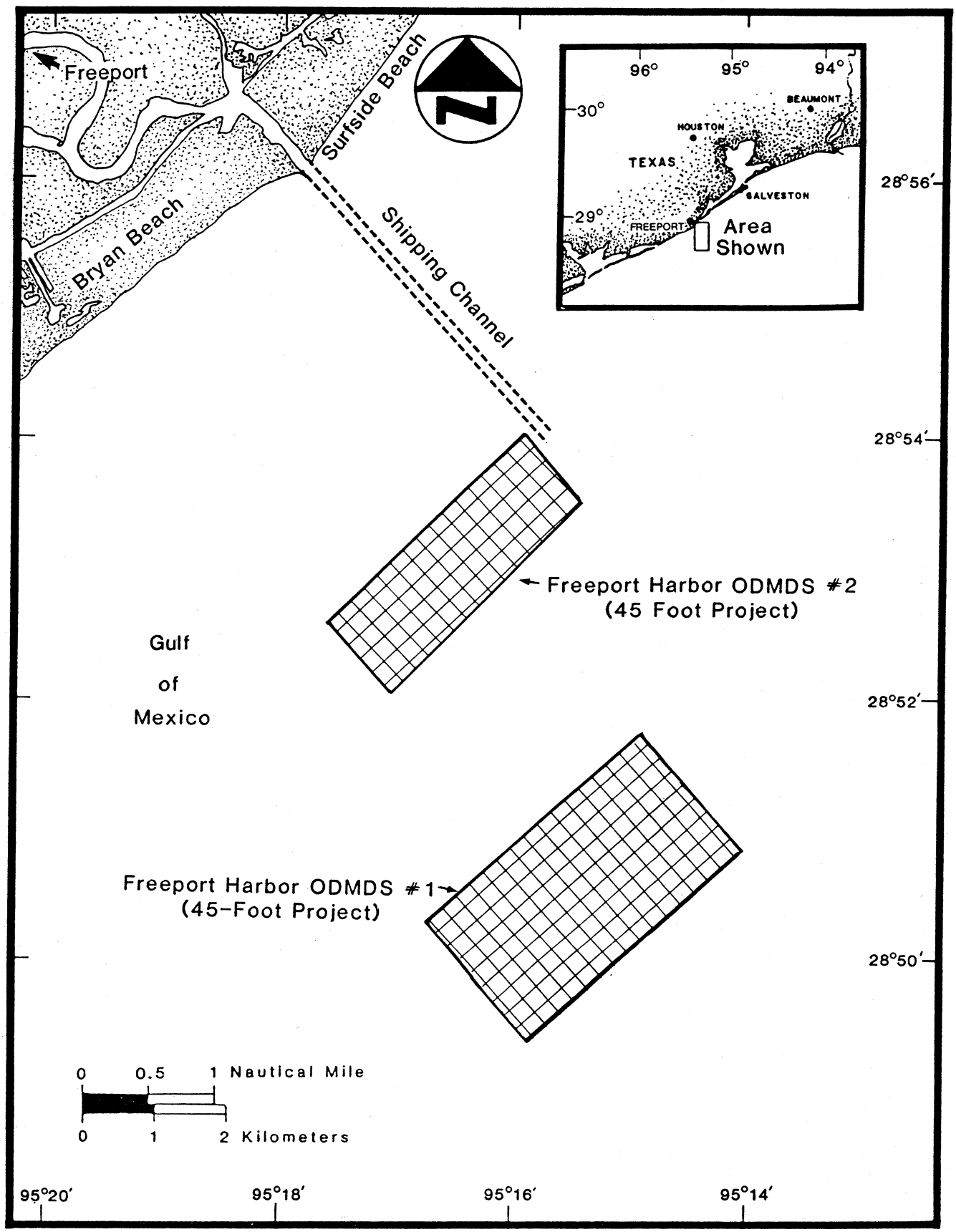
TEXAS

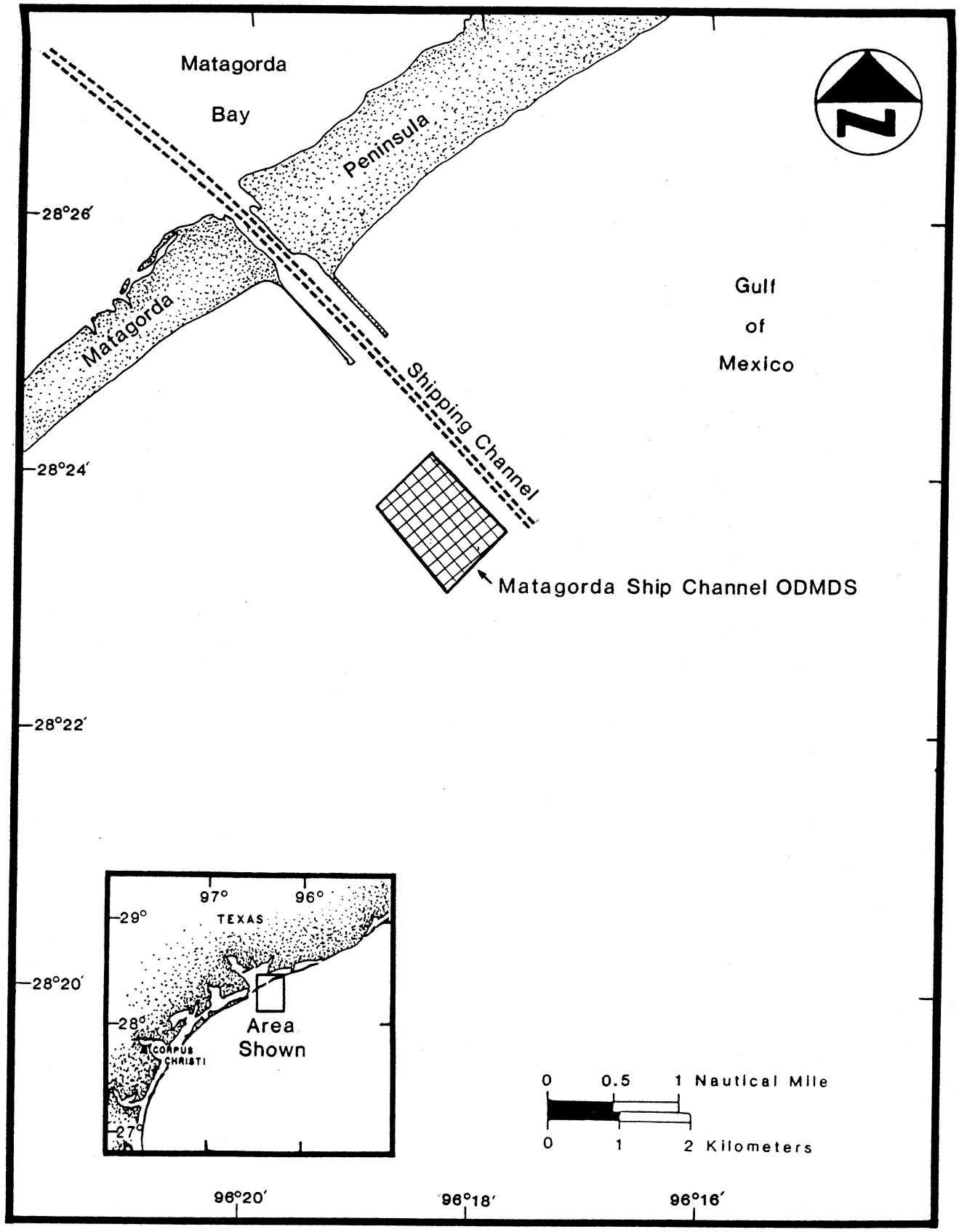
Reference Area boundary locations - Reference Sample collected within area

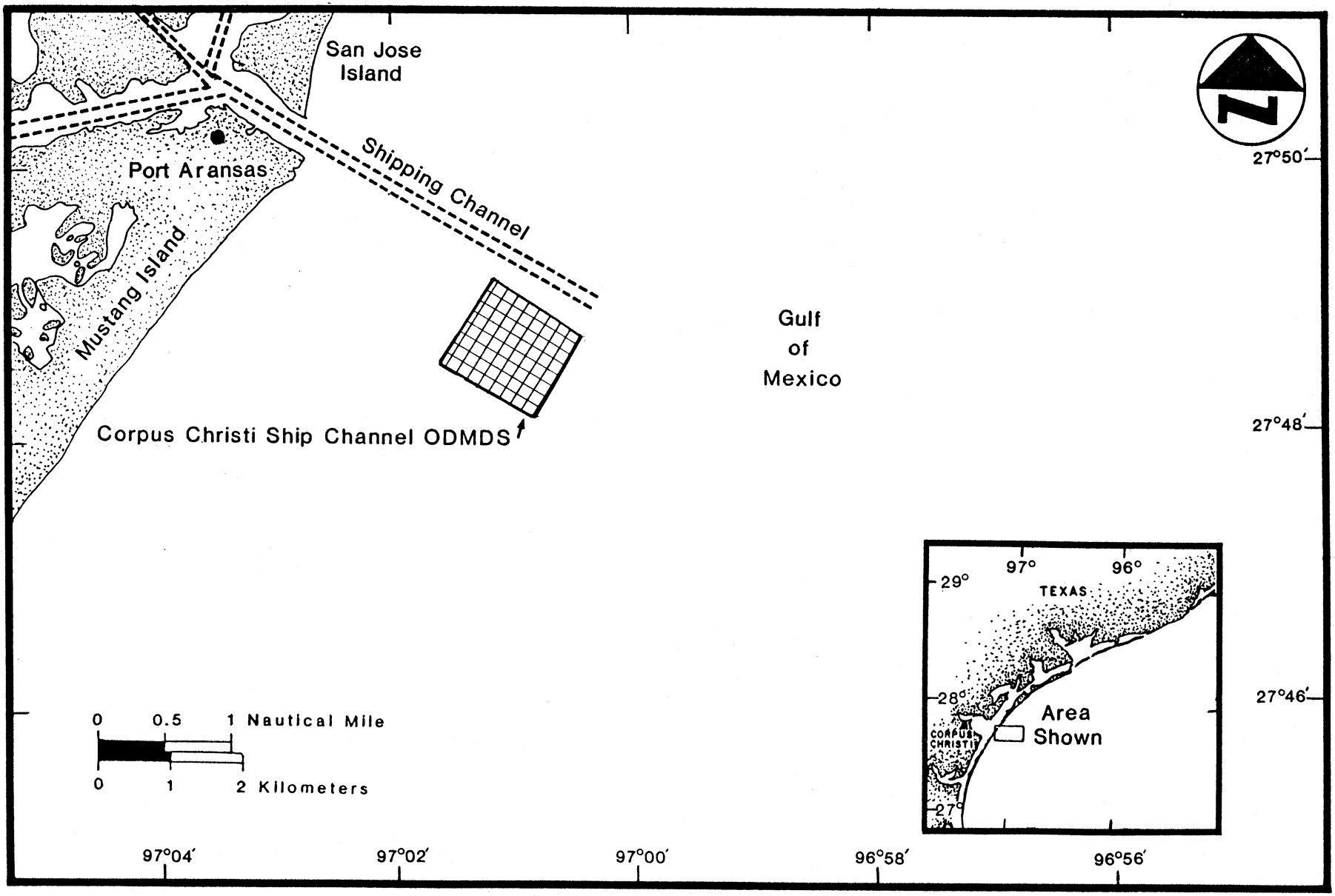
Sabine-Neches Waterway ODMDS No. 1 & 2	29°27’30”N, 93°37’00”W 29°27’30”N, 93°36’45”W 29°26’38”N, 93°36’45”W 29°26’38”N, 93°37’00”W
Sabine-Neches Waterway ODMDS No. 3 & 4	29°35’52”N, 93°41’45”W 29°35’52”N, 93°41’30”W 29°35’00”N, 93°41’30”W 29°35’00”N, 93°41’45”W
Galveston Harbor & Channel ODMDS	29°20’22”N, 94°37’11”W 29°19’32”N, 94°36’56”W 29°19’23”N, 94°37’06”W 29°20’13”N, 94°37’21”W
Freeport Harbor ODMDS	28°54’28”N, 95°13’40”W 28°54’35”N, 95°13’28”W 28°55’07”N, 95°14’01”W 28°54’60”N, 95°14’13”W
Matagorda Ship Channel ODMDS	28°24’27”N, 96°16’04”W 28°24’33”N, 96°15’52”W 28°25’10”N, 96°16’30”W 28°25’04”N, 96°16’42”W
Corpus Christi Ship Channel ODMDS	27°50’10”N, 96°59’17”W 27°50’20”N, 96°59’09”W 27°50’48”N, 96°59’57”W 27°50’38”N, 97°00’05”W
Port Mansfield ODMDS	26°32’11”N, 97°13’44”W 26°31’58”N, 97°13’44”W 26°31’58”N, 97°14’42”W 26°32’11”N, 97°14’42”W
Brazos Island Harbor ODMDS	26°02’18”N, 96°06’30”W 26°02’18”N, 97°07’26”W 26°02’05”N, 97°07’26”W 26°02’05”N, 96°06’30”W

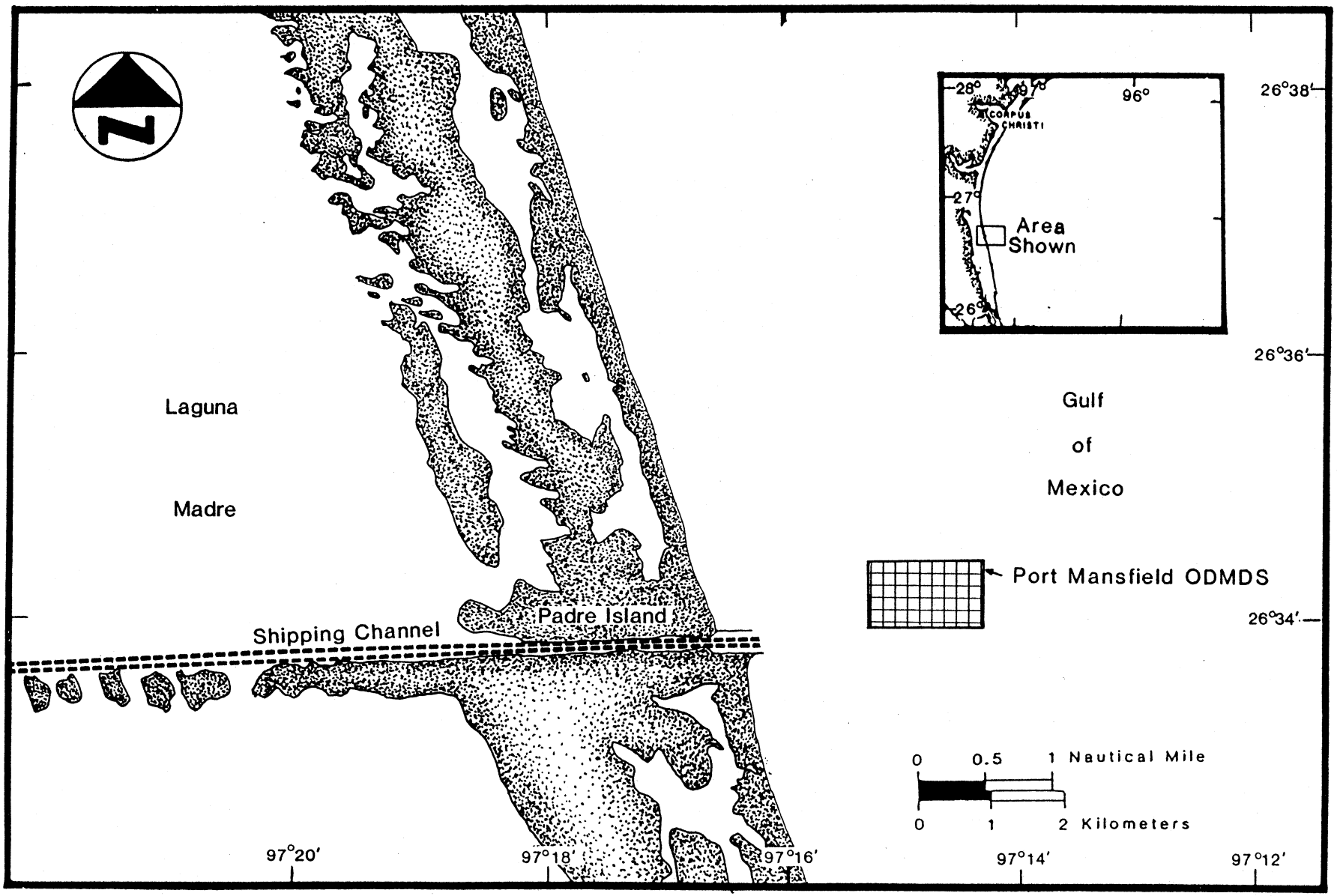

29°44'
Sabine Pass
Sabine
29°42'
Louisiana Pt.
Texas Pt.
29°40'
29°38'
Sabine-Neches
ODMDS #4
29°36'
Gulf
of
Mexico
Sabine Bank Channel
29°34'
Sabine-Neches
ODMDS #3
29°32'
0 1 2 3 Miles
0 2 4 6 Kilometers
Sabine-Neches
ODMDS #2
29°30'
95°
94°
93°
TEXAS
LOUISIANA
BEAUMONT
30°
HOUSTON
29°28'
Area
Shown
GALVESTON
29°
29°26'
Sabine-Neches ODMDS #1
93°54'
93°52'
93°50'
93°48'
93°46'
93°44'

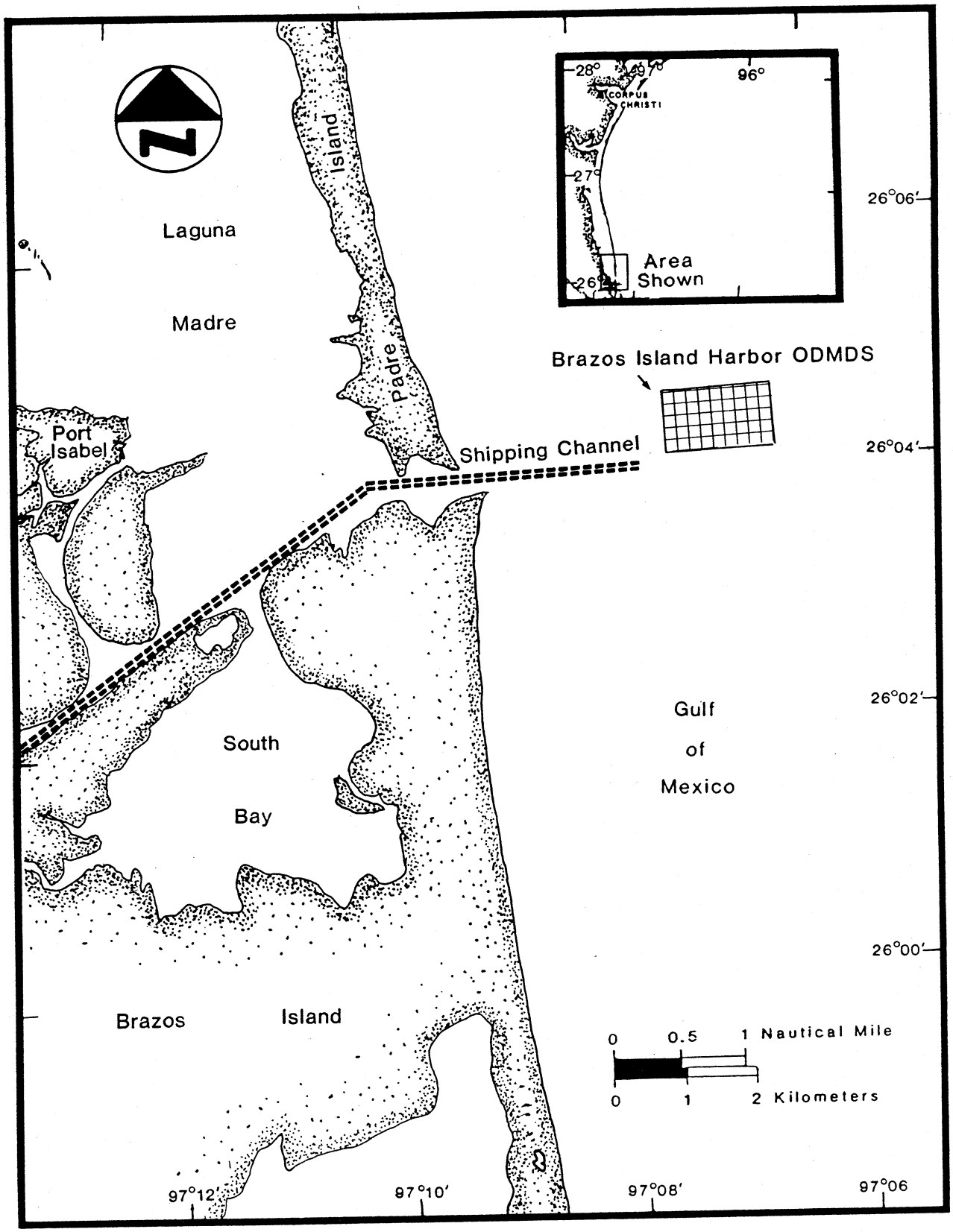

Bolivar Peninsula
29°22'
96°
95°
94°
30°
BEAUMONT
HOUSTON
TEXAS
GALVESTON
29°
AREA SHOWN
29°20'
Galveston Island
Shipping Channel
Gulf of Mexico
29°18'
Galveston Harbor and Channel ODMDS
29°16'
0 0.5 1 Nautical Mile
0 1 2 Kilometers
94°44'
94°42'
94°40'
94°38'


Freeport
Surfside Beach
Bryan Beach
Shipping Channel
96°
95°
94°
30°
29°
BEAUMONT
HOUSTON
TEXAS
GALVESTON
FREEPORT
Area Shown
28°56′
28°54′
28°52′
28°50′
Freeport Harbor ODMDS #2
(45 Foot Project)
Gulf
of
Mexico
Freeport Harbor ODMDS #1
(45-Foot Project)
0 0.5 1 Nautical Mile
0 1 2 Kilometers
95°20′
95°18′
95°16′
95°14′


Matagorda
Bay
Peninsula
N
28°26′
Matagorda
Gulf
of
Mexico
Shipping Channel
28°24′
Matagorda Ship Channel ODMDS
28°22′
97°
96°
29°
TEXAS
28°20′
28°
Area
Shown
CORPUS
CHRISTI
27°
0
0.5
1 Nautical Mile
0
1
2 Kilometers
96°20′
96°18′
96°16′


San Jose Island
Port Aransas
Shipping Channel
Mustang Island
Gulf of Mexico
Corpus Christi Ship Channel ODMDS
N
27°50′
27°48′
27°46′
0 0.5 1 Nautical Mile
0 1 2 Kilometers
97°04′
97°02′
97°00′
96°58′
96°56′
97°
96°
29°
28°
27°
TEXAS
CORPUS CHRISTI
Area Shown


N
28°
97°
96°
CORPUS CHRISTI
27°
Area Shown
26°
26°38'
26°36'
Laguna
Madre
Gulf
of
Mexico
Port Mansfield ODMDS
Padre Island
Shipping Channel
26°34'
0 0.5 1 Nautical Mile
0 1 2 Kilometers
97°20'
97°18'
97°16'
97°14'
97°12'


Laguna
Madre
Padre Island
Port Isabel
Shipping Channel
Brazos Island Harbor ODMDS
South
Bay
Gulf
of
Mexico
Brazos Island
Area Shown
CORPUS CHRISTI
28°
27°
26°
96°
26°06'
26°04'
26°02'
26°00'
97°12'
97°10'
97°08'
97°06
0 0.5 1 Nautical Mile
0 1 2 Kilometers

APPENDIX E

EPA EVALUATOR WORKSHEETS
FOR
TESTING AND EVALUATION OF DREDGED MATERIAL
PROPOSED FOR OCEAN DISPOSAL

Table 1

EPA Evaluator Worksheet for Tier I Data

Data for Compliance with the Exclusionary Criteria in 40 CFR 227.13(b)	Data Acceptable				Comments
	Yes	No	N/A	Need More	
1a. Proposed dredged material is composed predominantly of sand, gravel, rock or any other naturally occurring bottom material with particle sizes larger than silt (using results of grain-size analyses); **and**	G	G	G	G	
1b. Proposed dredged material is found in high current or wave energy areas.	G	G	G	G	
2a. Proposed dredged material is for beach nourishment or restoration; **and**	G	G	G	G	
2b. Proposed dredged material is composed predominantly of sand, gravel or shell with particle sizes compatible with material on the receiving beach (using statistical comparison of grain size at dredging site vs. disposal site).	G	G	G	G	
3a. The proposed material is substantially the same as the substrate at the proposed disposal site (using statistical comparison of grain size at dredging site vs. disposal site); **and**	G	G	G	G	
3b. The site the material is taken from is far removed from known existing and historical sources of pollution.	G	G	G	G	
4. Adequacy of disposal-site sediment and/or water sampling (as concluded from Table 6).	G	G	G	G	
5. QA verification of analytical procedures and results (as concluded from Table 7).					

N/A: not applicable

Table 1
EPA Evaluator Worksheet for Tier I Data (continued)

Data for LPC Determinations	Data Acceptable				Comments
	Yes	No	N/A	Need More	
6. Definition of the area to be dredged (maps, coordinates, depth of cut, side slopes, over-depth dredge, etc.).	G	G	G	G	
7. Physical and chemical characterization of the proposed dredged material, including contaminants of concern and their project locations.	G	G	G	G	
8. Procedures and results of prior physical, chemical, and bioassay tests of the dredged material or of tests on sediments from the vicinity of the proposed dredging area.	G	G	G	G	
- Adequacy of dredging-site sediment sampling (as concluded from Table 6).	G	G	G	G	
9. Procedures and results of monitoring studies of material similar to the proposed dredged material.	G	G	G	G	
- Adequacy of disposal-site sediment and/or water sampling (as concluded from Table 6).	G	G	G	G	
10. Data on the source of the dredged material (e.g., origin and history of the sediment) and known or suspected contaminant sources to the dredged material.	G	G	G	G	
11. Other existing data that are pertinent to the proposed dredged material.	G	G	G	G	
12. Confirmatory analysis (physical, chemical, and biological evaluations -- refer to 1991 Green Book).	G	G	G	G	
13. QA verification of analytical procedures and results, including statistical analyses, if any (as concluded from Table 7).					

N/A: not applicable

Table 2
EPA Evaluator Worksheet for Tier II Marine WQC Compliance and Water-Column Toxicity Data

	Data Acceptable				Comments
	Yes	**No**	**N/A**	**Need More**	
Data for Compliance with Marine WQC					
1. Chemical analysis of sediment and/or elutriate, including	**G**	**G**	**G**	**G**	
- Laboratory methods and individual method detection limits	**G**	**G**	**G**	**G**	
- Analytical results	**G**	**G**	**G**	**G**	
2. Data on elutriate preparation, if any:					
- Sample compositing	**G**	**G**	**G**	**G**	
- Homogenization and sieving methods	**G**	**G**	**G**	**G**	
- Storage method and duration	**G**	**G**	**G**	**G**	
- Elutriate-water source/quality	**G**	**G**	**G**	**G**	
3. List of applicable marine WQC.	**G**	**G**	**G**	**G**	
4. Criteria for selecting appropriate dilution model (e.g., STFATE):	**G**	**G**	**G**	**G**	
- Dilution model input parameters	**G**	**G**	**G**	**G**	
- Disposal site water quality parameters	**G**	**G**	**G**	**G**	
- Disposal site physical descriptions (size, depth, current directions and velocities, etc.)	**G**	**G**	**G**	**G**	
- Disposal operation descriptions (barge type, capacity, discharge rate, speed, course, etc.)	**G**	**G**	**G**	**G**	
- Dredged material descriptions (density, solid fractions, concentrations of contaminants, etc.)	**G**	**G**	**G**	**G**	
- Other project-specific data and assumptions for the model input (type of dredging equipment, incremental rate of discharge, etc.)					

N/A: not applicable

Table 2
EPA Evaluator Worksheet for Tier II Marine WQC Compliance and Water-Column Toxicity Data (continued)

	Data Acceptable				Comments
	Yes	**No**	**N/A**	**Need More**	
5. Dilution model output (hardcopy printout, output analysis and summary)	**G**	**G**	**G**	**G**	
- Maximum predicted concentration of dredged material in the water column outside of the boundaries of the disposal site during and post disposal	**G**	**G**	**G**	**G**	
- Maximum predicted concentration of dredged material in the water column within disposal site bounds after the 4-h initial-mixing period	**G**	**G**	**G**	**G**	
6. Adequacy of the sediment sampling (as concluded from Table 6)	**G**	**G**	**G**	**G**	
7. QA verification of analytical procedures and results, including model input and operation (as concluded from Table 7)	**G**	**G**	**G**	**G**	

N/A: not applicable

Table 3
EPA Evaluator Worksheet for Tier III Water-Column Toxicity Data

		Data Acceptable				Comments
		Yes	No	N/A	Need More	
1.	Data on elutriate preparation:	G	G	G	G	
	- Sample compositing, if any	G	G	G	G	
	- Homogenization and sieving methods	G	G	G	G	
	- Storage method and duration	G	G	G	G	
	- Dilution series and dilution-water source/quality	G	G	G	G	
2.	Chemical analysis of the elutriate, including:	G	G	G	G	
	- Laboratory methods and method detection limits (MDL)	G	G	G	G	
	- Analytical results	G	G	G	G	
3.	Data on treatments:	G	G	G	G	
	- Test species used and justification of selection	G	G	G	G	
	- Test endpoints	G	G	G	G	
	- Distribution of treatments	G	G	G	G	
	- Number of organisms in each treatment at start of test	G	G	G	G	
	- Observations and data recorded during the tests (observed mortality, water-quality measurements, etc.)	G	G	G	G	
	- Number of organisms in each treatment recovered alive at conclusion of test	G	G	G	G	
	- Additional observations (e.g., behavioral abnormalities)	G	G	G	G	
	- Percent survival in the control or the dilution water [mean survival should be 90% or more (70% or more for zooplankton) or test must be repeated]	G	G	G	G	
	- LC_{50} calculation for each sample or project segment	G	G	G	G	
	- Reference toxicants and reference toxicant LC_{50}s for each organism	G	G	G	G	
4.	Criteria for selecting appropriate dilution model (e.g., STFATE).					

N/A: not applicable

Table 3
EPA Evaluator Worksheet for Tier III Water-Column Toxicity Data (continued)

	Data Acceptable				Comments
	Yes	No	N/A	Need More	
5. Dilution model input parameters:	G	G	G	G	
- Disposal site water-quality parameters	G	G	G	G	
- Disposal site physical descriptions (size, depth, current directions and velocities, etc.)	G	G	G	G	
- Disposal operation descriptions (barge type, capacity, discharge rate, speed, course, etc.)	G	G	G	G	
- Dredged material descriptions (density, solid fractions, concentrations of contaminants, etc.)	G	G	G	G	
- Other project-specific data and assumptions for the model input (type of dredging equipment, incremental rate of discharge, etc.)	G	G	G	G	
6. Dilution model output (hardcopy printout, output analysis and summary):	G	G	G	G	
- Maximum predicted concentration of dredged material in the water column outside the boundaries of the disposal site during and post disposal	G	G	G	G	
- Maximum predicted concentration of dredged material in the water column within disposal site bounds after the 4-h initial-mixing period	G	G	G	G	
7. Comparison of predicted concentrations and 0.01 of the LC_{50} for each sample or project segment.	G	G	G	G	
8. Adequacy of the sediment sampling (as concluded from Table 6).	G	G	G	G	
9. QA verification of analytical procedures and results, including model input and operation and any statistical analyses (as concluded from Table 7).					

N/A: not applicable

Table 4
EPA Evaluator Worksheet for Tier III Benthic Toxicity Data

		Data Acceptable				Comments
		Yes	No	N/A	Need More	
1.	Treatment preparation procedures, including:	G	G	G	G	
	- Station identification	G	G	G	G	
	- Sediment compositing	G	G	G	G	
	- Homogenization	G	G	G	G	
	- Sieving	G	G	G	G	
	- Storage	G	G	G	G	
2.	Test species used in tests, and justification of selection.	G	G	G	G	
3.	Test organism data, including:	G	G	G	G	
	- Source of organisms	G	G	G	G	
	- Date of collection (if field collected)	G	G	G	G	
	- Laboratory holding conditions	G	G	G	G	
	- Organism care and feeding	G	G	G	G	
4.	Distribution of treatments within laboratory.	G	G	G	G	
5.	Test apparatus and setup.	G	G	G	G	
6.	Test endpoints.	G	G	G	G	
7.	Number of organisms in each treatment at start of tests.	G	G	G	G	
8.	Observations and data recorded during the tests (observed mortality, water-quality measurements, etc.).	G	G	G	G	
9.	Number of organisms recovered alive at conclusion of tests.	G	G	G	G	
10.	Additional observations (e.g., behavioral abnormalities).					

N/A: not applicable

Table 4
EPA Evaluator Worksheet for Tier III Benthic Toxicity Data (continued)

		Data Acceptable				Comments
		Yes	**No**	**N/A**	**Need More**	
11.	Percent survival in control sediment (mean control survival must be 90% or more or the test must be repeated).	**G**	**G**	**G**	**G**	
12.	Comparison of the dredged material and reference sediment test survival.	**G**	**G**	**G**	**G**	
13.	Reference toxicants and reference toxicant LC_{50}s for each test organism.	**G**	**G**	**G**	**G**	
14.	Adequacy of the sediment sampling (as conclude from Table 6).	**G**	**G**	**G**	**G**	
15.	QA verification of analytical procedures and results, including any statistical analyses (as concluded from Table 7)	**G**	**G**	**G**	**G**	

N/A: not applicable

Table 5
EPA Evaluator Worksheet for Tier III Benthic Bioaccumulation Data

		Data Acceptable				Comments
		Yes	**No**	**N/A**	**Need More**	
1.	Treatment preparation procedures, including:	**G**	**G**	**G**	**G**	
	- Station identification	**G**	**G**	**G**	**G**	
	- Sediment compositing	**G**	**G**	**G**	**G**	
	- Homogenization	**G**	**G**	**G**	**G**	
	- Sieving	**G**	**G**	**G**	**G**	
	- Storage	**G**	**G**	**G**	**G**	
2.	Test species used in tests and justification of selection.	**G**	**G**	**G**	**G**	
3.	Test organism data, including:	**G**	**G**	**G**	**G**	
	- Source of organisms	**G**	**G**	**G**	**G**	
	- Date of collection (if field collected)	**G**	**G**	**G**	**G**	
	- Laboratory holding conditions	**G**	**G**	**G**	**G**	
	- Organism care and feeding	**G**	**G**	**G**	**G**	
4.	Distribution of treatments within laboratory.	**G**	**G**	**G**	**G**	
5.	Test apparatus and setup.	**G**	**G**	**G**	**G**	
6.	Number of organisms in each treatment at start of tests.	**G**	**G**	**G**	**G**	
7.	Observations and data recorded during the tests (observed mortality, water-quality measurements, etc.).	**G**	**G**	**G**	**G**	
8.	Additional observations (e.g., behavioral abnormalities).	**G**	**G**	**G**	**G**	
9.	Reference toxicants and reference toxicant LC_{50}s for each test organism.					

N/A: not applicable

Table 5
EPA Evaluator Worksheet for Tier III Benthic Bioaccumulation Data (continued)

	Data Acceptable				Comments
	Yes	**No**	**N/A**	**Need More**	
10. Depuration procedures (if required).	G	G	G	G	
11. Procedures and results of chemical analysis of tissues from:	G	G	G	G	
- Dredged material tests	G	G	G	G	
- Reference sediment tests	G	G	G	G	
- Control sediment tests	G	G	G	G	
12. Statistical comparison of contaminants in tissues from dredged-material treatments to FDA standards.	G	G	G	G	
13. Statistical comparison of contaminants in tissues from dredged material and reference sediment treatments.	G	G	G	G	
14. Comparison of contaminants in tissues from dredged material to other appropriate values.	G	G	G	G	
15. Adequacy of the sediment sampling (as concluded from Table 6).	G	G	G	G	
16. QA verification of analytical procedures and results, including any statistical analyses (as concluded from Table 7).					

N/A: not applicable

Table 6
EPA Evaluator Worksheet for Determining Sampling and Analysis Plan Adequacy

		Data Acceptable				Comments
		Yes	No	N/A	Need More	
1.	Summary of project specifications, including:	G	G	G	G	
	- Project dimensions	G	G	G	G	
	- Dredging depths	G	G	G	G	
	- Allowable overdepth	G	G	G	G	
	- Side slopes	G	G	G	G	
	- Dredging methods	G	G	G	G	
2.	Summary of all applicable historical data including physical, chemical, and biological analyses of sediments in the project area, and analysis of land uses and other data on possible contaminant loading to project area.	G	G	G	G	
3.	Subdivision of the project area (if applicable) and basis for identification of project segments.	G	G	G	G	
4.	Sampling stations within each segment and method of station selection (objective, worst-case, random, uniform, skewed-random, skewed-uniform, exhaustive).	G	G	G	G	
5.	Navigation/positioning equipment used for sampling.	G	G	G	G	
6.	Record of sediment and water sampling, including:	G	G	G	G	
	- Field preparation	G	G	G	G	
	- Type of station (sediment samples: project, reference, or control; water samples: project or reference)	G	G	G	G	
	- Date, time, tide, and station location	G	G	G	G	
	- Sampling depth and equipment used	G	G	G	G	
	- Sample identification and replicate number	G	G	G	G	
	- Observations made during the sampling operations	G	G	G	G	
	- Sample handling, preservation, and storage procedures/requirements	G	G	G	G	
	- Sample custody and tracking procedures	G	G	G	G	

Table 6
EPA Evaluator Worksheet for Determining Sampling and Analysis Plan Adequacy (continued)

		Data Acceptable				Comments
		Yes	**No**	**N/A**	**Need More**	
7.	Sample composite scheme.	**G**	**G**	**G**	**G**	
8.	Chemical and Biological testing:	**G**	**G**	**G**	**G**	
	- Detection Limits and Methods	**G**	**G**	**G**	**G**	
	- Testing parameters	**G**	**G**	**G**	**G**	
	- Tissue preparation	**G**	**G**	**G**	**G**	
	- Statistical methods	**G**	**G**	**G**	**G**	
9.	QA verification of sampling and sample handling procedures (as concluded from Table 7)					

N/A: not applicable

Table 7
EPA Evaluator Worksheet for Verifying QA Components of Dredged-Material Evaluations

	Data Acceptable				Comments
	Yes	**No**	**N/A**	**Need More**	
General QA Components					
1. QA plan(s), approved and implemented prior to sampling/ analysis, including clear descriptions of:					
- Evaluation/testing objectives	G	G	G	G	
- Technical approach for each task	G	G	G	G	
- Schedule of tasks and products (e.g., collection dates, analysis dates, report dates)	G	G	G	G	
- Data quality assessments/criteria (quality control)	G	G	G	G	
- Sampling and analytical procedures	G	G	G	G	
- Field and laboratory instrument calibration and maintenance procedures	G	G	G	G	
- Sample custody and tracking procedures	G	G	G	G	
- Data documentation, reduction, validation, correction, and reporting procedures	G	G	G	G	
- Performance and system audits	G	G	G	G	
- Responsibilities of major participants					
2. Each sampling organization and testing laboratory:	G	G	G	G	
- Has an established QA program	G	G	G	G	
- Conducts all routine methods according to SOPs	G	G	G	G	
- Participates in inter-laboratory testing/certification program	G	G	G	G	
- Has qualified personnel	G	G	G	G	
- Has adequate facilities and equipment					

N/A: not applicable

Table 7
EPA Evaluator Worksheet for Verifying QA Components of Dredged-Material Evaluations (continued)

Specific QA Checks	Data Acceptable				Comments
	Yes	No	N/A	Need More	
3. Requirements met for:					
- Sample collection	G	G	G	G	
- Sample handling	G	G	G	G	
- Sample preservation, if necessary	G	G	G	G	
- Sample storage	G	G	G	G	
- Sample tracking and custody	G	G	G	G	
- Analytical methods	G	G	G	G	
- Analytical objectives					
4. Documentation of:	G	G	G	G	
- Sample custody and tracking	G	G	G	G	
- Equipment calibration and maintenance	G	G	G	G	
- Data reduction and validation	G	G	G	G	
- Sample processing and analysis	G	G	G	G	
- Performance and system audits	G	G	G	G	
- Corrective actions (if required)					
- Quantitation levels (detection limit actually met)					
	G	G	G	G	
5. Quality Control (QC) Data for Chemical Analyses:	G	G	G	G	
- Replicate analyses	G	G	G	G	
- Analysis of spikes	G	G	G	G	
- Analysis of blanks	G	G	G	G	
- Analysis of standard reference materials (SRM)					
- Detection limit is achievable with confidence					
	G	G	G	G	
	G	G	G	G	
6. QC Data for Biological Tests:	G	G	G	G	
- Control survival	G	G	G	G	
- LC_{50} determinations for SRMs					
- During-test measurements and observations					
- Replicate analyses					

APPENDIX F

COMMENT LETTERS

Texas General
Land Office

David Dewhurst
Commissioner

May 29, 2001

Mr. Sam Becker
U.S. Environmental Protection Division, Region 6
1445 Ross Ave., Suite 1200
Dallas, Texas 78711-2873

Dear Mr. Becker:

The Texas General Land Office has reviewed the April 2001 draft Regional Implementation Agreement for Testing and Reporting Requirements for Ocean Disposal of Dredged Material off the Louisiana and Texas Coasts (RIA). We have no comments regarding the technical aspects of the RIA.

I ask that the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers continue to coordinate the planning of dredged material disposal sites with state and federal resource agencies through the interagency team approach. The Coastal Projects Division of the Land Office is currently evaluating offshore sand sources for potential use for beach re-nourishment for some of our eroding Texas beaches. Perhaps some the information we obtain can be of assistance to your efforts in the future. You may also contact my staff with the Resource Management Program of the Land Office regarding the consistency of proposed dredged material management plans with the goals and policies of the Texas Coastal Management Act.

If you need any additional information regarding this matter you may contact Mr. Ray Newby with the Coastal Projects Division of the Land Office at 512/475-3624 or by email at ray.newby@glo.state.tx.us.

Sincerely,

David Dewhurst

David Dewhurst
Texas Land Commissioner

DD/rn

Stephen F. Austin Building

1700 North
Congress Avenue

Austin, Texas
78701-1495

512-463-5001

The Galveston District has utilized the Interagency Coordination Team approach successfully in the past and will continue to do so in the future. Additional coordination is encouraged by all resource agencies through participation in the District's annual Dredging Conference.

We look forward to coordinating with you in the future.

State of Louisiana

Department of Environmental Quality

M.J. "MIKE" FOSTER, JR.
GOVERNOR

J. DALE GIVENS
SECRETARY

Mr. Sam Becker, Acting Director
Water Quality Protection Division
United States Environmental Protection Agency
Region VI
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

RE: Regional Implementation Agreement, Final Draft, April 2001

Dear Mr. Becker:

We have received and reviewed the above referenced document and offer one comment.

1. The Preface page of the document lists the respective agencies requested to review the Regional Implementation Agreement. The National Oceanic and Atmospheric Administration (NOAA) was not listed as one of the reviewers. As you may be aware, NOAA has developed a set of
2. Screening Quick Reference Tables (SQuiRTs) that list screening concentrations for inorganic and organic contaminants in various media.

We suggest that you consider these values during your evaluation process when determining if the dredged material is suitable for disposal.

We appreciate the opportunity to review the Regional Implementation Agreement.

If you or your staff should have any questions, please contact Mr. Percy V. Harris of the Office of Environmental Assessment/Environmental Technology Division at (225) 765-0355.

Sincerely,

J. Dale Givens
Secretary

pvh

JDG-01-059

OFFICE OF THE SECRETARY P.O. BOX 82263 BATON ROUGE, LOUISIANA 70884-2263
TELEPHONE (225) 765-0741 FAX (225) 765-0746
AN EQUAL OPPORTUNITY EMPLOYER

1) The National Oceanic and Atmospheric Administration has been added to the list in the Preface.

2) The Ocean Dumping regulations require using effects-based bioassay results for determining suitability of dredged materials for ocean disposal and do not allow use of sediment screening values for compliance decisions.

State of Louisiana

6WQ-EM

M.J. "MIKE" FOSTER, JR.
GOVERNOR

JACK C. CALDWELL
SECRETARY

DEPARTMENT OF NATURAL RESOURCES

June 12, 2001

RECEIVED
01 JUN 20 PM 3:36
EPA-SWD-OCD

RECEIVED
01 JUN 21 AM 8:32
CUSTOMS PROTECTION

Sam Becker
Acting Director
Water Quality Protection Divison
U. S. Environmental Protection Agency, Region 6
1445 Ross Avenue, Suite 1200
Dallas, Texas 75202-2733

RE: C20010237, Solicitation of Views
U. S. Environmental Protection Agency
Direct Federal Action
Draft Regional Implementation Agreement (RIA) for testing and reporting requirements for ocean disposal of dredged material of the Louisiana and Texas coasts under the 103 Section of the Marine Protection, Research and Sanctuaries Act, **Gulf Coast of Louisiana**

Dear Mr. Becker:

The above referenced Draft Regional Implementation Agreement has been received and reviewed by this office. We offer the following preliminary comments for your consideration, although a final determination must await your submitting a Consistency Determination for the proposed action.

We are pleased that a Tier I evaluation will be conducted, at a minimum, for all dredged material disposal projects. As I am sure you are aware, the Louisiana Coastal Zone has almost 80 % of this Nation's coastal wetlands, and a large amount of fisheries habitat near the Gulf shorelines where the Ocean Dredged Material Disposal Sites (ODMDS) are located, that need protection from potential pollution sources. Without this Tier I evaluation, and the availability of adequate sediment sample and water quality data, it is not possible to determine with any certitude, the presence or absence of a potential pollution problem, or to make an informed regulatory compliance decision. We feel that the proposed RIA will provide a framework through which we will be able to protect these resources by determining whether or not we have a potential problem.

We would like to note that, as far as we are aware most of our known sediment pollution sources are located far from the ODMDS sites and are not likely to pollute sediments that may be dredged for disposal in the eight Louisiana ODMDS sites. However, to be sure that polluted sediments are not being placed in the ODMDS sites, we believe periodic sampling and monitoring of sediments and water quality is imperative, and we recommend this testing be required every five years.

COASTAL MANAGEMENT DIVISION P.O. BOX 44487 BATON ROUGE, LOUISIANA 70804-4487
TELEPHONE (225) 342-7591 FAX (225) 342-9439
AN EQUAL OPPORTUNITY EMPLOYER

We concur.

The RIA currently recommends that data greater than 5 years old may not be adequate to conduct dredged material evaluations.

If you should have any questions concerning this matter, please contact Jeff Harris of the Consistency Section at (225)342-7949.

Sincerely,

Terry W. Howey,
Administrator

TWH/JH/bgm

cc: Jack Caldwell, Secretary
Fred Dunham, LDWF
Ronald J. Ventola, COE-NOD
Richard Hartman, NMFS
Larry Wiesepape, LDEQ

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506

May 29, 2001

Mr. Sam Becker
U.S. Environmental Protection Agency
Acting Director
Water Quality Protection Division
1445 Ross Avenue, Suite 1200
Dallas, Texas 75202-2733

Dear Mr. Becker:

Please reference your May 10, 2001, letter requesting our review of the final draft "Regional Implementation Agreement for Testing and Reporting Requirements for Ocean Disposal of Dredged Material Off the Louisiana and Texas Coasts under Section 103 of the Marine Protection, Research and Sanctuaries Act." The following comments are submitted in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

1. Section 5.5. Reference and Control Sediments. Control Sediment. Second Paragraph. Page 17 - It is indicated (and again in Section 9.3.3 Data Analysis. page 24) that a bioassay test should be repeated if mortality/abnormality exceeds 30% in a zooplankton toxicity test. The 1990 Draft Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters, the "Green Book," in contrast, (page 10-13) states "If less than 10 percent mortality (20 percent for zooplankton and larvae) occurs in the control treatment for a particular test species, the data for that species may be evaluated," (i.e., those data are considered to be valid). The Inland Testing Manual (ITM) lists similar percentages for acceptability of bioassay results. The standard for mortality in a control is generally accepted to be 10%, except for amphipod bioassays in which 20% mortality is acceptable. Thus it appears that the 30% zooplankton mortality threshold is excessive and fails to follow that recommended in related guidance. We recommend that the subject portions of the document be revised to incorporate, at a minimum, the 20% threshold for consistency.

2. Table 2 Contaminants of Concern. page 20 - Several aroclors are listed under PCBs, but are absent from Appendix C.

10.3.3 Bioaccumulation Evaluations - This section places substantial credence on Food and Drug Administration (FDA) action levels (when they are available) in evaluating dredge site sediment

1) The Green Book was finalized in 1991, entitled *Evaluation of Dredged Material Proposed for Ocean Disposal-Testing Manual* (EPA-503/8-91/001), and recommends a 30% threshold for mortality in zooplankton for water column impact assessments (pg. 11-6)

2) Appendix C has been corrected to include the appropriate detection limits.

contaminant concentrations. FDA levels were promulgated to evaluate contaminant levels in various food items for human consumption. We recommend that this section be revised to incorporate more appropriate criteria for evaluating ecological risk to aquatic biota, such as the threshold effects levels (TELs), probable effects levels (PELs), effects range low (ERLs), and effects range median (ERMs) presented in the National Oceanic and Atmospheric Administration's Screening Quick Reference Tables (SquiRTs), which can be viewed at http://response.restoration.noaa.gov/cpr/sediment/squirt/html.

3.

4.

The Service appreciates the opportunity to review the final draft RIA. and encourages the Environmental Protection Agency to utilize appropriate ecological risk-based criteria when evaluating dredged sediments for ocean disposal in the future. If any further assistance is required, please contact Paul Conzelmann of this office at (337)291-3126.

Sincerely,

Russell C. Watson
Acting Field Supervisor

cc: FWS, Atlanta, GA (ES/HC)
USCOE, New Orleans, LA
NMFS, Baton Rouge, LA
NOAA, Dallas, TX
LDEQ, Baton Rouge, LA
LDWF, Baton Rouge, LA

3) The Green Book recommends utilizing FDA action levels as numerical screens for evaluating bioaccumulation potential. The sediment screening values mentioned here (e.g. ERL/ERM) are intended to evaluate the potential for acute toxic effects rather than bioaccumulative impacts. In addition, the Ocean Dumping regulations require using effects-based bioassay results for determining suitability of dredged material for ocean disposal and do not allow use of sediment screening values for compliance decisions.

4) The current science of dredged material evaluations is moving toward risk based evaluations. Some currently available examples are outlined in Section 11 of the RIA.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southeast Regional Office
9721 Executive Center Drive N.
St. Petersburg, Florida 33702

May 30, 2001

6WQ-E

Mr. Sam Becker
Acting Director
Water Quality Protection Division
US Environmental Protection Agency
Region 6
1445 Ross Avenue, Suite 1200
Dallas, Texas 75202-2733

Dear Mr. Becker:

As you requested in your letter dated May 10, 2001, the National Marine Fisheries Service (NMFS) has reviewed the draft version of the revised Regional Implementation Agreement (RIA), Ocean Dredged Material Disposal Program, dated April 2001. The RIA establishes administrative, coordination and documentation procedures, in addition to sampling, testing, and analytical procedures, that will be followed by the U.S. Army Corps of Engineers, New Orleans District and Galveston District and Environmental Protection Agency Region 6 in evaluating dredged materials proposed for ocean disposal at any of the eighteen (18) Marine Protection Research and Sanctuaries Act, Section 102(c) Ocean Dredged Material Disposal Sites along the Texas and Louisiana coasts.

The NMFS has no comments on this well organized and detailed testing manual. We appreciate the opportunity to offer our comments and if you have any questions, please call Mr. William Jackson at our Galveston Field Office at (409) 766-3699.

Sincerely,

Andreas Mager, Jr.
Assistant Regional Administrator
Habitat Conservation Division

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO ATTENTION OF:

August 13, 2001

Operations Division
Technical Support Branch

Mr. Sam Becker
Acting Director
Water Quality Protection Division
Environmental Protection Agency
1445 Ross Avenue
Dallas, TX 75202-2733

Dear Mr. Becker:

We have reviewed the revised Regional Implementation Agreement (RIA), dated April 2001, which complements the national guidance manual, *Evaluation of Dredged Material Proposed for Ocean Disposal – Testing Manual* (Green Book). Our Engineer Research and Development Center also reviewed the document and provided comments as follows:

a. GENERAL COMMENTS

1. An advantage of a regional guidance is the region specific issues may be included. Other regional guidance documents have been developed such as the PSDDA Guidance and Great Lakes Guidance. These documents have included regional specific issues that have not been included in the Region 6 document. An example of an issue that should be included is the development of a regional list of Contaminants of Concern. Inclusion of a list of contaminants of concern would eliminate the need to analyze contaminants that are on the national list of priority pollutants. These regional issues would be good to include, therefore we suggest reviewing these other regional guidance documents to identify areas where additional regional guidance could be included.

b. SPECIFIC COMMENTS

1. Page 4, Figure 1 - The bottom two boxes should be split. Remove suitability the two boxes and make the option for the EPA to concur or not concur with the determination independent of its suitability for ocean disposal. In other words, make one box that indicates the EPA concurs and one that EPA does not concur. From each of these, have one box that states the material is suitable for ocean placement and one that states the material is not suitable for ocean placement. This suggested modification of Figure 1 is included as an attachment.

2. Page 6, last line - Eliminate the last sentence because it is not always true. If the material is excluded there is no need for a bioassay.

A1) The RIA includes a list of Contaminants of Concern (Table 2) and language that addresses expanding or reducing the COC list on a project specific basis.

B1) The recommended changes to Figure 1 have been incorporated.

B2) This sentence has been clarified.

3. Page 12, bullet 1 - Include a line that indicates that COCs should be identified.

4. Page 13-14 - Eliminate the four approaches and make a statement that you should collect as much material that is necessary for the analysis. As it is listed, it endorses an approach that is a tiered collection (i.e., 1st collection is for chemistry, 2nd collection is for bioassays). This approach should be avoided because the material can be very different at each collection time making the interpretation very difficult.

5. Page 15 - Clean techniques are expensive and we would suggest they be used for water alone. Sediments will have a background concentration of metals that does not require clean analysis.

6. Page 17, 1st paragraph - What is the point reference? It is not clear what this is and why it is brought up here. Maybe eliminate it?

7. Page 17, Control Sediment - Use wording from the ITM or OTM to describe control sediment. We recommend the following wording:

> " Control sediment is distinguished from the reference because it is collected from the site where the test species were collected or it is the material that the organisms are cultured in the laboratory. The control sediment is used to confirm the health of the organisms during the bioassay tests and to validate the test protocol as part of the laboratory QA/QC program. The control sediment should . . ."

8. Page 20 - Identify regional contaminants of concern. We assume there are particular chemicals that are a routine problem for Region 6 (i.e., PAHs) while some may not be a problem.

9. Page 21, last paragraph - Change "The liquid phase is the supernatant . . ." to "The dissolved phase is obtained by filtering or centrifuging the supernatant and is used . . ."

10. Page 25, Last bullet - Eliminate "and disposal of the dredged material is not supported." The placement of the material can still be done; it may just require management as indicated in the next sentence.

11. Page 26, bullet 2 - The approach of eliminating COCs from the analysis during the bioaccumulation test is, appropriate, progressive and will save money during the evaluation.

12. Page 33, last paragraph - Move the discussion of the CBR approach to the interpretation of bioaccumulation data. Then discuss ecological risk assessment approaches that would include evaluating other ecological receptors, food webs, additional exposure pathways, and comparative risk analysis of other placement options.

13. Page 52 and 53 - Include a description of the site, physical characteristics of the sediment, and water conditions (salinity). This would provide one to more easily identify the appropriate reference for his or her project.

B3) This recommendation has been incorporated.

B4) The entire Section 5.3 Sampling Approach has been revised.

B5) The discussion on clean techniques has been clarified to apply to collection and analysis of metals in water samples only.

B6) The reference point is discussed in Section 3.1.2 of the Green Book. The RIA clarifies that this approach is not recommended in this Region.

B7) The recommended revisions have been incorporated.

B8) We agree that for the existing Ocean Dumping projects, certain classes of contaminants are not routinely a problem. We are hesitant however to create site specific lists in the event that other applicants besides the USACE use the sites in the future. We prefer to create project specific COC lists.

B9) The term liquid phase, rather than dissolved fraction, is used throughout the Green Book and the Ocean Dumping regulations.

B10) The sentence has been clarified.

B11) The entire Section 10.1 has been removed.

B12) Section 11 is intended to apply to assessment of risk in interpreting bioaccumulation data, and CBR is one of several approaches discussed.

B13) Reference area locations have already been determined for each ODMDS. A table of reference area locations and maps of each area and ODMDS are included in Appendix D.

We suggest that we teleconference with the Galveston District and your office to discuss resolution of these and any other comments received on the document.

It has been a pleasure working with Ms. Monica Young of your Ecosystems Protection Branch on the revision of this RIA. Ms. Young is extremely knowledgeable in all aspects of ocean disposal and in particular in interpreting the regulations as they relate to dredged material evaluation. She is to be commended for her work in the ocean disposal arena.

Sincerely

Linda G. Mathies

Linda G. Mathies, Ph.D.
Chief, Environmental Function

Copy furnished w/attachment:

Ms. Monica Young
Ecosystems Protection Branch (6WQ-EM)
Environmental Protection Agency
1445 Ross Avenue
Dallas, TX 75202-2733

EPA has been closely coordinating all revisions with both the Galveston District and New Orleans District.

Office of Water
Office of Wetlands, Oceans, and Watersheds
Oceans and Coastal Protection Division

AUG 27 2001

MEMORANDUM

SUBJECT: Review of Region 6 Draft Regional Implementation Agreement for the Testing and Reporting Requirements for Ocean Disposal of Dredged Material

FROM: Suzanne Schwartz
Director
Oceans and Coastal Protection Division, HQ

TO: Sam Becker
Acting Director
Water Quality Protection Division (6WQ)

Thank you for the opportunity to review the draft version of the revised Region 6 Regional Implementation Agreement, dated April 2001, which complements the national guidance manual, known as the Green Book (*Evaluation of Dredged Material Proposed for Ocean Disposal – Testing Manual*).

We are very pleased with the efforts that Region 6 has put forth in establishing a consensus-based process and close working relationship with both the New Orleans and Galveston Districts through the development of the RIA. We have provided several specific edits for your consideration (see attachment). In addition to the specific edits, there is a more general issue raised in the RIA that concerns us and may require discussion between our staffs. This issue pertains to Inland Testing Manual (ITM) references. We recommend further consideration as to when the ITM can be referenced because it is not the appropriate testing manual for evaluating the suitability of dredged material proposed for ocean disposal. We do recognize that sections of the ITM may be a helpful reference where techniques and approaches of both the ITM and the Greenbook overlap, and the ITM can provide more updated, technical information. However, references to the ITM for other reasons are not appropriate because the two dredged material management regulatory programs have several significant differences. For example, the "reason to believe" concept applies only to the CWA Section 404 program and the ITM. It does not apply to ocean dumping. Therefore we recommend deleting it from the RIA.

If you have any questions, please feel free to contact me or David Lopez (202) 260-9179, who will be the acting Chief for the Marine Pollution Control Branch until the end of September. Thank you again for including us in the review.

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The RIA has been revised to clarify that only certain technical sections of the ITM (e.g. sampling approach, quality assurance considerations, and statistical analyses) are more technically advanced and should be used. In the discussion of Tier I evaluations all references to the ITM and "reason to believe" have been removed.

Regional Implementation Agreement
Region 6
HQ Comments/Edits

*Note: The following comments are prepared in redline/strikeout.

p. ii, Glossary of Terms

1. Acute Toxicity – The second sentence of this definition should read as follows: "The acute toxicity of contaminated sediment is ... under either field or laboratory conditions, for a specified ~~project~~ period."

2. Bioaccumulation – "The accumulation of contaminants in the tissue of organisms ... contaminated water, sediment, or pore water ~~or dredged material.~~"

3. Data Quality Objectives – "Qualitative and quantitative statements of the overall uncertainty that a decision maker is willing to accept in results or decisions ~~derives~~ derived from environmental data."

4. The definition for **Dredged Material Elutriate** should come before **Effects range-low (ER-L) and Effects range-~~median~~ medium (ER-M).**

   Effects range-low (ER-L) and Effects range-~~median~~ medium (ER-M) – ...

5. p. iii, Inland Testing Manual (ITM) – "Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual ... Section 404 of the Clean Water Act (inland waters, near coastal waters, and surrounding environs – all waters other than the ocean and the territorial seas, regulated pursuant to Section 404 CWA) through ..."

6. p. iv, Marine Protection Research and Sanctuaries Act (MPRSA) – "Enacted by Congress in 1972 ... or the London ~~Dumping~~ Convention of 1972..."

7. Reference Sediment – "A sediment, substantially free of contaminants, that is as similar as practical..."

8. Solid Phase – The second sentence should read as follows: For the purposes of the RIA, solid phase refers to the whole sediment as defined in the Green Book which includes the material that would settle in one hour."

9. p. v, Target Detection ~~Level~~ Limit (TDL) – **Note: Throughout the manual TDL is referred to as the target detection level. Please make a global change throughout the document of target detection level to target detection limit.

1) The sentence has been corrected.

2) The sentence has been corrected.

3) The description of Data Quality Objectives has been revised.

4) All references to Effects range-low and Effects range-medium screening values have been removed from the RIA.

5) This recommendation has been incorporated.

6) The sentence has been corrected.

7) The sentence has been corrected.

8) This recommendation has been incorporated.

9) This recommendation has been incorporated throughout the document.

10. p. vi, **List of Acronyms**, TDL – Target Detection ~~Level~~ Limit

11. p. 1, Section 1.2, **Purpose**, please add the following as the last sentence of the first paragraph: "This document is intended to serve as guidance to implement the MPRSA and its implementing regulations at 40 CFR 220-229.

12. p. 2, Section 2, **Applicability**, we recommend the sentence in this section to read as follows: "This document applies to all activities involving the transportation of dredged material for the purpose of disposing it in ocean waters and is applicable to dredging activities authorized or permitted by the USACE and navigational projects constructed and maintained by the USACE."

13. p. 2, Section 3, **Administrative Process**, we recommend the 2nd sentence to read as follows: "In accordance with Section 103 of MPRSA, the USACE is the permitting authority for dredged material disposal, subject to EPA review and concurrence."

14. p. 6, Section 4.2, **Tier I Existing Information**, the last sentence of the paragraph should read as follows: "If no bioassay data exists for a proposed dredging project which does not meet the exclusionary criteria, ~~it will be necessary to conduct~~ Tier III bioassay tests will be conducted." Please add the following sentence at the end of the same paragraph: "Data used to make a decision in Tier I must meet the current testing requirements as discussed in this manual, i.e., species used, analytical methods."

15. p. 7, Figure 2, we recommend the following edit to the title: "Overview of Tiered Testing Approach"

16. p. 8, Section 4.3, **Tier I Exclusionary Criteria**, the second sentence should read as follows: "Information on the proposed dredging site ~~and reference site~~, sediment grain size..."

17. p. 9, we recommend the following as the first sentence of the page: "1) ~~The existing information is sufficient to make a decision on environmental acceptability of the dredged material *AND* ...~~ The dredged material meets..."

18. p. 10, first paragraph of that page, the 4th sentence makes reference to Table 1 in Section 8. It's actually Table 2 in section 8.

19. p. 14, the first full paragraph, delete the last sentence which reads as follows: "~~For sampling approach 2, biological testing can proceed without re-analysis of sediment chemistry; however, samples for the biological testing must be taken from the same stations as the sediment chemistry samples.~~"
Please add the following sentence at the end of that same paragraph: "Sediment collected for bioassays and other tests should be collected at the same time – not months apart – in order to meaningfully compare the biological and chemical data."

10) The sentence has been corrected.

11) This section has been clarified. A reference to the regulations (40 CFR 220-229) was added.

12) This section has been revised and reflects the changes recommended.

13) This recommendation has been incorporated.

14) This section has been revised and reflects the changes recommended.

15) This recommendation has been incorporated.

16) The sentence has been corrected.

17) The recommendation has been incorporated.

18) The sentence has been corrected.

19) The entire section 5.3 Sampling Approach has been revised.

20. p. 18, Section 7, **Dredged Material Evaluation**, the second paragraph, second sentence, should read as follows:
"If no acceptable biological effects-based data exist for a proposed dredging project and ~~there is reason to believe that contaminants are present in the sediments~~ it does not meet the exclusion criteria then biological effects-based bioassays ~~must~~ will be conducted to determine regulatory compliance."

21. The last sentence of that paragraph which continues onto p. 19 should read as follows:
"For most projects, the impact of the solid phase on the benthic environment deserves the most rigorous evaluation, because the dredged material that is deposited on the sea floor usually has greater potential to ~~causes greater~~ impact to a smaller area..."

22. Please add the following sentence as the last sentence of the first full paragraph on p.19 (the last paragraph of the **Dredged Material Evaluation** section):
"In the meantime, an evaluation of bioaccumulation potential is used to assess the potential for chronic effects."

23. p. 19, Section 8.2, **Chemical Analysis**, subsection **Contaminants of Concern**, the first sentence should read as follows:
"Table 2 lists potential contaminants of concern ..."

24. p. 21, we recommend the first full paragraph to read as follows:
~~"The dredged material shall be analyzed for compounds identified as COC and compounds known or suspected of being present at the dredging site.~~ If no sediment chemistry data exist for a dredging project ~~and there is no reason to believe that contamination of the dredged material might exist,~~ analysis for the complete list of COC in Table 2 ~~is required~~ will be performed."

25. p. 26, Section 10, **Benthic Evaluations** and Secion 10.1, **Theoretical Bioaccumulation Potential (TBP) Tier II**, We recommend the following edits to these sections:

10. BENTHIC EVALUATIONS

Benthic evaluations are required to determine compliance with the LPC of the solid phase (40- CFR 227.27(b)) of the dredged material. These evaluations include assessment of toxicity of the dredged material to appropriate sensitive benthic marine organisms and an evaluation of the bioaccumulation potential of the COC in the proposed dredged material. An initial screen of the dredged material may be performed for estimating the potential of non-polar organics to bioaccumulate using a theoretical bioaccumulation potential calculation. However, tier III bioaccumulation bioassays also will be performed to determine if the dredged material is suitable for ocean disposal.

20) This recommendation has been incorporated.

21) This sentence has been revised.

22) This paragraph has been revised.

23) This recommendation has been incorporated.

24) This recommendation has been incorporated.

25) The entire Section 10.1 has been removed. Reference to TBP is included in the introductory paragraph of Section 10 and states that TBP may not be used to make regulatory decitions in absence of bioassay tests but may be used as a screening tool to re-evaluate the need for ocean disposal in an effort to avoid Tier III bioassay costs.

10.1 Theoretical Bioaccumulation Potential (TBP)–Tier II. Currently, only the potential bioaccumulative impact of non-polar organic compounds in dredged material on benthic organisms can be evaluated at Tier II. The procedure calculates the TBP for a test organism by factoring the concentration of the COC in the test sediment and reference sediment, the total organic carbon in the sediment, and the lipid content in the organism. Chemical analysis of the dredged material and reference sediment is required for the Tier II TBP procedure (Table 1). Section 10.2 of the Green Book provides a detailed description of the TBP calculation.

The following points shall be considered when calculating the TBP:

- If the TBP value calculated for the test sediment is greater than that calculated for the reference sediment, bioaccumulation of that non-polar organic COC is predicted and further bioaccumulation testing at Tier III is necessary. At this point, other disposal alternatives may be considered to avoid Tier III bioassay costs. ~~The TBP calculation~~ Evaluation of bioaccumulation potential alone is not sufficient for determining suitability of the dredged material for ocean disposal; evaluation of the water column impacts and toxicity of the solid phase must also be conducted. In addition, the remaining applicable subparts of sections 40 CFR must be analyzed (40 CFR 227 Subparts B, C, D, E, G and 228.4(c)).[[Moved below.]]

- ~~If the TBP value calculated for the test sediment is less than that calculated for the reference sediment, then bioaccumulation is not predicted for that particular non-polar organic COC. This may eliminate the need for further testing of these COC at Tier III and reduce costs.~~ Even where the TBP value calculated for the test sediment is less than that calculated for the reference sediment, the Tier III bioaccumulation test will be conducted for these COC. Furthermore, if ~~I~~f additional COC, other than non-polar organic compounds, such as polar organics and metals, are detected in the sediments, the Tier III bioaccumulation test ~~must~~ will be conducted and tissues analyzed for those compounds. ~~The TBP calculation~~ Evaluation of bioaccumulation potential alone is not sufficient for determining the suitability of the dredged material for ocean disposal; evaluation of the water column impacts and toxicity of the solid phase must also be conducted. In addition, the remaining applicable subparts and sections of the 40 CFR must be analyzed (40 CFR 227 Subparts B, C, D, E, G and 228.4(c)).[[Moved below.]]

In either case, ~~The TBP calculation~~ evaluation of bioaccumulation potential alone is not sufficient for determining suitability of the dredged material for ocean

26. disposal; evaluation of the water column impacts and toxicity of the solid phase must also be conducted. In addition, ~~the analyses required by other remaining applicable subparts of sections 40 CFR must be analyzed~~ provisions of the regulations (including 40 CFR Part 227 Subparts B, C, D, E, and G and section 228.4(e)) must be performed.

OK

26) The recommended revisions to the other applicable provisions of the regulations has been incorporated throughout the document.

27. p. 28, the footnote for *Mulinia lateralis* (on p.27) which is printed at the top of p. 28 should be deleted:

~~[+]Draft method available from EPA, Region 6 of EPA Narragansett Laboratory; could possibly substitute with Quahog, *Mercenaria sp.*~~

27) The footnote was deleted. The Mulinia procedure was incorporated as a reference document in the text.

28. p. 28, please substitute the red-lined sentence as the first sentence of the second bullet: "~~If survival in the dredged material treatments is greater than the reference sediment treatments, or no more than 10% (20% for amphipods) lower than the reference sediment treatment, the LPC for benthic toxicity has been met.~~ If mortality in the dredged material is statistically greater than in the reference sediment and exceeds the mortality in the reference sediment by at least 10% (20% for amphipods), the dredged material exceeds the LPC for benthic toxicity."

28) This section has been revised.

29. p. 28, Section 10.2.3, **Data Analysis**, delete the third bullet: "~~If the difference between survival in the dredged material treatments and the reference sediment treatments is greater than 10%...~~"

29) This section remains unchanged.

30. p. 30, the third paragraph, first sentence should read as follows: "Tissue concentrations of test organisms ~~may~~ should be measured prior ..."

30) The recommendation has been incorporated.

31. p. 31, the third bullet should read as follows: "If the contaminants concentrations in tissues exposed to sediment from the dredging site do not statistically exceed the contaminant concentrations in tissues exposed to the reference sediment, the bioaccumulation LPC for the solid phase is met."

31) The recommendation has been incorporated.

32. p. 31, It is not clear how a compliance decision can be made without using factors 5 through 8 along with factors 1 through 4. For this reason, we recommend listing all eight factors without group distinctions. However, factor # 9 could remain separate as was presented in this manual.

32) The recommendation has been incorporated.

33. p. 34, first bullet under section 12. Emergency Procedures: We recommend specifying a time within which the District must notify EPA of an emergency situation (e.g., within 24 hours) rather than "as soon as possible."

33) A time frame was specified for notification of emergencies.

34. p. 40, under section **Exclusionary Criteria, Tier I**, the first sentence should read as follows: "Information on the proposed dredging site ~~and reference site,~~ including sediment grain size ..."

34) This sentence was corrected.

Response to Comments
Peer Review of Regional Implementation Agreement
August 13, 2002

Reviewer #1 Comments

The document is satisfactory overall, however, there are two things the EPA/USACE might want to consider:

1. Section 7. Dredged Material Evaluation (in the last paragraph) notes that 40 CFR 227.27(b) requires that both acute and chronic toxicity effects of dredged material be measured and further comments that a chronic toxicity method based on Leptocheirus has been developed and is currently available. Although neither the Green Book nor the ITM currently address chronic toxicity, it seems clear that the regulations require it and that sometime in the future the programs will have to implement chronic toxicity evaluation. It would be really "forward-thinking" if the agencies could foresee this eventuality and elevate Leptocheirus from it's current status as an alternate species to a recommended species. This could be the driver needed to wean the agencies away from Ampelisca abdita (BTW, did you know the latter part of the binomial is latin for "the devil's bug?").

Response: The RIA was revised to state that either amphipod Ampelisca or Leptocheirus is recommended for benthic toxicity evaluations.

2. The RIA should provide guidance for dealing directly with confounding factors, such as ammonia and/or hydrogen sulfide, when there is toxicity and evidence of >1 TU of such constituents in the sediments. Currently, the ITM suggests that whole sediment TIE procedures could/should be employed to answer some of these questions and I generally concur; however, when there is strong weight-of-evidence for ammonia toxicity to an ammonia-sensitive organism but no toxicity to an ammonia-insensitive organism in a companion test (as in the recent Bayou Segnette project for the New Orleans District), there is no need to perfom expensive TIE tests to prove ammonia toxicity and, as you know, there is generally no contractual basis for doing so either. It would be very useful, and time- and money-saving everyone, if the RIA could simply state that there is no need for TIEs if the weight-of-evidence supports a claim for a single-causative toxicant, such as ammonia or hydrogen sulfide, whose effects would be minimal or non-existent following open water disposal of the subject dredged material.

Response: The RIA was revised to state that causes of test failures in the control sediments should be identified (e.g. grain size sensitivity, pH and ammonia) and addressed appropriately.

Reviewer #2 Comments

1. In general I felt the manual was well written and useful for EPA and the Corps as a condensed summary of the national manuals. I would turn to your manual to assist a novice in understanding the complexities of the national manuals. Several places in the manual discuss state WQ requirements and use of the ITM. It is difficult to separate 103,404, and 401

requirements. You never discuss distances to sites in this manual, but I am assuming that WQ Certification is necessary for some or all of your sites. With the proposed national level effort to combine the OTM and the ITM, I would strongly recommend that your manual also be a joint manual for both 404 and 103 evaluations. If the states requirements could be incorporated and agreed to, I feel you would have a true regional manual. That said I will offer up several suggestions that I feel would make your efforts more regional and make the document more user friendly to permit applicants and the states.

Response: Our manual is intended as guidance on implementing the ocean dumping testing procedures recommended in the national guidance and not on the process of regulating dredged material disposal.

2. In general it is unclear to me any advantage of this manual over using the national manuals. A regional manual should develop COC lists for specific projects , sub-regions and/or the entire region. Sampling and analysis requirements should be established in the manual so applicants know what to expect and budget for. The only regionalization I saw in this manual was the establishment of reference areas, which you are to be commended for, but this should have been followed by a discussion of the region's dredging projects and recommendations on which sites should be used for them under what conditions. I also recommend that state WQ Certification requirements be included in the discussion. I believe a regional manual should act as the guide to the process to applicants, state personnel , and new federal agency employees. Our NW Regional Manual has served us well be making the States of Washington and Oregon signatory to the document.

Response: As currently presented the COC list is intended to serve as a starting place for identifying project specific contaminants. Due to the nature of the coastline in our Region, we are hesitant to create site specific lists based solely on information from one project currently utilizing the ODMDS in the event that other applicants besides the USACE use the sites in the future. In addition, we have regionalized our species lists for bioassays. Our manual is intended as guidance on implementing the testing procedures recommended in the national guidance and not on the process of regulating dredged material disposal.

3. Page iv: The only place LPC is defined as to what it is and how to use it is in this Glossary. Because this value is interwoven throughout the document I would suggest that there be a more general discussion of what it is and how it is used. Perhaps you could provide a list of the values in the appropriate place in the report.

Response: A section has been added to the document addressing LPC and defining LPC for the three phases.

4. Page 1: This page discusses both national manuals and reasons for needing both. If there are reasons for not making this manual for both 404 and 103 they should be discussed here. sec 1.3: subject to review should be discussed. Is this a public review with public notice.

Response: This document is not intended to serve as a joint CWA/MPRSA document. References

to the ITM are limited to technical guidance that is more up-to-date than that provided in the Green Book (e.g. statistical analyses, QA/QC). The review discussed is intended to be by the public, the document has been revised to reflect this.

5. Page 2, sec 2: It should be discussed here why it is only for 103, it is unclear to me why it can not be used for 404 evaluations and what the role of the states are, if WQ cert. is needed within the three mile overlap of the two laws.

Response: Our manual is intended as guidance on implementing the ocean dumping testing procedures recommended in the national guidance and not on the process of regulating dredged material disposal.

6. Page 2 and 3 sec 3: This report should also be an applicants guide to the process. It should be something with enough detail that they can understand what is required of them. The 103 process is more than a sediment evaluation. The process should be discussed and perhaps a case study be included as an appendix.
sec 3.1: Our region has had difficulty agreeing on what constitutes a completed permit application this term should be defined in your report. sec 3.2: In our region as a matter of comity we obtain state WQ certification for 103 actions. It is confusing to me why the states role is not discussed here.

Response: Our manual is intended as guidance on implementing the ocean dumping testing procedures recommended in the national guidance and not on the process of regulating dredged material disposal.

7. Page 5: Because of the general nature of the requirements in the manual and the discretion EPA has in determining adequacy of information, it doesn't appear to me that 3 months in sufficient time to conduct additional test that might be required by EPA. If EPA requires additional chemical analysis or bioassays or Bioaccumulation tests 3 months is not enough time to get additional samples collected and results back.

Response: Both EPA and the COE have agreed that the three month time frame is adequate.

8. Page 6: The states of Louisiana and Texas were ask to provide comments and their letters are appended to the report. Their role and purpose of requesting comments from them is not discussed in the report. this page would be a good place to discuss the states role.

Response: The States were included in a technical review of the testing requirements along with the other resource agencies that have some responsibility for dredged material management. Again, our manual is intended as guidance on implementing the ocean dumping testing procedures recommended in the national guidance and not on the process of regulating dredged material disposal.

9. Figures 1 and 2 are the first place LPC is used, other than in the Glossary. The term should be discussed and its importance to the process pointed out before it is abbreviated on these

figures.

Response: A section has been added to the document addressing LPC and defining LPC for the three phases.

10. Page 8 sec 4.3: Predominantly sand has to be defined it is critical to the assessment process. Later in the report it is discussed it will be determined on a case by case bases. This will not be acceptable to applicants. a regional definition is necessary as the bases for all decisions that follow.

Response: We believe, as with determination of COC, that predominantly sand determinations should be made on a case-by-case basis.

11. Pages 8,9, and 10: LPC is used extensively as a decision tool in this discussion. Because of this I strongly recommend that a discussion of how, what, and why and the importance of LPCs be discussed.

Response: A section has been added to the document addressing LPC and defining LPC for the three phases.

Page 9: sec 4.5: Protocols should be defined in this manual not case by case in each projects sampling plan. The plan should reflect protocols agreed to by all the parties subject to this manual which are full reviewed and public noticed. Also COCs can be and should be agreed to up front for each general project area. The national list should be adjusted for chemicals known not to be in the area or additional chemicals not on the national list. It seems to me that the states should also play a role in making up regional/subregional COC lists.

Response: We agree. The section has been clarified to state that sediments should be collected and analyzed according to the approved sampling and analysis plans. As currently presented the COC list is intended to serve as a starting place for identifying project specific contaminants and states that this list should be adjusted for the specific project. Due to the nature of the coastline in our Region, we are hesitant to create site specific lists based solely on information from one project currently utilizing the ODMDS in the event that other applicants besides the USACE use the sites in the future.

12. Page 12. Requirements for a SAP can be developed for this manual. Applicants in the NW know how many individual and composite samples will be needed based on the dredging volumes and where the samples should be collected within the dredging prism. Recommend that the manual be more specific into the numbers types and locations of the samples required, and not make it a case by case decision.

Response: This approach is not appropriate for our Region due to the large nature of the projects.

13. Page 19: The logic of adding chemicals to the National COC list should also be used to

remove chemicals from the list. If the dredging location is in a pristine natural bay chances of manufacturing chemicals be present a remote. They could be removed from the list. The analysis of all National COCs is expensive and time consuming and chemical should be eliminated when ever possible, to reduce the monetary burden to the applicant.

Response: As currently presented the COC list is intended to serve as a starting place for identifying project specific contaminants and states that this list should be adjusted for the specific project. Due to the nature of the coastline in our Region, we are hesitant to create site specific lists based solely on information from one project currently utilizing the ODMDS in the event that other applicants besides the USACE use the sites in the future.

14. Page 20: sec 9: Here is another example of discussion of state WQ Standards, but no discussion here or elsewhere as to why this is necessary or the role of the states. Page 22 also specifically discussed Texas and Louisiana standards but not why they are being used.

Response: The reference to the State Standards is necessary to show compliance with the regulatory requirement of meeting water quality criteria (the LPC for the liquid phase). A section has been added to the document addressing LPC and defining LPC for the three phases.

15. Page 29: The manuals discussion of the tiered testing procedures is good and appears to fully comply with the national manuals. The statement at the bottom of page 29 is however troubling. "in some cases, however it may be desirable to analyze tissues for compounds not detected in the sediments" this statement if true must be supported.

Response: In our Region we have occasionally encountered project specific contaminants that are a concern to the public but which may not have been detected in the sediments and thus are included on the COC list for tissue analyses.

16. Appendix A If this is indeed a 103 evaluation process or part of one. it should reference that fact. It appears that the two Corps districts should also be discussed and their role in the process. As written this appendix puts EPA in sole control.

Response: The Appendix has been clarified to reflect that the 103 evaluative process is a joint process between the USACE and EPA

<u>Reviewer #3 Comments</u>

1. The Agreement is well-organized and covers the issues very well; I found it generally easy to interpret, which is always helpful in a guidance document!

Response: We appreciate the comment.

2. Some areas that could be clarified:

a. Sec. 4.6 (2); it is unclear whether dredged material must meet all three criteria to be eligible for ocean disposal;

Response: This section has been clarified to state that the dredged material is not compliant if it does not meet any one or more of the three phases.

b. Sec. 9.3.2; other species used successfully in past dredged material evaluations included sea urchins and oysters, but neither is included in the list of species that are cited as eligible for water column bioassays;

Response: These species are included on the national lists but are not included on our regionalized listing and are not recommended.

c. Sec. 10.1.2; has Neanthes arenaceodenta been eliminated as a whole sediment bioassay test species?

Response: This organism has not been removed from the national list, however, it is not included on our regionalized list and is not recommended.

d. Sec. 10.2.2; this section should state clearly whether bioaccumulation test tissue replicates can be composited for chemical analysis;

Response: The section has been clarified to state that only organisms in a given replicate chamber my be composited for chemical analysis, therefore sufficient biomass must be obtained from each replicate.

3. Except as noted in 2.a above, the RIA is clear with respect to decision-making and interpretation of analytical results.

Response: We thank you for your comment.

4. Bioaccumulation potential estimates based on limited tissue data are inherently unreliable, but represent the most practicable approach to addressing this issue. It may be appropriate to stipulate that control sediment-exposed tissues and pre-exposure tissues be analyzed chemically, to provide a clearer picture of bioaccumulation in test sediment exposures. The RIA addresses bioaccumulation well, although some additional treatment of bioaccumulation factors and ecological risk may be called for. If replicates are able to be composited for tissue chemistry, what statistical analysis can/would be performed to compare reference and test sediments?

Response: The RIA currently recommends that tissues be analyzed prior to exposure to obtain necessary information regarding background tissue concentrations. We do not recommend compositing replicates. Only organisms in a given replicate chamber my be composited for chemical analysis, therefore sufficient biomass must be obtained from each replicate. Statistical recommendations are currently provided in the RIA.

5. Overall, the lab analyses recommended are appropriate and based on good technical methodologies, except that some species should be added to lists of acceptable test species (eg., sea urchin species, for fertilization test method). Dredged material characterization guidelines are easy to follow; however, it should be stated clearly whether alternative test methods can be employed, if sufficient justification is provided.

Response: The RIA currently allows for alternative test methods if sufficiently justified and approved by the USACE and EPA prior to use.

Reviewer #4 Comments

Page v: Should you say something about the reference Rule when you talk about reference sediment?

Response: The reference rule is only applicable to dredged materials removed from inland waterways and regulated under the Clean Water Act, Section 404 and not to ocean dumping of dredged materials. Reference areas for the existing ODMDS have been selected and are provided in the RIA.

Page 15: Do you have a minimum requirement for survival in the reference sediment? What about test sediments that are not suitable for the test organisms because of salinity, or grain size, or pH or some other factor that is not COC-related?

Response: There is currently no minimum survival requirement for the reference sediments. The RIA was revised to state that causes of test failures in the control sediments should be identified (e.g. grain size sensitivity, pH and ammonia) and addressed appropriately.

Page 19: Wouldn=t you need to do testing even if there was only one COC?

Response: Yes. The RIA has been clarified to state that testing would be required due to the presence of one or more contaminants.

Page 21: Does Table 2 relate to Water or Seds or both?

Response: Table 2 relates to both water and sediments.

Page 22, diamond 1: What if there is only one COC that is exceeded?

Response: The RIA has been clarified to state that synergistic effects may be expected if one or more contaminant is detected. In some cases contaminants may be undetected but still present and causing synergistic effects.

Page 22, Diamond 2: I would say Apossible@ rather than Asuspected@.

Response: The recommended change has been incorporated throughout the document.

Page 22, Diamond 3, point 1: I would say Apossible@ rather than Asuspected@.

Response: The recommended change has been incorporated throughout the document.

Page 22, Diamond 3, point 2: Should we get a flow chart?

Response: We do not intend to incorporate a flow chart at this time.

Page 23, 9.3.1: Should you refer back to the 1:4 dilution?

Response: The recommended change has been incorporated.

Page 24, Table: Can you use the mysids twice? Would you use different stages for different categories?

Response: The Green Book and the RIA allow for using different stages of the Mysids for different categories.

Page 24: Would a flow chart be helpful here?

Response: We do not intend to incorporate a flow chart at this time.

Page 24, Diamond 4: What does A100% dredged material@ mean? Does it mean Afull-strength elutriate@?

Response: The section has been clarified to say the A100% dredged material elutriate@. This change has been made throughout.

Page 25, Square 4: Is it possible to do a cheap flunk here? Might you cahnge the dilution to get it?

Response: The current guidance recommends a serial dilution in order to extrapolate the LC_{50}. The RIA also recommends this approach.

Page 26, 10.0:@The initial screen...may be used to aid in re-evaluating...@ How would this work? Are you referring to a Acheap flunk?@

Response: The intent of utilizing the TBP calculation is aid in deciding whether to spend additional money to conduct further testing or to forgo ocean disposal for a different disposal method. It is not intended to be used to make regulatory decisions.

Page 26, 10.1.1: Do you need to define Areference sediment@ and Acontrol sediment@?

Response: The RIA currently defines and addresses reference and control sediments.

Page 27, Paragraph 2: AAt least two species should be selected....to cover three..@ Is this legal?

Response: Yes, the existing regulations allow for utilizing two species to cover the three feeding strategies.

Page 27, 10.1.3: Will the test fail if the control survival is below 90%, but all of the test sediments are above 90%? Are there any requirements as to minimum survival at the reference site?

Response: If control survival is below 90% it is recommended that the test be rejected and repeated. There is currently no minimum survival requirement for the reference sediments. The RIA was revised to state that causes of test failures in the control sediments should be identified (e.g. grain size sensitivity, pH and ammonia) and addressed appropriately.

Page 29: Why would you recommend Mercenaria? Is it not a biological rock?

Response: Species recommended for bioaccumulation analyses should be hardy species that allow for accumulation of contaminants and not mortality when exposed to the dredged materials.

Page 31: Could you just list the FDA limits in the RIA? I think that there is a lot of cross-referencing in the document, and you might want to make it easier for the applicants where you can, and save them a look up, maybe by putting stuff into an appendix.

Response: We prefer to reference items such as criteria and limits rather than include them in the RIA since these items are the most likely to change.

Page 32: Are these factors modified from the original 11 factors in the Green Book? You might mention it if they were.

Response: These nine factors are not modified from how they appear in the Green Book.

Page 32, 9.: Is there a Areference reference@ that values can be compared to?

Response: Currently, background tissue concentrations of in situ organisms have not been obtained for this region and would need to be determined on a case-by-case basis, as is recommended in the Tier IV evaluations.