United States Environmental Protection Agency
Region 4
Science and Ecosystem Support Division (SESD)
980 College Station Road
Athens, Georgia 30605-2720

Gulf Coast Bays Post Impact Water Quality Monitoring Quality Assurance Project Plan

Mississippi/Alabama/Florida
May 26, 2010
Revision 3

SESD Project Identification Number: 10-XXXX

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Approval Sheet

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Date

SESD Project Leader:

_____ _____

John Deatrick, Chief
Ecological Evaluation Section
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Date

This quality assurance project plan (QAPP) has been prepared according to: EPA Requirements for Quality Assurance Project Plans (EPA QA/R5 EPA/240/B-01/003, U.S. Environmental Protection Agency, Office of Environmental Information, Washington, DC, March 2001 (USEPA, 2001).

This document will be used to ensure that environmental and related data collected, compiled, and/or generated for this project are of the type, quantity, and quality required for their intended purposes within the limitations of available resources.

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1.0 QAPP Distribution List

Table 1: QAPP Distribution List

Recipient	Organization	Telephone Number	Address/Email Address
Doug Mundrick	Environmental Protection Agency (EPA)	404-562-9328	Water Protection Division 61 Forsyth St. SW Atlanta, Georgia 30303-8960
Chris Russell or current IC	Environmental Protection Agency (EPA)	850-274-1575	Incident Commander Water Protection Division 61 Forsyth St. SW Atlanta, Georgia 30303-8960

2.0 Project Organization

Requesting Program: Incident Command
Responsibilities: IC personnel requested SESD support to monitor Gulf Coast Bays in EPA Region 4 in order to assess water and sediment quality potentially impacted by oil resulting from the British Petroleum Deepwater Horizon oil spill.

Principal Data User: Doug Mundrick, Acting Deputy Director
Water Protection Division (WPD)

Chris Russell, Incident Commander
Superfund Division

Project Leader: John Deatrick, EPA Science & Ecosystem Support Division
Responsibilities: The project leader will be responsible for planning and implementing the field study to meet the data quality objectives. The project leader is responsible for:

- quality assurance project plan (QAPP) preparation
- all data collection activities
- collation of study data; and
- report preparation.

Table 2: Project Study Team

Team Members	Organization	Responsibilities	Contact
John Deatrick	SESD/EAB/EES	Project Coordinator	706-355-8774
TBD	SESD/EAB	Bay Water/Sediment Sampling & In Situ Monitoring	706-355-8xxx
TBD	SESD/EAB	Bay In Situ Monitoring/ GPS data	706-355-8xxx
TBD	SESD/EAB/ABS	Sampling Support, Photos	706-355-8xxx

Data Review: Internal technical review will be conducted by EPA SESD Senior Scientists.

Responsibilities: Upon completion of the draft report, copies will be provided to SESD team members for review. Once comments are addressed, a final report will be issued.

3.0 Project Management

3.1 Site Description

The Gulf of Mexico is currently receiving as much as 200,000 gallons per day of oil from a leak at British Petroleum's Deepwater Horizon oil rig resulting in a plume spreading within the Gulf of Mexico. In anticipation of a plume reaching bays along the Gulf Coast, SESD conducted a baseline water and sediment quality study in selected bays in Alabama and Florida. The post-impact study entails a re-sampling of these bays for comparison with baseline conditions and sampling in selected bays in Mississippi for comparison with a similar study conducted by SESD in 2005 following Hurricane Katrina.

3.2 Problem Definition

During the week of May 2, 2010, SESD conducted a baseline water and sediment quality study of selected Gulf coast bays including Mobile Bay, Weeks Bay, Bon Secour Bay, and Oyster Bay in Alabama and Perdido Bay, Pensacola Bay, and the Santa Rosa Sound in Florida. This study was conducted to provide baseline data for comparison with similar data collected at these same locations following potential arrival of an oil plume in one or more of these bays. SESD has subsequently been requested to develop a plan for obtaining post-impact comparison data should oil reach these bays. In addition, SESD was requested to expand this study into selected bays in Mississippi for

comparison with the 2005 post-Katrina study conducted by SESD (Figure 1). Locations in Mississippi include the Pearl River, Bayou Caddy, Bay St. Louis, Back Bay of Biloxi, the Pascagoula and West Pascagoula Rivers, Bayou Casotte, and Bangs Lake.

This post-impact study is designed to provide a re-sampling of the baseline study stations and selected 2005 Mississippi bays stations for a variety of contaminants that were identified in consultation with WPD, Superfund Division, and EPA Region 6. This study will provide a dataset for comparison with the baseline data. The intent of this effort is to evaluate the potential recovery of water and sediment quality from bays impacted by oil. However, during the baseline assessment, SESD observed the deployment of booms at the outlet to several bays such as Weeks Bay. As of May 4, the booms were not fully deployed; however, if these booms are deployed prior to or during arrival of an oil plume, sampling in these bays will proceed as this data may provide for some assessment of the effectiveness of the booms with respect to the target constituents.

Figure 1 – Potential Post-Impact Bay Sampling Locations

3.3 Project Description

Working with Incident Command and the Water Protection Division, SESD will initiate sampling following arrival of an oil plume at one or more of the subject bays. The primary task, by request of Incident Command and the Water Protection Division (WPD), is to assess the water and sediment quality at selected bays following arrival and subsequent dilution or dispersion of oil in the bay. This post-impact study will follow the approach of the baseline study to provide data for comparison. This will be accomplished by:

- Collection of surface water samples for the analysis of TOC, COD, BOD_5, total metals including mercury (plus dissolved metals at 10% of the stations), volatiles, semi-volatiles, alkyl-PAHs, dispersant compounds, and petroleum hydrocarbons (gas, oil, and diesel range organics).
- Collection of sediment samples for the analysis of TOC, ammonia nitrogen, sulfides, total metals including mercury (plus dissolved metals at 10% of the stations), volatiles, semi-volatiles, alkyl-PAHs, dispersant compounds, and petroleum hydrocarbons (gas, oil, and diesel range organics).
- Measurement of In Situ water quality (temperature, pH, salinity, dissolved oxygen, and turbidity) using an *in situ* multi-probe instrument.
- Collection of Global Positioning System (GPS) data at each sampling location.
- Toxicity testing of water and sediment samples.

Initially, a single post-impact sampling effort is anticipated; however, subsequent efforts may be required depending conditions versus baseline and/or on continued flushing of oil in sampled bays. In the case of a subsequent sampling effort, this QAPP will be reissued under a new Project ID Number. Table 3 provides the anticipated reporting schedule.

Table 3: Project Schedule

Activity	Organization	Anticipated Date of Completion	Deliverable
QAPP Preparation	SESD/EAB	May 19, 2010	Draft-final QAPP for Incident Command review.
Field Investigation	SESD/EAB	Based on oil arrival in bays – TBD in consultation with WPD.	Complete sampling effort

Report Generation	SESD/EAB	14 Days following release of final chemical analyses results.	Draft Report issued for internal review
Final Report	SESD/EAB	5 Days following draft report issuance.	Final Report

3.4 Quality Objectives and Criteria for Measurement Data

The primary objective of this study is to evaluate post-impact water and sediment quality in selected bays along the Region 4 Gulf Coast. Post-impact data will be compared to the SESD baseline study conducted during the week of May 2, 2010 and/or the SESD 2005 post-Katrina study depending on the location(s) of oil impacts. SESD, in consultation with the Incident Command and WPD, will determine the specific set of stations to be sampled during the post-impact survey drawing from the stations listed in this document with flexibility to add, remove, or change stations locations, as needed, to address other scientific or logistical issues that may arise. Data quality objectives (DQOs) for this study are provided in Appendix A.

3.5 Special Training Requirements

Per SESD's Field Branches Quality System, the Project Leader and all Scientists assisting with this project have been trained and deemed competent by SESD management to conduct the described field activities.

3.6 Documents and Records

Dedicated field logbooks will be used to record all information (USEPA 2007f). The Quality Assurance Project Plan (QAPP) and Final Report will be prepared in accordance with SESD Operating Procedures for Project Planning (USEPA 2007h) and Report Preparation and Distribution (USEPA 2007j), respectively. The report will include a tabular presentation of results, discussion, and conclusions. Upon completion and transmittal of the report to the appropriate parties, project records will be submitted to the SESD Records Room. The files will be maintained in the SESD Records Room according to the EPA records schedule as described in Control of Records (USEPA 2007a). The most current records schedules are available at http://epa.gov/records/policy/schedule.

4.0 Data Generation and Acquisition

4.1 Study Design

An authoritative approach was enlisted for the baseline study based on discussions with the requestor and logistical considerations. The post-impact study would target sampling at the same locations; however, sampling may be limited to locations receiving oil. The

movement of the oil within the Gulf and bays may necessitate a staggered sampling approach with sampling occurring over multiple weeks. The full list of potential sampling locations is provided in Table 4 and shown in Figure 1.

At each sampling location, a suite of chemical and physical data will be collected. *In situ* water quality measurements including, temperature, pH, salinity, dissolved oxygen, and turbidity will be collected using a multi-probe water quality instrument (USEPA 2007e). Surface water samples will be collected for chemical analysis (Table 6) by dipping the sample containers into the bay (USEPA 2007l) unless in situ profiling indicates stratification for temperature, salinity, or dissolved oxygen. If stratification is observed (Appendix B), a composite sample comprised of a mid-depth sample from each layer for all laboratory analyses except volatile organic compounds will be collected using a submersible pump with Teflon tubing. The volatile organic sample will be collected from the upper layer regardless of stratification. Sediment samples will be collected for chemical analyses (Table 7) using a petite Ponar® grab (USEPA 2007m). GPS coordinates will be recorded at each sampling location using a handheld or boat-mounted GPS (USEPA 2007d).

At 10 % of the total number of samples stations, a duplicate metals sample with be collected and filtered in the field for dissolved metals analyses. The filter size will be determined in cooperation with WPD and Region 6 to meet the specific data quality objective of developing a relationship between total and dissolved metals for comparison with EPA dissolved metals criteria. To the extent possible, dissolved metals samples will be spread across the Region gulf coast states.

Table 4: Surface Water Sampling Locations

Station ID	Description of Location	Approximate GPS Coordinates	
		Latitude (deg)	Longitude (deg)
UpMB	Upper Mobile Bay	30.6026	-87.9563
MidMB	Middle Mobile Bay	30.4209	-88.0675
MBOut	Mobile Bay Outlet	30.2379	-88.0506
MSSnd	Mobile Outlet to MS Sound	30.2890	-88.1205
BonSB	Bon Secour Bay	30.3173	-87.8723
OysterB	Oyster Bay	30.2794	-87.7320
WeeksB	Weeks Bay	30.3898	-87.8354
PerdB	Perdido Bay	30.3429	-87.4583
PerdOut	Perdido Bay Outlet	30.3050	-87.5048
PensB	Pensacola Bay	30.3692	-87.2094
PensOut	Pensacola Bay Outlet	30.3262	-87.3048
SRSnd	Santa Rosa Sound	30.3705	-87.0336
PEARL1	Pearl River	30.2357	-89.6162
BCD1	Bayou Caddy	30.2379	-89.4307
SLB1	Bay St. Louis Bay nr Outlet	30.3196	-89.3068
SLB3	Bay St. Louis	30.3432	-89.3231
BBB1	Back Bay of Biloxi nr Outlet	30.4073	-88.8469
BBB2	Back Bay of Biloxi	30.4220	-88.8960

WPR1	West Pascagoula River	30.3792	-88.6085
PR1	Pascagoula River	30.3675	-88.5647
BC1	Bayou Casotte nr Outlet	30.3333	-88.5133
BC2	Bayou Casotte	30.3407	-88.5085
BL1	Bangs Lake	30.3539	-88.4667

4.2 In Situ Monitoring

Table 5 summarizes In Situ measurement equipment and accuracy.

Table 5: In Situ Measurement Equipment/Accuracy

Parameter	Units	Equipment	Accuracy
Dissolved Oxygen	mg/l	Luminscent Optical Probe	± 2%
Temperature	°C	Thermistor	± 0.15
Salinity	ppt	Conductivity Probe	Greater of ± 1% of reading or 0.1 (± 5% conductivity)
pH	SU	pH Electrode	± 0.2
Turbidity	NTU	Optical Probe	± 10% of reading
Latitude/Longitude	Decimal degrees or deg/min/sec	Differential GPS based on NAD83	± 10 m

4.3 Sample Handling and Custody

Surface water samples will be stored on ice and delivered or shipped from the field to a contract laboratory. A chain-of-custody form will be completed for all samples requiring laboratory analysis.

4.4 Analytical Methods

Any analyses performed by SESD will be conducted in accordance with the SESD Analytical Support Branch Laboratory Operations and Quality Assurance Manual (ASB LOQAM; USEPA 2009). The analytical methods, sample containers, sample preservation and analysis holding times for surface water and sediment samples are listed in Tables 6 and 7, respectively. In the event that SESD does not have the capacity to perform any requested analyses, a contract laboratory may be utilized to conduct the analysis. All analyses performed by contract laboratories will be conducted in accordance with the contract laboratory statement of work. Any contract laboratories utilized for the analyses will be secured by the Incident Command.

Table 6: Surface Water Sample Requirements

Analytical Group	Volume/Container	Preservative	Holding Time
TOC	1 liter polyethylene	H_2SO_4 to pH <2, Ice	28 days
COD	I liter amber glass	H_2SO_4 to pH <2, Ice	28 days
BOD_5	1 liter amber glass	Ice	48 hours
Dispersant Compounds 1/	1 liter amber Glass (2 per station)	Ice	7 Days
Total Metals + Hg (+ diss. Metals @ 10% of stations)	1 liter polyethylene	HNO_3 to pH < 2, Ice	6 Months (Hg: 28 days)
Volatiles	40 ml glass vials 3/station	HCl to pH < 2, Ice	14 Days
Semi-Volatiles (including PAH)	1 liter amber Glass (2 per station)	Ice	7 Days
Alkyl PAHs 1/	1 liter amber Glass (2 per station)	Ice	7 Days
Petroleum Hydrocarbon (DRO & ORO)	1 liter Amber	Ice	7 Days
Petroleum Hydrocarbon (GRO)	Glass/40 ml vials	Ice	7 Days

Table 7: Sediment Sample Requirements

Analytical Group	Volume/Container	Preservative	Holding Time
TOC	8 oz. glass	Ice	TBD
Dispersant Compounds 1/	8 oz. Glass	Ice	TBD
Ammonia Nitrogen	8 oz. Glass	Ice	TBD
Sulfides	8 oz. Glass	Ice	TBD
Total Metals + Hg	8 oz. Glass	Ice	6 Months
Volatiles	Encore (3) + 2 oz. glass for % moisture	Ice	48 Hours
Semi-Volatiles	8 oz. Glass	Ice	7 Days
Alkyl PAHs 1/	8 oz. Glass	Ice	TBD
Petroleum Hydrocarbon (DRO & ORO)	8 oz Glass	Ice	7 Days
Petroleum Hydrocarbon (GRO)	2 oz Glass with septum	Ice	7 Days

1/ - specific analytical methods are under discussion between Region 4 and Region 6

4.5 Ecotoxicty Methods

Ecotoxicological effects from the spill will be assessed using a two-phased approach for the water samples: 1) acute toxicity screening tests and 2) definitive sublethal (chronic) toxicity tests. Because of holding time and other constraints, the acute and chronic water tests will be conducted concurrently. This is because the lack of acute toxicity does not preclude chronic effects. Each of the acute tests will comprise a control (i.e. dilution water only), a reference sample collected from non-impacted areas (i.e., an area that appears free from visible oil contamination or detectable oil related constituents) and 100% spill water. The chronic definitive tests will comprise of 50% dilution series of the spill water to provide test concentrations of 0, 6.25, 12.5, 25, 50, and 100% water. A lack of acute or chronic effects in any of the test samples implies that no further action is required. Whole sediments toxicity tests will also be performed with an amphipod and a polychaete. Details of the test species and methods are presented below.

4.5.1 Acute Toxicity Screening Tests (Standard)

96-hour acute toxicity screening tests will be performed to determine if there is a significant difference between the 100% aqueous samples and the laboratory control or field reference waters. Tests will be performed with the inland silverside fish, *Menidia beryllina*, and the mysid shrimp, *Americamysis bahia* (formerly identified as *Mysidopsis bahia*) in accordance with the guidance provided in "Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms (EPA 2002a)." A summary of test conditions and acceptability criteria proposed for the acute tests are presented in Tables 4-4 for *A. bahia* and 4-5 for *M. beryllina*. Additional toxicity tests with an echinoid, *Arbacia punctulata* and/or the eastern oyster, *Crassostrea virginica*, will be performed depending on the availability of organisms for these tests. Test methods for the latter two organisms provided in ASTM (2004a) "Standard Guide for Conducting Static Acute Toxicity Tests with Echinoid Embryos" and ASTM (2004b) "Standard Guide for Conducting Static Acute Toxicity Tests Starting with Embryos of Four Species of Saltwater Bivalve Mollusks." The sensitivity of the each batch of test organisms used will be evaluated with reference toxicant tests. The results of the reference toxicant tests will be compared with historical limits to determine if the organisms are within their normal sensitivity ranges.

4.5.2 Acute Toxicity Screening Tests (Photo-enhanced)

Oil in the water column can be 10 times to greater than 100 times more toxic in the presence of natural sunlight. Photo-enhanced toxicity assessment will be used to assess the enhanced toxicity of simulated solar radiation using the same organisms used in the standard acute toxicity assays above.

Assessment of photo-enhanced toxicity is critical to the complete assessment of the potential impacts of the spill to aquatic life. Many waters of the Gulf are clear, allowing sunlight to penetrate and potentially enhance the toxicity of bioaccumulated oil. Photo-

enhanced acute toxicity tests (i.e., conducted under full spectrum lights) will be performed concurrently with the standard acute screening tests (i.e., conducted under normal laboratory lighting) using the same test methods and batch of test organisms but under separate conditions of lighting. Measurements of both light wavelength and intensity will be made using a broad wavelength radiometer (e.g., International Light Model IL1400BL or similar device). Light intensity will be measured by placing the detector at the bottom of surrogate test containers filled with reference water. Surrogate containers will be placed at multiple locations within the test facility and measurements will be made at both test initiation and termination. Similar measurements of wavelength and intensity will also be collected at select sampling locations in the field to aid in the interpretation of the results and facilitate the ecological risk assessment.

4.5.3 Short-term Chronic Toxicity Tests

In addition to the acute tests, short-term chronic toxicity tests will be performed with the inland silverside fish, *Menidia beryllina*, and the mysid shrimp, *Americamysis bahia*. The tests will be performed in accordance with the guidance provided in the following documents: Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms (EPA 2002b), and Short-term Methods for Estimating the Short-term Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms (1995). A summary of test conditions and acceptability criteria proposed for the short-term chronic tests are presented in Appendix C for *A. bahia* and 4-9 for *M. beryllina*. The sensitivity of the each batch of test organisms used will be evaluated using reference toxicant tests. The results of the reference toxicant tests will be compared with historical limits to determine if the organisms are within their normal sensitivity ranges.

4.5.4 Whole Sediment Acute Toxicity Tests

Whole sediment toxicity screening tests will be performed to determine the effects of the contaminants in sediments arising from the Gulf Spill on the survival of the marine amphipod, *Leptocheirus plumulosus*, and the polychaete, *Neanthes arenaceodentata*. The tests will be performed following guidance provided in USEPA (1994) entitled "Methods for Assessing the Toxicity of Sediment-Associated Contaminants with Estuarine and Marine Organisms," and ASTM (2007) entitled "Standard Guide for Conducting Sediment Toxicity Tests with *Polychaetous Annelids*." A summary of test conditions and acceptability criteria are presented in Appendix C for the amphipod and polychaete, respectively. Each batch of test organisms will be evaluated in reference toxicant tests and the results shall be compared with historical control limits in order to determine if the organisms are within their normal sensitivity ranges.

4.6 Quality Control

Each sampling, analysis, or measurement technique to be performed for this site investigation has associated quality control (QC) requirements. QC activities associated with the field operations may include, but are not limited to the following: trip blanks, preservative blanks, equipment rinse blanks, and temperature blanks. Laboratory QC activities may include use of blanks, matrix spikes (MS) and MS duplicates, surrogates, second column confirmation, laboratory control samples, initial and continuing calibration verifications, etc. The specific QC requirements, acceptance criteria, corrective action in case of non-conformance and the procedures used to calculate applicable statistics, are provided in the EPA Region 4 field and laboratory SOPs and methods, and in the following QA/QC documents: SESD Operating Procedure for Field Sampling Quality Control (USEPA 2007c), and chapter 5 of the ASB LOQAM (USEPA 2009).

4.7 Equipment Maintenance and Calibration

All equipment used during this study will be maintained and calibrated according to the requirements of the SESD Operating Procedure for Equipment Inventory and Management (USEPA 2007b). Spare parts for all critical elements of the study will be taken to the field in the event of a malfunction.

Calibration procedures and frequency for the *in situ* multiprobe water quality instrument will be performed in accordance with SESD Operating Procedure for *In Situ* Water Quality Monitoring (USEPA 2007e).

4.8 Inspection/Acceptance for Supplies and Consumables

All critical supplies and consumables for this field study are inspected and maintained in accordance with the following procedures:

SESD Operating Procedure for Purchasing of Services and Supplies, SESDPROC-015-R3 (USEPA 2007i).
SESD Operating Procedure for Equipment Inventory and Management, SESDPROC-108-R3 (USEPA 2007b).
SESD Operating Procedure for Field Sampling Quality Control, SESDPROC-011-R2 (USEPA 2007c).

The SESD Field Quality Manager and the Branch Quality Assurance Officers are responsible for ensuring that these requirements are met.

4.9 Non-direct Measurements

Non-direct measurement data for this project may include hydrologic or meteorological data available from other Federal or State agencies. These data may be used

qualitatively to enhance understanding of the SESD sampling effort. Therefore, there are no Quality Assurance requirements for this data.

4.10 Data Management

The project leader will be responsible for ensuring that all requirements for data management are met. All field data generated during this study, whether hand-recorded or obtained using an electronic data logger will be recorded, stored and managed according to the SESD Operating Procedures for Control of Records (USEPA 2007a), Sample and Evidence Management (USEPA 2007k), and Logbooks (USEPA 2007f).

5.0 Assessment/Oversight

5.1 Assessments and Response Actions

Assessments will be conducted during the field investigation according to the SESD Operating Procedure for Project Planning (USEPA 2007h) to ensure the QAPP is being implemented as approved. The project leader is responsible for all corrective actions while in the field. Any issues that may arise during the study will be documented in the logbooks. This documentation and any corrective actions taken will be used to determine the overall quality and usability of the data.

5.2 Reports to Management

The project leader will be responsible for notifying the project requestor (Incident Command) and appropriate SESD management if any circumstances arise during the field study that may adversely impact the quality of the data collected. Any problems noted during field sampling that could result in unusable data will be addressed in the final report.

6.0 Data Validation and Usability

All data derived from SESD field measurements will be reviewed, verified, validated and reported in accordance with the SESD Operating Procedure for Report Preparation and Distribution (USEPA 2007j). Analytical data prepared by the SESD Analytical Services Branch will be reviewed, verified, validated in accordance with SESD's ASB LOQAM (USEPA 2009). Analytical data prepared by contractor will be reviewed and validated by the Region 4 Environmental Services Assistance Team.

7.0 References

USEPA 2007a. Operating Procedure for Control of Records SESDPROC-002-R4, Region 4, SESD, Athens, GA

USEPA 2007b. Operating Procedure for Equipment Inventory and Management SESDPROC-108-R3, Region 4, SESD, Athens, GA

USEPA 2007c. Operating Procedure for Field Sampling Quality Control SESDPROC-011-R2, Region 4, SESD, Athens, GA

USEPA 2007d. Operating Procedure for Global Position System SESDPROC-110-R2, Region 4, SESD, Athens, GA

USEPA 2007e. Operating Procedure for *In Situ* Water Quality Monitoring, SESDPROC-111-R2, Region 4, SESD, Athens, GA

USEPA 2007f. Operating Procedure for Logbooks SESDPROC-010-R3, Region 4, SESD, Athens, GA

USEPA 2007g. Operating Procedure for Packing, Marking, Labeling and Shipping of Environmental and Waste Samples. SESDPROC-209-R1, Region 4, SESD, Athens, GA

USEPA 2007h. Operating Procedure for Project Planning SESDPROC-016-R1, Region 4, SESD, Athens, GA

USEPA 2007i. Operating Procedures for Purchasing of Services and Supplies SESDPROC-015-R3, Region 4, SESD, Athens, GA

USEPA 2007j. Operating Procedure for Report Preparation and Distribution SESDPROC-003-R3, Region 4, SESD, Athens, GA

USEPA 2007k. Operating Procedure for Sample and Evidence Management SESDPROC-005-R1, Region 4, SESD, Athens, GA

USEPA 2007l. Operating Procedure for Surface Water Sampling. SESDPROC-201-R1, Region 4, SESD, Athens, GA.

USEPA 2007m. Operating Procedure for Sediment Sampling. SESDPROC-200-R1, Region 4, SESD Athens, GA.

USEPA 2009. SESD Analytical Services Branch Laboratory Operations and Quality Assurance Manual (ASB LOQAM). United States Environmental Protection Agency. Region 4, SESD, Athens, GA

American Society for Testing and Materials (ASTM). 2004a. Standard Guide for Conducting Static Acute Toxicity Test with Echinoid Embryos. Annual Book of ASTM Standards, Vol. 11.06. E1563-98 (2004-e1). American Society for Testing and Materials, Philadelphia, PA.

ASTM, 2004b. Standard Test Methods for Measuring the Toxicity of Sediment-Associated Contaminants with Estuarine and Marine Invertebrates. Annual Book of ASTM Standards, Vol. 11.06. E1367-03e1. American Society for Testing and Materials, Philadelphia, PA.

ASTM. 2007. Standard Guide for Conducting Sediment Toxicity Tests with Polychaetous Annelids. Annual Book of ASTM Standards, Vol. 11.06. E1611-00 (2007). American Society for Testing and Materials, Philadelphia, PA

USEPA. 1990. Conducting the Sea Urchin Larval Development Test. ERL-Narragansett Standard Operating Procedure 1.03.007.

USEPA. 1994. Methods for Assessing the Toxicity of Sediment-Associated Contaminants with Estuarine and Marine Amphipods. EPA/600/R-94/025.

USEPA. 1995. Short-Term Methods for Estimating the Chronic Toxicity of Efluents and Receiving Waters to West Coast Marine and Estuarine Organisms. First edition. EPA/600/R-95/136. West Coast Manual. EPA/600/R-95/136.

USEPA. 1997. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments. Interim Final. EPA/540/R-97/006.

USEPA. 1998. Guidelines for Ecological Risk Assessment. Risk Assessment Forum. EPA/630/R-95/002F.

USEPA. 2002. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms. 5th Edition. EPA-821-R-02-012. U.S. Environmental protection Agency, Office of Water, Washington, DC.

USEPA and U.S. Army Corps of Engineers. 2008. Southeast Regional Implementation Manual (SERIM) Requirements and Procedures for Evaluation of the Ocean Disposal of Dredged Material in Southeastern U.S. Atlantic and Gulf Coast Waters. Prepared by EPA Region 4 Atlanta, Georgia and U.S. Army Corps of Engineers South Atlantic Division Atlanta, Georgia, with assistance from ANAMAR Environmental Consulting, Inc. 904-B-08-001.

Appendix A: Data Quality Objectives

STEP	DATA QUALITY OBJECTIVES		DESCRIPTION
1	State the Problem	$ Concise description of the problem $ Identify members of the planning team and the primary decision maker $ Develop a conceptual model of the environmental hazard to be investigated $ Determine resources – budget, personnel, and schedule	<u>Description of Problem</u> The Incident Commander for the United States Environmental Protection Agency (USEPA) may need post-impact sediment and water quality data for Gulf Coast bays in Alabama, Mississippi, and Florida in the event of oil plumes impacting these bays. These data would be compared to a baseline assessment of Alabama and Florida bays conducted by SESD the week of May 2, 2010 and post-Katrina data collected by SESD in 2005 in Mississippi Bays. <u>Planning Team</u> John Deatrick* R4, SESD Bill Cosgrove Mike Peyton Mike Bowden Linda George Doug Mundrick R4 Andrea Zimmer R4 Dave Melgaard Doug Johnson Glenn Adams R4, Superfund Division *QAPP Preparer <u>Resources/Personnel/Schedule</u> Field survey(s) will be scheduled in consultation with Incident Command based on the migration of oil plumes into monitored bays. The duration of study and personnel resources will be dependent upon the extent of oil migration and the number of bays impacted. Following field survey(s), a draft report will be prepared by the project leader 14 days following data release from the lab with a final report 5 days following the draft.

STEP	DATA QUALITY OBJECTIVES		DESCRIPTION
2	Identify the Goal of the Study	$ Identify the principal study question $ Define the alternative actions that could result from resolution of the principal study question. $ For decision problems, develop decision statements(s), organize multiple decisions. $ For estimation problems, state what needs to be estimated and key assumptions.	<u>Principal Study Questions</u> 1. What is the change in water and/or sediment quality resulting from oil entering targeted bays in Mississippi, Alabama, and Florida. 2. Are bay waters or sediments acutely toxic to marine life? <u>Alternative Action</u> Any actions will be determined by Incident Command based on data generated by this field study.
3	Identify Information Inputs	$ Identify types and sources of information needed to resolve decisions or produce estimates. $ Identify the basis of information that will guide or support choices to be made in later steps of the DQO process. $ Select appropriate sampling and analysis methods for generating the information	<u>Information Type and Source (based on consultation with Water Protection Division)</u> Analytical laboratory results of surface water and sediment chemistry. *In situ* water quality measurements. Sediment and water toxicity testing.
4	Define the Study Boundaries	$ Define the target population of interest and its relevant spatial boundaries. $ Define what constitutes a sampling unit. $ Specify temporal boundaries and other practical constraints associated with sample/data collection. $ Specify the smallest unit on which decisions or estimates will be made.	Selected bays in Mississippi, Alabama and Florida. Temporal boundary based on evaluation of impacted bays following some period following arrival of oil to be determined by WPD and SESD to evaluate potential recovery of impacted bays.
5	Develop the Analytic Approach	$ Specify appropriate population parameters for making decisions or estimates. $ For decision problems, choose a workable Action level and generate and "If....then....else" decision rule which involves it. $ For estimation problems, specify the estimator and the estimation procedure.	Results of surface water analysis will be compared to the State/National water quality standards, baseline study data and 2005 post-Katrina data. Results of sediment analyses will be compared to NOAA published effect levels, baseline study data and 2005 post-Katrina data..

STEP	DATA QUALITY OBJECTIVES		DESCRIPTION
			In situ water quality data will be used to evaluate current water quality conditions.
6	Specify Performance or Acceptance Criteria	$ For decision problems, specify the decision rule as a statistical hypothesis test, examine consequences of making incorrect decisions from the test, and place acceptable limits on the likelihood of making decision errors. $ For estimation problems, specify acceptable limits on estimation uncertainty.	<u>Decision Ruling</u> There is no decision rule for this effort.
7	Develop the Plan for Obtaining Data	$ Compile all information and outputs generated in Steps 1 through 6 above. $ Use this information to identify alternative sampling and analysis designs that are appropriate for your intended use. $ Select and document a design that will yield data that will best achieve your performance or acceptance criteria.	<u>Sampling and Analysis Design</u> The project team will make assessments based on interpretation of all data generated.

APPENDIX B: STRATIFICATION GUIDELINES

SESD has developed the following guidance for evaluating stratification in estuarine environments. This guidance is intended to aid in the determination of composite versus surface grab sampling as described earlier in this QAPP; however, professional judgment will be used by SESD scientists in the application of these guidelines.

Salinity:

- Depth at which salinity increases 5 ppt in 1' interval (10 ppt if profiling at 2' intervals) OR
- Difference of 10 ppt in observed strata in the water column.

Temperature:

- Depth at which temperature changes 1^{o} C in 1' interval (2^{o} C if profiling at 2' intervals.

APPENDIX C: TOXICITY TEST TABLES

SUMMARY OF TEST CONDITIONS AND TEST ACCEPTABILITY CRITERIA FOR *Crassostrea virginica* LARVAE, ACUTE TOXICITY WATER COLUMN TEST	
1. Test type:	Static non-renewal
2. Test duration:	48 h, based on control development; not to exceed 54 h
3. Temperature:	25 ± 1°C
4. Salinity:	Optimal 30 (range: 18-32) ± 2‰
5. DO concentration:	60-100% of saturation
6. pH:	Optimal 7.8 ± 0.5; measure according to ASTM protocol
7. Light quality:	Ambient laboratory illumination
8. Light intensity:	500-1000 lux
9. Photoperiod:	16L/8D
10. Test chamber size:	20-30 ml
11. Test solution volume:	10-30 ml
12. Renewal of test solutions:	None
13. Age of test organisms:	Larvae, less than 4 h after fertilization
14. Concentration of organisms per test chamber:	15-30/ml; do not exceed 30/ml
15. Number of replicate chambers per elutriate concentration:	Minimum of 5, plus 1 chamber for water quality monitoring
16. Feeding requirements:	None
17. Test solution aeration:	None
18. Dilution water:	Optimal 30 (range: 18-32) ± 2‰; natural seawater or suitable artificial seawater prepared with Milli-Q® or equivalent deionized water
19. Test treatments:	100% elutriate, 100% control water, 100% dilution water (if different from control)
20. Dilution series:	100%, 50%, 10%, 1% of the dredged material elutriate (Note: lower concentrations may be necessary if test elutriate is toxic or contains very fine non-settleable solids)
21. Endpoint:	Survival, embryo shell development to hinged, D-shaped prodisoconch I larva
22. Sample holding requirements:*	<2 wk for sediments. Toxicity tests prepared from sediments should be started within 2 wk of sampling, but not later than 8 wk after sampling. <14 d for site, dilution, and control waters; elutriates are to be used within 24 h of preparation
23. Field sample volume required:^	1 L sediment per sample station/4 L site water for creation of 100% elutriate
24. Test acceptability:	>90% survival **AND** ≥70% shell development to hinged, D-shaped prodisoconch I larva in the control

* Obtain prior approval from your local EPA and USACE district offices if sediment samples will be held longer than the specified sample holding requirements. Prior approval could be obtained during the review and approval of the Sampling and Analysis Plan.
^ This is the minimum volume required to run the test one time. If you need to repeat the test or archive the sample, you should collect additional equivalent volumes.

Test Conditions and Acceptance Criteria: 10-day *Leptocheirus plumulosus* Acute Toxicity Test

SUMMARY OF TEST CONDITIONS AND TEST ACCEPTABILITY CRITERIA FOR THE AMPHIPOD, *Leptocheirus plumulosus*, 10-DAY ACUTE TOXICITY SEDIMENT TEST	
1. Test type:	Static non-renewal
2. Test duration:	10 d
3. Temperature:	25 ± 1ºC
4. Salinity:	Optimal 20 (range: 1-32) ± 2‰
5. DO concentration:	Not less than 60% saturation
6. pH:	Optimal 7.8 ± 0.5; measure according to ASTM protocol
7. Light quality:	Ambient laboratory illumination
8. Light intensity:	500-1000 lux
9. Photoperiod:	Continuous light
10. Test chamber size:	1-L glass beaker or jar with 10-cm inner diameter
11. Test solution volume:	200 ml (about 2 cm depth minimum) 700 ml overlying water
12. Renewal of test solutions:	None
13. Age of test organisms:	2 to 4 mm, no mature males or females
14. Number of organisms per test chamber:	20
15. Number of replicate chambers per treatment:	5
16. Feeding requirement:	None
17. Test solution aeration:	Water in each test chamber should be aerated overnight before start of test, and throughout the test; aeration at rate that maintains >90% saturation of DO concentration without disturbing the sediment surface
18. Overlying water:	Optimal 20 (range: 1-32) ± 2‰, natural seawater or artificial seawater prepared with Milli-Q® or equivalent deionized water
19. Test treatments:	Site sediment, a reference sediment, and a control sediment
20. Endpoint:	Survival
21. Sample holding requirements:*	<2 wk for sediments. Sediment toxicity tests should be started within 2 wk of sampling, but not later than 8 wk after sampling. <14 d for overlying water
22. Field sample volume required:^	4 L of site, reference site, and control sediment, depending on chamber size
23. Test acceptability:	≥90% survival in controls **AND** meet requirements of Table A1.3 in ASTM 2004 and Table 11.3 in USEPA 1994

* Obtain prior approval from your local EPA and USACE district offices if sediment samples will be held longer than the specified sample holding requirements. Prior approval could be obtained during the review and approval of the Sampling and Analysis Plan.
NOTE: Pore-water/overlying water ammonia concentrations greater than 60 mg/l total (or 0.8 mg/l unionized) ammonia at pH 7.7 will result in mortality. Follow recommended procedures in Appendix N to reduce ammonia levels before beginning tests.

Test Conditions and Acceptance Criteria: 10-day *Neanthes arenaceodentata* Acute Toxicity Tests

SUMMARY OF TEST CONDITIONS AND TEST ACCEPTABILITY CRITERIA FOR THE POLYCHAETE, *Neanthes arenaceodentata*, 10-DAY ACUTE TOXICITY SEDIMENT TEST	
1. Test type:	Static, non-renewal
2. Test duration:	10 d
3. Temperature:	20 ± 1°C
4. Salinity:	Optimal 30 (range: 28-36) ± 2‰
5. DO concentration:	60-100% of saturation
6. pH:	Optimal 7.8 ± 0.5
7. Light quality:	Ambient laboratory illumination
8. Light intensity:	500-1000 lux
9. Photoperiod:	16L/8D
10. Test chamber size:	1 L minimum
11. Test solution volume:	200 ml (about 2 cm depth minimum) 700 ml of overlying water
12. Renewal of test solutions:	None
13. Age of test organisms:	2-3 wk post emergence
14. Number of organisms per test chamber:	5-10
15. Number of replicate chambers per treatment:	5
16. Feeding requirement:	None
17. Test solution aeration:	Trickle flow (<100 bubble/min)
18. Overlying water:	Optimal 30 (range: 28-36) ± 2‰; natural seawater or suitable artificial seawater prepared with Milli-Q® or equivalent deionized water
19. Test treatments:	Site sediment; reference sediment; and control sediment
20. Endpoint:	Survival
21. Sample holding requirements:	* <2 wk for sediments; sediment toxicity tests should be started within 2 wk of sampling, but not later than 8 wk after sampling; <14 d for overlying water
22. Field sample volume required:^	4 L of site, reference site, and control sediment, depending on chamber size
23. Test acceptability:	≥90% survival overall in controls, with >80% survival in individual replicates

*Obtain prior approval from your local EPA and USACE district offices if sediment samples will be held longer than the specified sample holding requirements. Prior approval could be obtained during the review and approval of the Sampling and Analysis Plan.

^ This is the minimum volume required to run the test one time. If you need to repeat the test or archive the sample, you should collect additional equivalent volumes.