U.S. Geological Survey Protocol for Sample Collection in Response to the Deepwater Horizon Oil Spill, Gulf of Mexico, 2010

Sampling Methods for Water, Sediment, Benthic Invertebrates, and Microorganisms in Coastal Environments

This report supersedes USGS Open-File Report 2010-1191.

By Franceska D. Wilde and Stanley C. Skrobialowski

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Both U.S. customary English (inch/pound) and SI (metric) units of measurement have been used in this report. The utility of this report led to the decision to allow mixed units in the text and tables. USGS field personnel purchased much of the specialty equipment needed from sources using English units exclusively. In general, however, metric units are used to determine sample volume and th volume of chemical preservatives.

Inch/Pound to SI

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
	Volume	
ounce, fluid (oz)	0.02957	liter (L)
gallon (gal)	3.785	liter (L)
barrel (bbl)	42.0	gallon (gal)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:
°F=(1.8×°C)+32
Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:
°C=(°F-32)/1.8

SI to Inch/Pound

Multiply	By	To obtain
	Length	
micrometer (µm)	3.937×10^{-5}	inch (in.)
centimeter (cm)	0.3937	inch (in.)
millimeter (mm)	0.03937	inch (in.)
meter (m)	3.281	foot
liter (L)	33.82	ounce, fluid (oz)
liter (L)	0.2642	gallon (gal)
mlliliter (mL)	0.0338	ounce, fluid (oz)
	Area	
square meter (m^2)	0.0002471	acre
	Mass	
gram (g)	0.03527	ounce, avoirdupois (oz)
kilogram (kg)	2.205	pound avoirdupois (lb)

Specific conductance is given in microsiemens per centimeter at 25 degrees Celsius (µS/cm).

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Technical Review

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Editorial, Graphics, Layout, and Bureau Approval

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U.S. Geological Survey Protocol for Sample Collection in Response to the Deepwater Horizon Oil Spill, Gulf of Mexico, 2010

1.0 Post-Landfall Sampling Protocol

In response to the potential for environmental damage to the Gulf of Mexico from a massive release of oil caused by failure of the Macondo-1 well and explosion of the Deepwater Horizon oil rig, U.S. Geological Survey (USGS) scientists collected environmental data at sites along the Gulf coast from Florida to Texas (fig. 1), both before and after oil reached shore. The pre-landfall water and sediment samples and relevant site data were collected in accordance with official USGS protocols, as directed by a heretofore unpublished sampling plan (Appendix A-1) and as prescribed for routine sample collection in the USGS *National Field Manual for the Collection of Water-Quality Data*, also referred to as the *National Field Manual* or NFM (U.S. Geological Survey, variously paged), available online only at *http://pubs.water.usgs.gov/twri9A*. All members of field teams engaged in this post-landfall sampling were to have completed formal training and be experienced in the sampling methods established in this field manual.

While the *National Field Manual* provided the field teams with the methods and procedures needed for the pre-landfall field effort, it lacked the information needed to meet the regulatory, health-and-safety, and logistical requirements for conducting field activities at heavily oil-impacted and potentially hazardous sites. As a result, the USGS developed this *U.S. Geological Survey Protocol for Sample Collection in Response to the Deepwater Horizon Oil Spill, Gulf of Mexico, 2010* as an addendum to the protocols, methods, and procedures stipulated in the National Field Manual in order to provide post-landfall field teams with the explicit requirements and guidance needed for sampling potentially hazardous substances under potentially hazardous conditions. “Post-landfall” refers to conditions along the Gulf of Mexico coastline following the shoreline arrival of oil from the Deepwater Horizon well failure and ocean-bottom oil release. Site deployment and sample collection under these conditions necessitated modifications to standard USGS sampling and analysis procedures.

The first version of this sampling protocol was published in August 2010 (*http://pubs.usgs.gov/of/2010/1191/*) to provide authorities responsible for the oversight of oil-response activities, other agencies and organizations collecting post-spill data in the Gulf of Mexico, and USGS field teams with USGS sample-collection plans at Gulf Coast sites where oil had encroached. The protocols were subsequently field tested and revised to account for changed and changing conditions on the ground. This report incorporates modifications to the protocol since it was first published, includes the pre-landfall sampling plan (Appendix A–1), and provides a list of the laboratory analyses performed for this project (Appendix A–2), a list of the sites and dates sampled (Appendix A–3), and location maps of the pre- and post-landfall sites sampled (Appendix A–4).

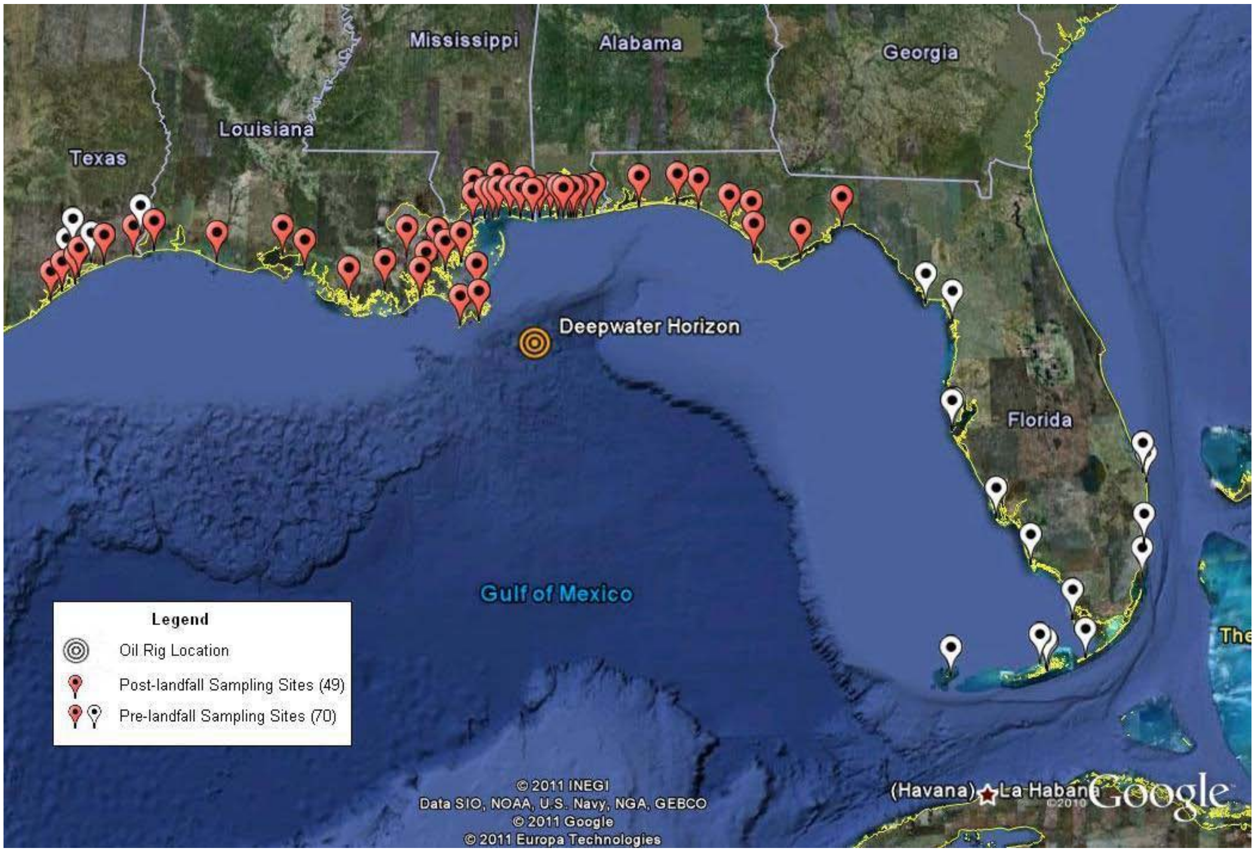

Figure 1. Map showing USGS sites sampled in response to the Deepwater Horizon oil spill, Gulf of Mexico, 2010.

Background

On April 20, 2010, the Deepwater Horizon oil rig exploded, resulting in release of crude oil into the northern Gulf of Mexico from the ruptured British Petroleum (BP) Macondo-1 (BP M-1) well. By July 15, 2010, an estimated 4.4 million barrels (approximately 185 million gallons)[1] of oil had entered Gulf waters (Crone and Tolstoy, 2010), posing a potential threat to the viability of sensitive habitats and other critical and unique environmental resources along the Gulf of Mexico shoreline (fig. 2).

The initial response of the USGS was to mobilize as rapidly as possible to collect samples and data before landfall of the oil in order to establish a baseline chemical and biological profile against which to understand any post-landfall effects on, or changes to, Gulf of Mexico coastal environments. USGS Water Science Centers in Texas, Louisiana, Mississippi, Alabama, and Florida coordinated efforts to sample water and sediments at 70 sites from beaches, barrier islands, and coastal wetlands that could suffer severe environmental damage as a result of oil from the spill coming ashore. Pre-landfall data collection occurred from May 7 through July 7, 2010.

Post-landfall collection of coastal sediments and nearshore water by the USGS was initiated in October 2010, following a request by the U.S. Coast Guard (USCG) to assess the existence of "actionable" levels of Deepwater Horizon-related oil-spill contamination after extensive cleanup efforts of coastal areas by BP. Sampling was carried out at 48 of the original 70 sampling sites that were considered at highest risk for oil contamination and environmental degradation. In addition, one "oiled" wetland site was sampled on August 23, 2010, as part of a separate project to coordinate collection of ground data at Bay Jimmy, La., with data collected during an AVIRIS (Airborne Visible/Infrared Imaging Spectrometer) overflight.

U.S. Geological Survey field teams collected post-landfall samples and site data by following the protocols and procedures laid out in this report in addition to those articulated in the USGS *National Field Manual* (U.S. Geological Survey, variously paged). Appendix A in this report has been expanded to include the guidelines used for the pre-landfall sampling effort in addition to a list and map locations of the 70 pre-landfall and 49 post-landfall sampling sites.

Objective and Approach

The objective of the October 2010 post-landfall sampling effort is to document environmental indicators at 49 of the 70 sites previously sampled; that is, at the subset of sites deemed most vulnerable to oil contamination. Comparisons of pre- and post-landfall sample analyses are being used to document the presence of oil related to the Deepwater Horizon incident and, by use of oil fingerprinting analysis, to distinguish it from historic (pre-Deepwater Horizon) oil. Samples also are analyzed for concentrations of polycyclic aromatic hydrocarbons (PAHs), oil and grease,

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[1] Both U.S. customary English (inch/pound) and SI (metric) units of measurement have been used in this report. The utility of this report led to the decision to allow mixed units in the text and tables. USGS field personnel purchased much of the specialty equipment needed from sources using English units exclusively. In general, however, metric units are used to determine sample volume and the volume of chemical preservatives.

metals and other trace and major elements, nutrients, volatile and semi-volatile organic compounds, total petroleum-range and diesel-range hydrocarbons, dissolved organic carbon, residue of the Corexit surfactant used to disperse the oil released to the Gulf of Mexico, and to identify the status of benthic invertebrate populations, characterize oil-digesting bacterial populations, and examine the toxicity of pore waters extracted from sediment samples (Appendix A-2). Profiles of the research scientists and laboratories used for this work can be found in Appendix C.

Purpose and Scope

This report was intended originally as an addendum to the *National Field Manual*, to provide USGS field teams with the general information and protocols needed to meet the requirements associated with working in an oil-impacted environment that poses a potential hazard to human and environmental health. The urgency of the rapidly mobilized response to the oil spill dictated, however, that these protocols incorporate a level of detail specific to that response. This report, while describing protocols and procedures that are relevant to oil-spill environmental investigations in general, has been focused to address the practical and immediate needs of USGS field teams charged with collecting the data needed to underpin scientific investigations in the northern Gulf of Mexico. The information provided in this report was designed, therefore, to facilitate field preparations and address the necessary data-collection requirements and guidance specific to this sampling effort.

A

B

Figure 2. Photographs showing *(A)* a pristine Louisiana coastal marsh and *(B)* oil encroaching on a Louisiana coastal marsh. Photographs by Dennis Demcheck, U.S. Geological Survey.

2.0 Preparations for Sampling at Oil-Contaminated Sites

Multimedia sampling associated with this response to the Deepwater Horizon oil spill involves the collection of surface-water, sediment, benthic invertebrate, and microorganism data at potentially hazardous sites along the northern Gulf of Mexico coastline. The preparations required to accomplish the proposed field work follow, as applicable, from the procedures established in chapter 1 of the National *Field Manual for the Collection of Water-Quality Data* (see U.S. Geological Survey, variously dated). The *National Field Manual* currently does not, however, provide the detailed guidance needed for sample and data collection at field sites that are considered by regulatory agencies to include oil-contaminated “exclusion zones” or “hot zones.” This report, therefore, augments the standard protocols established in the NFM to ensure the legal and scientific defensibility of data collection and associated field activities at sites considered to include exclusion zones in Gulf of Mexico coastal areas. Before beginning field activities, therefore, it is necessary for field personnel to be familiar with the procedures, requirements, and implementation of NFM protocols in addition to those laid out in this report. **For this project, a three-person field team generally is required for collection of water and sediment samples; site-related field operations may dictate additional field personnel.** A synopsis of the equipment and preparations needed to carry out field activities for this project are provided in this section and are summarized in Appendix B.

2.1 Communication with Incident Command

USGS personnel are to contact the Incident Command (IC) or Unified Command (UC), as applicable, two or more days in advance of deployment to the field site to obtain the “Daily Operational and Safety Situational Report” (the “shift” or operations plan) for their sampling area or sector. The IC/UC may request a description of planned field activities and typically requires personnel to carry an IC-generated identification pass in addition to official USGS identification.

2.2 Training and Safety

All personnel involved in Deepwater Horizon Post-Landfall field activities require 4 hours of training provided by British Petroleum (BP) in addition to formal Hazardous Waste Operations (HazWOper) training. HazWOper training consists of either the 40-hour or 24-hour training or the 8-hour HazWOper refresher (for those having had the 40-hour training over 1 year ago), as detailed in Section 3 of this protocol.

Field personnel also are required to have completed the USGS Water-Quality Field Methods course (QW1028) or the Refresher course (QW3190) within the last 5 years, and the Motorboat Operator Certification Course (MOCC) for those operating motorboats to access sampling sites.

The safety procedures outlined in this protocol are required when entering oil-contaminated areas and are described in detail in Section 3. These procedures mandate monitoring and mitigating the effect of exposure to toxic and combustible compounds associated with the oil release and use of Level D personal protective equipment (and organic vapor analyzers (photoionization detectors), as appropriate to site conditions and given in HazWOper training. Site-specific safety precautions must be identified and addressed adequately in a site-specific Health and Safety Plan (HASP); the provisons in the HASP must be acknowledged and implemented by all members of the field team.

2.3 Equipment and Supplies

Field personnel must allow sufficient time to order and obtain, test, quality assure, and familiarize themselves with the equipment and supplies required for this water- and sediment-sampling operation. A list of recommended equipment and supplies is compiled in Appendix B, with additional information given in each section of this report (for example, Section 5, for field measurement instruments, and Section 6, for water sampling).

- Use of a photoionization detector (PID) is required when working in areas contaminated by petroleum products (see Section 3.0).
- A Global Positioning System (GPS) instrument will be used by each team to document and verify site and sampling locations. In addition, documentation of site and sampling location, features, and conditions requires use of a digital camera, maps, and a bound log book (see Section 8.2.1).

When ordering or assembling articles for the field effort, it is important to include backup, spare, and extra equipment. Spare equipment/supplies includes all that might be needed for sample collection and processing, such as sample containers and labels; capsule filters; backup meters, calibration solutions, and batteries; Teflon core tubes, scoops and bucket liners; an assortment of gloves and glove sizes; field forms, including those for chain-of-custody; decontamination and exclusion zone materials and supplies. It is necessary, for example, to order a sufficient number of sample containers so as to have at least one spare set onsite plus a sufficient number of containers for collection of quality-control samples.

- Sample containers and chemical preservatives are obtained from the TestAmerica Laboratory, Inc. (TAL) in Pensacola, Fla., for samples that will be analyzed at TAL. Some sample containers already contain the chemical preservative required for the respective analysis. Such containers must be handled with caution.
- Supplies and sample containers for samples to be analyzed at USGS research laboratories are obtained through the USGS National Field Supply Service (NFSS) of the National Water Quality Laboratory (NWQL).
- Containers, sample collection and processing equipment, articles needed for equipment decontamination, and supplies for shipping, record keeping, and documentation that are not available from NFSS are obtained on the open market.

Any equipment that will be in contact with the sample must be pre-cleaned and quality assured as prescribed in the USGS water-quality *National Field Manual*. Equipment blanks must be collected to determine if sample-collection and sample-processing equipment could bias analytical results (see Sections 6, 7, and 9). It is important that equipment-blank results be obtained and assessed before field work begins, to the extent possible, so that any corrective action can be taken, if needed.

2.4 Prepare for Field Deployment

Field teams should allow several days to assemble gear; prepare coolers, labels, and paperwork; and make logistical arrangements with Incident Command and the shippers of samples. In many cases two vehicles are needed to transport the gear.

- Create a checklist of all the equipment and supplies to be transported.
- Create and review a workplan that includes the types of environmental and quality-control samples to be collected.
- Prepare a logbook, paperwork, and labels ahead of time to the extent possible.
- Label coolers with the type of samples they will contain. Coolers used for transport and storage of food, water, decontamination supplies, and so on also must be clearly labeled.
- Prepare and check maps for emergency routes and facilities.
- Make a copy of this protocol document to keep in the field; print out Appendix D separately for quick reference.
- Be familiar with and test the operation of the GPS, PID, camera, and other such equipment and instruments.
- Some sampling locations will be accessed by boat; therefore, USCG clearance as well as all training, certifications, and equipment necessary to conduct these activities safely and efficiently must be available and in order. Appropriate arrangements should be in place for and decontamination of the vessel (Section 4.0).

2.5 Initial Onsite Preparations

Upon arrival at the field site, the field team must:

1. Evaluate and record field conditions with respect to provisions of the site-specific Health and Safety Plan (see Section 3.0);
2. Define the exclusion zone (EZ), contamination reduction zone (CRZ), support zone (SZ), and contamination reduction corridor (CRC) (described in Section 4.0) for sampling and equipment decontamination before sample collection can begin;
3. Evaluate and document the nature and extent of apparent oil-spill-related contamination at the time of site visits;
4. Refer to these protocols and previous sampling training and experience to select and implement the appropriate environmental and quality-control sampling and data-collection methods and procedures (Sections 4, 5, 6, 7, 8, and 9);
5. Follow explicitly all chain-of-custody (CoC) and documentation requirements (Section 8). All samples collected for this project must be collected and shipped in accordance with CoC procedures; and
6. Maintain a logbook in which the date/time, place, personnel, visitors, site conditions, and procedures and methods used must be recorded (Section 8).

The flowchart in figure 3 shows the major considerations and actions needed before deploying to the field site. Similar flowcharts are included in Section 4 for equipment decontamination (fig. 4), in Section 6 for water sampling (fig. 7), and in Section 7 for sediment sampling (fig. 8). Appendix D includes two very useful tables, one for water sampling and one for sediment (solids) sampling, that list container requirements for each analysis, summarize how the samples should be preserved and shipped, and list laboratory contacts and addresses. Printing copies of the flowcharts and the Appendix D tables is recommended to serve as quick reference guides for field work.

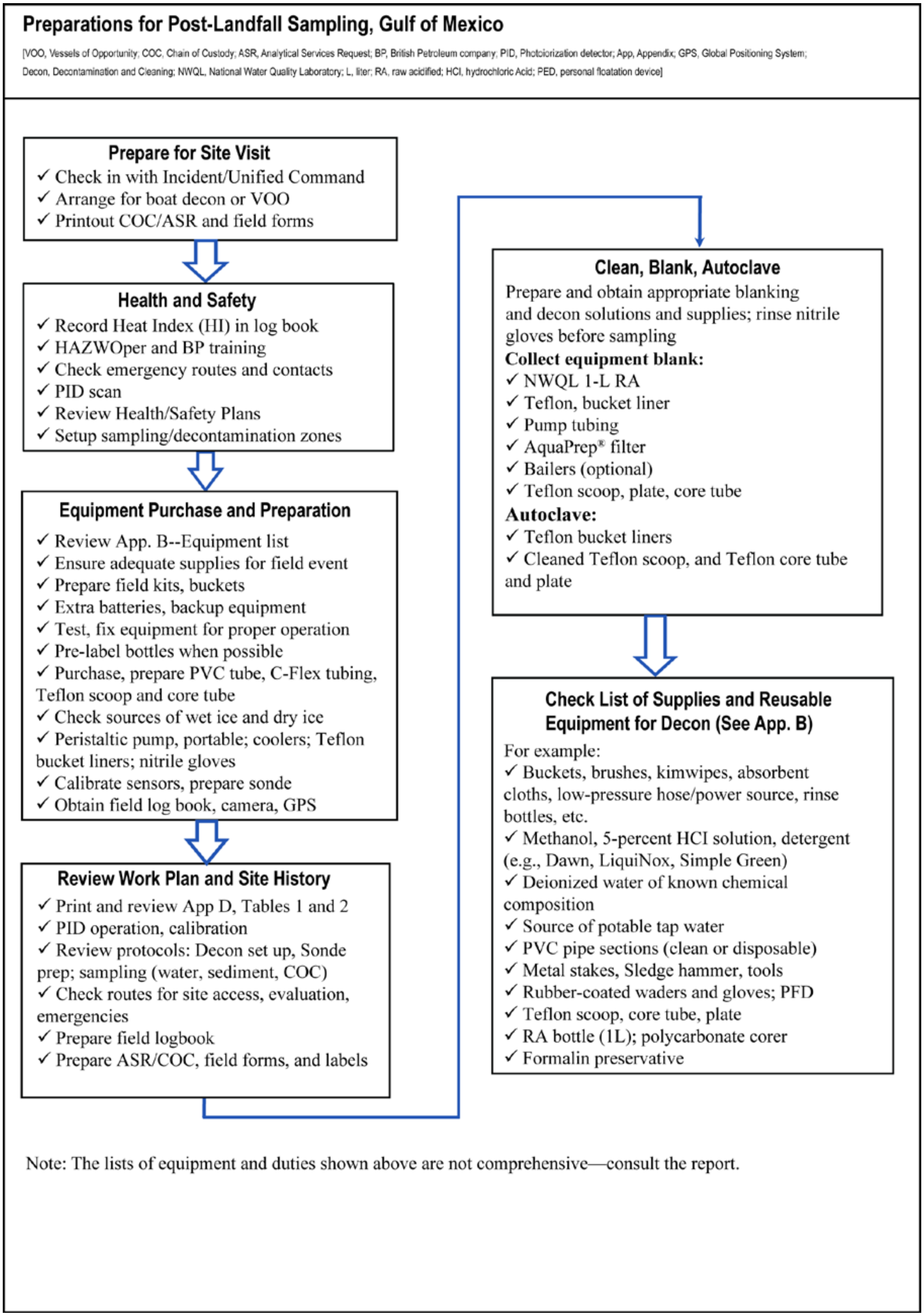

Figure 3. Flowchart showing preparations for post-landfall sampling, Gulf of Mexico, 2010.

3.0 Safety in Field Activities

Large-scale petroleum releases can result in various scenarios for human exposure. The hazards of exposure should not be underestimated when planning to work in affected areas. The Health and Safety Plan (HASP) and other safety procedures and precautions outlined in this section of the protocol are required for USGS personnel entering oil-contaminated areas. The protocol includes procedures for safe work practices, working in exclusion zones, personal protective equipment (PPE), training, and identification of contacts to assist with response to onsite conditions and emergencies. Much of the information covered in this section, as well as examples of HASP documents, are included in greater detail in Appendix E. In brief, the safety requirements described in this section will mandate:

- Development of site-specific HASPs and Job Hazard Analyses (JHA).
- HazWOper and British Petroleum (BP) training specific to the Gulf of Mexico: **Plan on 24 or 40 hours of HazWOper training, plus an additional 4 hours of BP training** (see explanation in 3.2 below). (In addition, OSHA generally requires medical monitoring and CPR/First-Aid Certification training; this is not covered in this document.)
- Two-week Water-Quality Field Class training.
- Motorboat-Operator training and certification for personnel piloting water vessels.
- Air-quality monitoring. Photoionization detection (PID) that exceeds the 20 parts per million by volume (ppmv) action level for total volatile organic compounds will result in evacuation of the field site.[2]
- PPE including Tyvek apparel, PFDs, latex overboots or rubberized waders, eye protection, rubberized elbow-length gloves and nitrile hand gloves, used as described in the protocols for sample collection and handling.
- Strict adherence to HazWOper training and preventing heat stress is required, including **mandatory rest periods every 15 to 30 minutes. DO NOT NEGLECT THIS MANDAT**E.

Changing field conditions may require modifications to these protocols as they apply to Gulf of Mexico oil-spill sampling. Protocol changes will be communicated to field teams and supervisors electronically, as needed. Familiarization with the guidance provided in this section does not replace the requirement to read and understand the HASP (Appendix E).

[2] The U.S. Geological Survey or Department of the Interior industrial hygienist determines if and when PID use can be halted. Use of respirators and monitoring air quality for exposure to benzene are not included in this protocol as they are not relevant to the field conditions planned for USGS shoreline sampling for the 2010 Deepwater Horizon project.

TAKE NOTE! *Field personnel are required to stop work and rest at the first sign of heat discomfort; do not overextend your limits. It is the responsibility of every team member to monitor each other for signs of overheating or other evidence of deteriorating health.*

3.1 Health and Safety Plans

The Occupational Safety and Health Administration (OSHA) requires the development of site-specific Health and Safety Plans (HASPs) that must be given in hard copy to each employee performing oil-response or site-cleanup activities. The field-team leader or supervisor has the responsibility to ensure that the safety protocols and their expectations are understood by each member of their field team.

The USGS has produced a template that can serve as the basis for developing a site-specific HASP for oil-contaminated areas. Some of the information required to populate this template may be included in the *Daily Operational and Safety Situational Report* (Shift Plan) described below. The Incident Command contact or USGS regional safety/industrial-hygiene staff can be called on to provide additional assistance regarding requirements for the HASP.

USGS HASP requirements for response to the Gulf of Mexico (GOM) Deepwater Horizon (DWH) oil spill are fulfilled by assembling a USGS DWH GOM HASP package, which should be kept on hand when deploying to the field site. This package includes the following documents, some of which are included in Appendix E and which USGS personnel can download by opening "HASP Package" found at *https://my.usgs.gov/OWQ_Deep_OilWiki/*[3]:

1. **Agency HASPs.** A HASP provided by the Incident Command (IC) or agency under whose jurisdiction the work will be conducted should be appended to the site-specific HASP, described above. In the case of this project, the HASP provided by the U.S. Fish and Wildlife Service (FWS) will suffice, unless directed otherwise. The links for USCG and FWS plans given below are specific to the current oil release in the Gulf of Mexico and may become inactive at the close of investigations related to this incident.
   a. *U.S. Coast Guard (http://www.uscg.mil/forms/ics/ICS_208_CG.pdf)*
   b. Available to USGS personnel from FWS*:* *http://internal.usgs.gov/ops/safetynet/FWS%20WIldlife%20Branch%20HASP%20(MC%20252%20Oil%20Spill).pdf.*

2. **The Daily Operational and Safety Situational Report (the "Shift" or Operations Plan).** The Shift Plan, which may cover a 24- or 48-hour time period or longer, is to be obtained in advance from the designated IC safety or industrial hygiene staff for the day(s) of field deployment. Contact information for this project is described in Section 3.6; however, the responsible parties shift in and out of their respective positions frequently, requiring field teams to consult the latest Shift Plan.

[3] *https://my.usgs.gov/OWQ_Deep_OilWiki/wiki/Main*; non-USGS parties may request access by contacting fwilde@usgs.gov or sski@usgs.gov and providing the rationale for their request.

a. To avoid delay of field work, arrangements should be made within two or more days in advance to receive the Shift Plan via e-mail for the time period of planned field deployment.
b. The field-team leader or representative also should request information about the accessibility to 911 or other emergency contacts at the site(s) to be visited.
c. Field personnel must be briefed on the health and safety information given in the Shift Plan before commencing with field work; this includes, for example, weather conditions, heat-index values, official emergency evacuation plans, and current emergency contacts.
d. The Shift Plan fulfills the requirement that the HASP include the specific information covering health, safety, and hazardous conditions that pertain to USGS sampling sites on the days of sampling and to keep an up-to-date list of operational and emergency contacts on hand.

3. **Evacuation Plan.** Evacuation plans may or may not be included in the Shift Plan. Evacuation plans are specific to and provided by the Huoma, La., or Mobile, Ala., Incident Commands for this project. The field team should request the latest evacuation plan when requesting the Shift Plan and include it in their HASP package.
4. **Site-specific job and work-site hazards (Job Hazard Analysis or JHA).** Those hazards that have not been included in the HASP or Daily Report should be added to the JHA, as is illustrated in the example JHA in Appendix E. Any other hazards that are identified onsite also should be recorded on the JHA form upon arrival onsite, along with the actions to be taken to eliminate or reduce the hazard(s) noted.

a. JHAs for the handling of dry ice, chemical preservatives such as hydrochloric acid and formalin (see NFM 9.6), and other types of equipment can be accessed at the following URL, and should be downloaded and added to the HASP package *http://1stop.usgs.gov/safety/topic/jha/index.html*.
b. Wildlife hazards, such as snakes, alligators, and ticks and mosquitoes need to be identified and plans in place for a safe and appropriate response—refer to chapter 9 of the *National Field Manual* at *http://water.usgs.gov/owq/FieldManual/Chap9/content.html* (U.S. Geological Survey, variously paged).

5. **Site setup for sampling hazardous materials**. Standard procedures for avoiding contact with and removal of hazardous materials, including setting up Exclusion and Contamination Reduction Zones, normally are included in a HASP developed for exposure to environmental release of petroleum products, as detailed in Section 4.0.

3.2 Training

The training specified below is a prerequisite for USGS personnel whose duties will require field work in oil-contaminatedareas, operation of a motorboat, and who will be engaged in data and sample collection.

3.2.1 HazWOper and British Petroleum Training

USGS personnel entering the “exclusion zones” or “hot zones” (see Section 4) to collect samples are required to complete HazWOper training, plus an additional 4 hours of training from BP, as described below.

The Incident Command requirement stipulates a minimum of 24 hours of HazWOper training for nonsupervisory onsite personnel and 40 hours of training for “supervisory” personnel (defined as one who has authority, control, and oversight of the activities performed at the site). The 40 hours of training are recommended for all USGS field personnel, as any member of a USGS field team may be asked to take on supervisory duties.

- If no one has been given onsite responsibility, or when an onsite supervisor is not present, the individual who is supervising field activities from an offsite location is required to complete the 40-hour HazWOper training.
- The 8-hour refresher course for HazWOper training is required for personnel whose HazWOper training is not current. Initial and refresher training certification expires 12 months from the completion of the last training.
- For this project, USGS employees can take HazWOper training online through the FWS vendor at no cost. Select the course below to register, then select “U.S. Fish and Wildlife” as the company name. Leave the bottom (payment) portion blank, as billing arrangements have been made. After clicking to submit your registration, the course opens immediately. Your place is saved automatically if you leave the training session before finishing.
  - 40 Hours of HazWOper training - *https://www.natlenvtrainers.com/register.html?course=40HazWOper*
  - 24 Hours of HazWOper training - *https://www.natlenvtrainers.com/register.html?course=24HazWOper*
  - 8 Hours of HazWOper Annual Refresher training - *https://www.natlenvtrainers.com/register.html?course=HazWOper*
- Other vendors approved to provide classroom or electronic HazWOper training can be found at ERTP Virtual University (*http://www.ertpvu.org/kc/login/login.asp?kc_ident=kc0001*). Registration is required to access the site. Once logged on, select the external provider from the left side of the screen and then select the List of EPA Approved External Providers to locate vendors.
- In addition to the HazWOper training, all field personnel engaged in this project must take the following 4-hour online BP training, regardless of previous or current HazWOper training (instructions for taking this training are provided in Appendix E): Post Emergency

Spilled Oil Cleanup (HSEREH004)
https://www2.virtualtrainingassistant.com/BPPublic/wc.dll?learner~cmenu.

3.2.2. Motorboat Operation

All USGS personnel who operate a motorized watercraft vessel less than 26 feet in length for Gulf coast sampling are required to complete the Department of the Interior Motorboat Operator Certification Course (MOCC). This course involves "hands-on" watercraft activities, including watercraft handling and maneuvering, docking, emergency procedures, fire suppression, and trailering exercises, as well as classroom instruction. MOCC Certification is valid for 5 years and recertification is available either online or in combination with a MOCC Instructor.

3.2.3 Water-Quality Field-Methods Training

QW1028, the 2-week course on "Groundwater and Surface-Water Water-Quality Field Methods," contains protocols and guidance on safety when sampling under a variety of environmental conditions, using various chemical agents. This course is based on the USGS National Field Manual (U.S. Geological Survey, variously paged), which also contains a chapter on "Safety in Field Activities" (Chapter A9). All USGS personnel engaged in on-site sampling and data collection for this project should have completed the 2-week classroom and hands-on course or its refresher course within the past 5 years and have experience implementing the protocols and procedures provided within each chapter of the water-quality National Field Manual**. At a minimum, the field team leader and one other team member must be current in this water-quality field-methods training.**

3.3 Air Monitoring

Air monitoring is required to determine if a given area is receiving volatilized petroleum compounds at a level that may present a hazard to human health. The Department of the Interior (DOI) has set a limit on respiratory exposure to total VOC (volatile organic compounds) of 20 ppmv.[4] The U.S. Environmental Protection Agency (USEPA) maintains a database of air-monitoring results at *http://www.epa.gov/bpspill/air.html*.

3.3.1 Air-Quality Monitoring Equipment

In general, a combination meter that includes a photoionization detector (PID) and a lower explosive limit (LEL)/upper explosive limit (UEL) meter is recommended when exposure to petroleum-based products is anticipated. Depending on the situation, monitoring of benzene concentrations might need to be added to the HASP.[5] For the Gulf of Mexico shoreline work, a

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[4] 16 June 2010 e-mail from Robert J. Garbe, Office of Occupational Health and Safety, U.S. Department of the Interior: A 5 ppm cut point for the PID is too low to minimize false positive readings. Recommend that a 20 ppm initial cut point be used. Also recommend any excursion above this level be reported to the USGS Safety Office for input and guidance prior to reentering the area.

[5] OSHA (Occupational Safety and Health Administration) guidance stipulates a permissible exposure limit (PEL) of 1 ppm and a short-term exposure limit (STEL) of 5 ppm for benzene. The STEL is based on a 15-minute excursion average, while the PEL is based on an 8-hour average; that is, over an 8-hour excursion the average benzene concentration is not to exceed 1 ppm.

single-function PID should be used to monitor for organic vapors in the ambient and breathing zone during sampling activities. An LEL/UEL meter is recommended if there is a source of ignition (such as a boat engine) in the area. Appendix B includes additional PID information.

All air-quality monitoring equipment shall be field-calibrated daily before use and in accordance with the manufacturer's instructions. Anyone calibrating or using the air-monitoring equipment should be trained and familiar with exposure-monitoring instrumentation. The time of calibration and ambient measurements are to be recorded in the field logbook and the data are to be recorded on the field form (Appendix F).

3.3.2 Air Quality: Exposure Criteria and Actions

Personnel are to evacuate the immediate area if the total VOC concentration indicated by the PID reaches 20 parts per million by volume (ppmv). It is necessary to report exceedance conditions to the USGS or FWS Industrial Hygienist for input and guidance before reentering the area (written commun., DOI Office of Occupational Health and Safety, 2010). The USGS Industrial Hygienist has authority to advise when PID scans are not or are no longer necessary.[6]

- To avoid potential inhalation of vapors, personnel should be positioned upwind of free product in the water or on land and upwind of field vehicles or other petroleum-containing or -burning equipment. If this is not possible the team leader will determine if the health and safety of personnel are at risk and if sampling should be aborted.
- Field personnel must evacuate the site if PID action levels are exceeded. **Do not enter or reenter the site until concentrations fall below the action limit** unless properly fitted respirators are at hand and the team leader determines that sample or data collection can continue. Personnel for this project will not be placed in any situation where respirators are required; that is, if volatile organic concentrations exceed 20 ppmv.
- Personnel who experience symptoms of exposure while onsite, even when air monitoring does not indicate excursions above the action limit, are to evacuate the site and to contact the Safety Point of Contact (see Section 3.6) for specific guidance.

PID readings should be recorded:

- Upon initial entry to the area.
- Every 10 to 30 minutes, or as often as practical while in the breathing zone while work is in progress, as long as the PID reading does not appear to be increasing and does not exceed 20 ppmv.
- When weather conditions change.
- When adverse conditions are encountered, such as exposing fresh crude oil or noticing an increase in odors since initial entry.
- When work begins on another portion of the site (for example, moving from water sampling to the collection of sediments and other solid materials).

[6] By the start of the post-landfall sampling on October 5, 2010, field teams were notified by the USGS Industrial Hygienist that PID scans were no longer required at Gulf of Mexico coastal areas.

U.S. Department of the Interior) Industrial Hygienists collect air samples and air-sample data to characterize exposures for DOI employees involved in the response activities. USGS Safety and Health Industrial Hygienists are using this information to develop the safety and health requirements and guidelines. At the end of field operations, copies of field forms containing air-monitoring results should be sent to the USGS Bureau Industrial Hygienist. Air–monitoring results for the Gulf of Mexico can be found under the following URLs:

- USEPA: *http://www.epa.gov/bpspill/air.html*
- Current Air Quality along the Gulf Coast: *http://gulfcoast.airnowtech.org/*

3.4 Personal Protective Equipment

The recommendations in this section regarding personal protective equipment (PPE) have been developed from information taken from U.S. Department of Health and Human Services, National Institutes of Health, regarding the current crude oil spill, and from DOI and USGS Health and Safety officials. To the extent possible, disposable PPE will be used to minimize the risk of skin contact with potentially contaminated sediment or water and to minimize extensive PPE decontamination procedures. A list of recommended PPE is at the end of this discussion and in Appendix E.

All personnel working in a near-shore or off-shore environment must wear a properly fitted Personal Floatation Device (PFD) as described in USGS Safety Bulletin “Personal Floatation Device Selection/Use,” issued 07/22/2010 (Appendix E). Hearing protection is recommended when working in the vicinity of boat motors or other loud equipment. Protocols and procedures for discarding oil-contaminated clothing and materials are described in Section 4.

- **Personnel working in water affected by free product are required to wear modified Level D clothing**, including: disposable Tyvek coveralls or pants, safety glasses, and disposable nitrile gloves (for handing sample containers and chemical preservatives); and nondisposable (cleanable) PFDs, rubber waders, and elbow-length rubber gloves.
- **Waders should be worn over Tyvek apparel.** If working in conditions where water could enter the waders, the top of the wader should be taped to the underlying apparel with duct or Chemron tape. If working in shallow water for which waders are not required, latex waterproof boots should be worn over waders and taped to Tyvek pants to form a seal, as water will leak through Tyvek seams. Waders should be removed and cleaned once back on shore.
- **PFDs should be worn over the Tyvek and wader suspenders** when working in water and should be adequately cleaned or discarded (see Section 4) if soiled by free product or other contaminant.
  - Where there is a potential for oil contamination, the Revere Type V Model 280 Work Vest (nylon-buckle closure) PFD has been recommended. This PFD should be used and modified as follows to meet DOI standards: obtain pre-cut patches of SOLAS adhesive-backed reflective tape from the Bureau Watercraft Safety Program Manager

along with a detailed drawing of where to attach the tape. The Type V Model 280 PFD can be cleaned of oil using soap and water or alcohol swabs.

  – The standard Type 3 PFD supplied to USGS personnel may be worn where there is no potential for oil contamination; however, should the PFD become contaminated with oil or oil-related product, the PFD may not be reused and must be disposed of as hazardous waste.

- Elbow-length rubberized gloves are worn over layered nitrile gloves. Do not reach into contaminated water to collect samples without wearing appropriate gloves. Rubberized gloves can be cleaned as described in Section 4. Disposable (nitrile) gloves need to be replaced often in order to maintain chemical protection, and disposed of as described in Section 4.
- Splash shields or safety glasses are worn to protect eyes from splashes during sampling, decontamination procedures, or boat travel.
- **Personnel working on land also are required to wear modified Level D clothing**.
- Use latex boots instead of Tyvek boots; Tyvek shreds readily when walking on beach sands.
- Take care to prevent skin contact with contaminated water and sediments by wearing hand and arm protection (Sections 5, 6 and 7). (Care also must be taken to avoid exposure of sediment samples to materials other than the Teflon devices designated for sample collection, including contact with gloved hands).

List of recommended PPE:

- Calibrated PID, possibly in combination with an explosimeter (LEL/UEL meter) and benzene sensor.
- National Institute of Standards and Technology (NIST) traceable calibration gases and regulators for the specific instrumentation.
- Operator's Manual for PID/UEL instrumentation.
- Eye protection (safety glasses, splash shield, goggles, as appropriate).
- Nitrile gloves.
- Rubberized gloves, elbow-length or longer.
- Tyvek pants or coveralls.
- Latex waterproof overboots (as appropriate).
- Rubberized (cleanable) hip or chest waders.
- PFD, Revere Model 280 Type V work vest (available from, for example, WestMarine/Port Supply, "Model # 10967776) with nylon-buckle closure. This PFD must be modified to conform to the USGS standard for PFD reflectivity (Section 3.3 above).
- PFD, standard Type 3, as specified in USGS Safety Bulletin 7/22/2010 (Appendix E).
- Duct or Chemron tape.
- Insect repellent (noncontaminating) and head nets.

- Steel-toed shoes/boots (as specifically required by work task).
- Hard hat (as specifically required by work task).

3.5 Health Monitoring: Exposure and Heat Stress

Ingestion of contaminated materials is minimized by good personal hygiene and taking the appropriate cautions while handling materials and solutions associated with petrochemical contamination and equipment decontamination (that is, by thoroughly washing face and hands with soap and water, especially before eating or drinking).

The Heat Index (HI) is the temperature the body feels when heat and humidity are combined. It sometimes is referred to as the "apparent temperature." The HI, given in degrees Fahrenheit (ºF), is a measure of how hot it feels when relative humidity is added to the actual air temperature. The National Oceanic and Atmospheric Administration (NOAA) posts a heat-index calculator at *http://www.hpc.ncep.noaa.gov/html/heatindex.shtml*; the heat index also can be found from the National Weather Forecast. HazWOper training and subsequent refresher training should include prevention and identification of heat stress-related injuries and illnesses. **Field personnel must record the Heat Index (HI) in their field notes (this information should be included in the Shift (Operational) Plan described in Section 3.1 above).**

The Heat Stress Prevention Program outlines exposure controls to protect employees working in hot environments and follows current American Conference of Governmental Industrial Hygienists, guidelines. These are general guidelines that need to be tailored to provide specific guidance for the work site. **The Heat Stress Prevention Program is implemented when work-area temperatures rise above 90oF when Level D PPE is worn.** Work practices and exposure controls are used to reduce the risk of elevating an employee's core body temperature. These work practices and exposure controls are detailed in the HASP package, include the following:

- Defining and adjusting employee work/rest intervals.
- Monitoring for physiological signs of heat stress.
- Providing cool liquids at the ratio recommended in the site-specific Shift Plan.
- Establishing and implementing acclimatization schedules.

TAKE NOTE! *Wearing PPE can increase your risk for heat stress, exhaustion, and heat stroke when working in hot climates or at elevated levels of temperature and humidity.*

Stay hydrated and be alert to signs of headaches, dizziness, nausea, cramps, and profuse sweating followed by no sweating in yourself and others.

Do not push yourself. Switch sampling duty among team members every 30 minutes or less.

3.6 Points of Contact

Points of contact refer to those offices or individuals having responsibility over a specific function related to the oil-spill response. These personnel often rotate in and out of a given position along with their phone number, making it necessary for field personnel to obtain up-to-date contact information for the period of field work. This information is provided in the Shift (Operational) Plan.

For this project, the team leader obtains the Shift (or "Ops") Plan from the Houma (Texas and Louisiana Water Science Centers) or Mobile (Alabama, Mississippi, and Florida Water Science Centers) Unified Command Sector Safety Officer ahead of field deployment (Section 3.1). The information below shows the office to be contacted for a given function or need and, if available, provides contact information that is persistent and therefore, in general, not subject to change. **For this project the IC/UC, or FWS Safety Officer on duty is the primary coordinating contact.**

3.6.1 Incident Command Operations, Safety Officers, and Other Resources

USGS personnel should notify the local Incident Command (IC) Center about the location and the type of work being done. The IC staff advises on areas that are off limits, or if IC authorization is required to enter certain areas. USGS personnel can obtain current guidance on safety and health issues, such as known hazardous conditions, from their local and Regional Safety staff if primary points of contact are not available.

Incident Command and Safety Officers

- Houma, La., Incident Command - 1697 Highway 311, Houma LA 70395, Main 985-493-7600; Operations 985-493-3343; mc252decon@gmail.com
- Mobile, Ala., Incident Command - One South Water Street Mobile AL 36602, 251-442-1938.
- Houma Sector, Wildlife Branch, Safety Officer -- BP persistent cell phone (985-665-7093).
- BP-provided Safety Officer for Houma - 985-709 5957
- St. Petersburg, Fla., Incident Command - Fish and Wildlife Research Institute, 100 8th Avenue SE, St. Petersburg FL 33701, 904-755-8008
- Fish and Wildlife Service (FWS) Safety Officer, Mobile, Ala. sector
- Fish and Wildlife Service Safety Officer, Houma, La. sector
- DOI Occupational Safety and Health Manager
- USGS Bureau Industrial Hygienist
- USGS Eastern Region Industrial Hygienist
- USGS Bureau Watercraft Safety Program Manager, USGS Center for Coastal and Wetland Studies, St. Petersburg, Fla.

Online resources

- Joint Incident Command:
  http://www.deepwaterhorizonresponse.com/go/doctype/2931/53023
- DOI: *http://www.doi.gov/deepwaterhorizon/*, and
  https://www.smis.doi.gov/smisaux/OilSpillInfo.htm
- USGS: *http://www.usgs.gov/deepwater_horizon/*

3.6.2 Waste Disposal and Other Environmental Issues

Questions should be referred to the designated DOI IC staff at the Office of Environmental Policy and Compliance for Policy, Management, and Budget. Waste disposal and other environmental issues are covered in Section 4.

3.6.3 Watercraft Decontamination and Vessels of Opportunity (see Section 4.2)

- USGS personnel should notify the IC in advance regarding decontamination services for Water Science Center vessels: Mobile, Ala., Incident Command Center, 985-493-3343 mc252decon@gmail.com
- Mobile Decontamination Center, 251-455-3010 (for locations of Mobile IC Region Decon Centers, see www.bpdecon.com)
- Vessels of Opportunity coordination hotline: 866-279-7983 or 877-847-7470

3.6.4 Accident Reporting

All accidents are to be reported within the DOI Safety Management Information System (SMIS) accessible at *https://www.smis.doi.gov/* and by clicking on the "Accident Reporting" tab. Note that under the "Special (Disaster Response Related) Accident Report" selection, the Department has added the following category "During the Response to the Gulf Oil Spill." This category must be marked when reporting accidents involving individuals who become ill or are injured during natural disaster relief efforts. On the injury selection page there is an entry button that allows the reporting supervisor to categorize an injury. This specialized entry page has specific questions on PPE and training. Questions related to SMIS may be directed to the DOI Occupational Safety and Health Manager, 202-288-5549/202-904-0008 or USGS Headquarters Safety and Health Specialist, 703-648-7553.

4.0 Site Setup and Decontamination

This section provides protocols and procedures for dividing a highly contaminated site into zones of greater to lesser contact with hazardous substances (Section 4.1) and the procedures to be used to clean equipment that has been in contact with such substances (Section 4.2). Requirements for how to handle the decontamination of sampling equipment when working under hazardous-waste operations is described in Title 29 Code of Federal Regulations (CFR) 1910.120 (*http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=9765*).

This guidance specifically addresses work performed in oil-contaminated environments, such as those encountered in the Gulf of Mexico as a result of the Deepwater Horizon oil rig explosion. It is to be implemented in addition to the procedures described in chapter 3 of the *National Field Manual* (U.S. Geological Survey, variously dated) that are used routinely by USGS project personnel for cleaning sample-collection and sample-processing equipment. The cleaning of multiparameter sondes is treated separately in Section 5.0 of this report.

The extent to which all or some of the procedures described in this guidance are implemented is determined by the team leader or project management and depends on conditions at the site during field operations, the types of equipment being used, and whether or not the equipment will be reused at another site. The team leader must hold a current certification for the 40-hour Hazardous Waste Operations and Emergency Response (HazWOper) training, which qualifies her/him to make the appropriate onsite decisions. All decisions made and actions taken that deviate from the original plan are to be documented in the field logbook.

4.1 Work Zones

Upon entering the field site, sampling and decontamination areas are delineated so that the level of contamination decreases at the boundaries of the work zone (fig. 4). These work zones are defined by the level of contamination contained within their boundaries and provide the framework for a system of movement between and among the zones. Delineation of the work zones described below is adapted when sampling involves working from or on a boat.

- **The Hot Zone or Exclusion Zone (EZ)** is where sample collection and processing take place and therefore is the zone of heaviest contamination. **The EZ is designated and cordoned off with police tape; for example, the yellow tape shown in the photos** (fig. 5). Personnel who enter the EZ must be properly certified, trained, and equipped, as described in Section 3 of this report and in the HASP (Appendix E). Sampling equipment and personnel move from the EZ directly to the CRZ to contain any contamination that was encountered.
- **The Contamination Reduction Zone (CRZ)** is the area designated for the cleaning and decontamination of handheld equipment, including nondisposable PPE, and for disposal of single-use clothing and equipment. Decontamination stations are set up within the CRZ during site mobilization and before sampling. One person should be assigned responsibility for activities carried out in the CRZ.

- **The Support or Safety Zone (SZ)** is where field personnel put on PPE before starting work and where clean and decontaminated equipment and supplies are stored and protected from the contaminated environments of the EZ and CRZ.
- **The Contamination Reduction Corridor (CRC)** is the pathway between the EZ, CRZ, and SZ, along which personnel move to the EZ and from the EZ to the CRZ and, after decontamination, from the CRZ to the SZ. Personnel entering the CRC wear the same level of PPE as those who work in the CRZ. Another corridor may be required for the entry and exit of heavy equipment.

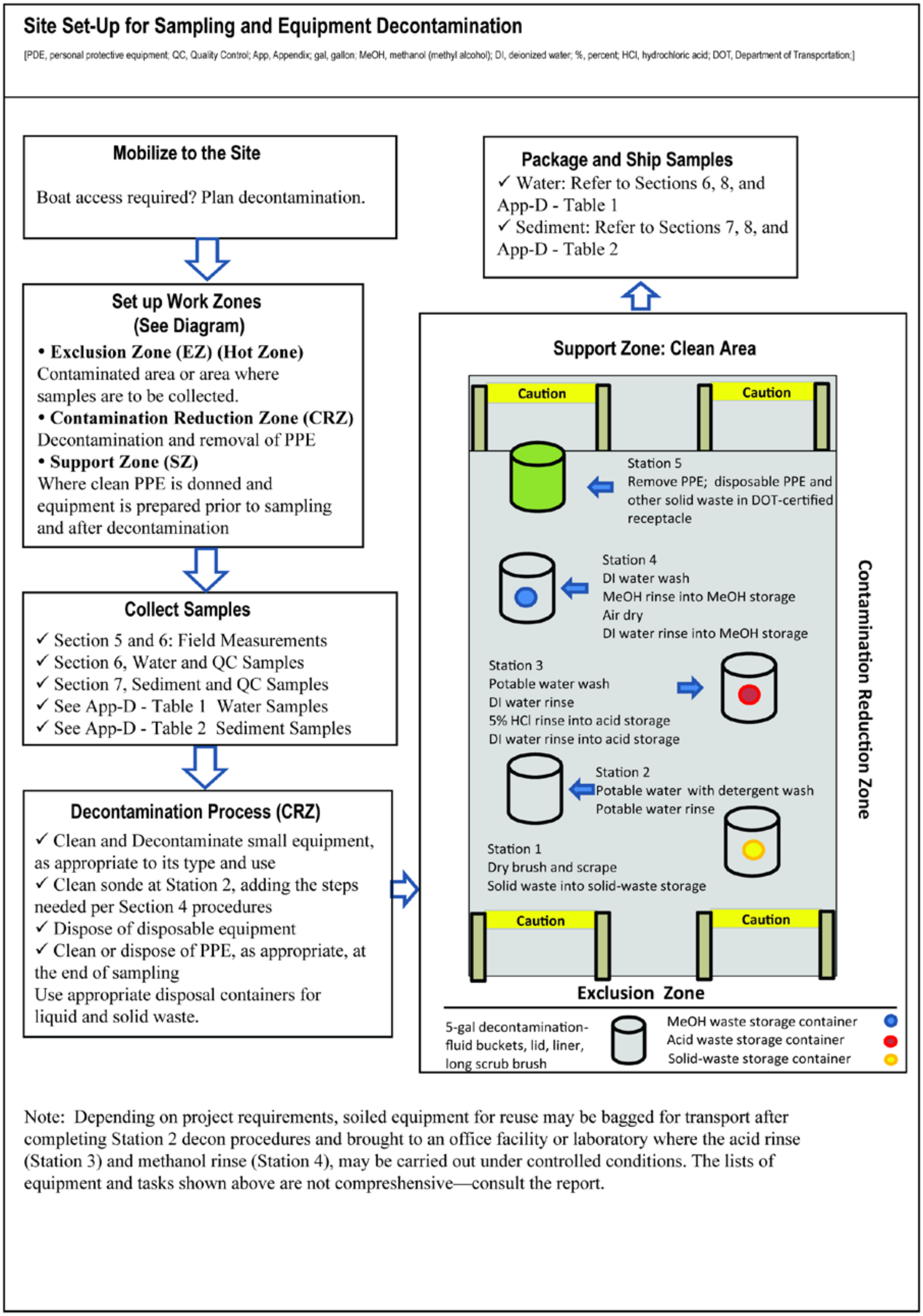

Figure 4. Flowchart showing site setup for sampling and equipment decontamination.

For sampling operations that require site access by boat, the EZ is established on the wetland or barrier island (fig. 5B) and a zone of initial equipment decontamination (a CRZ) and a clean support zone (SZ) should be established on board and delineated with police tape. (See Section 4.2.2.2 for boat decontamination.)

A

Photo by Shane Stocks, U.S. Geological Survey.

B

Photo by Jason Griffith, U.S. Geological Survey.

Figure 5. Photographs showing the exclusion zone delineated by yellow police tape: (*A*) Biloxi Beach, Mississippi, and (*B*) wetlands at Bay Jimmy, Louisiana.

4.2 Decontamination Procedures

The purpose of decontamination is to eliminate the transfer of contaminants, including chemical substances and nonindigenous invasive species, to other samples, sites, personnel, and equipment. Removing or neutralizing contaminants from equipment minimizes the likelihood of sample cross contamination, reduces or eliminates transfer of contaminants to clean areas, and prevents mixing of incompatible substances. Protocols for decontamination and disposal of PPE are to be included in the HASP.

- In preparation for the site visit, all the equipment to be used for sampling that actually or potentially will contact the sample must be cleaned and stored according to standard USGS protocol (see NFM chapter 3 *in* U.S. Geological Survey, variously dated). This protocol includes the collection and analysis of equipment blanks before field work begins, to the extent possible.
- Nondisposable sampling equipment and clothing (for example, rubberized waders, elbow-length rubber, and Type V Model 280 PFDs) must be decontaminated or otherwise cleaned appropriately after each use according to the procedures provided in this protocol.
- In general, equipment only undergoes full decontamination at the field site if the equipment will be used at another site on the same day and additional sets of precleaned equipment are not available. To the degree practical for this project, disposable equipment will be used and disposable clothing will be worn to minimize the need for decontamination and avoid contact with caustic or volatile decontamination fluids as well as contaminated equipment.

4.2.1 Cleaning Agents

Gross contamination of equipment is removed using a combination of mechanical and chemical methods, depending on the type of equipment, the degree to which equipment has been contaminated, and the sample analyses to be performed.

1. Mechanical actions
    a. Abrasive action: Abrasive materials, such as disposable metal or nylon brushes, are used to remove the surface layer of the contaminant. Care must be taken not to scratch or otherwise damage vulnerable surfaces of the equipment being cleaned.
    b. Water under low or high pressure: A low-pressure water rinse using a slender nozzle and hose, similar to a garden sprayer, can be used to spray hard-to-reach places in smaller equipment onsite. High-pressure pumps flush contaminants from equipment and are used, generally, offsite for boats or other large equipment at pressure ranges from 340 to 680 atmospheric units (atm) and flow rates from 20 to 140 liters per minute. Pressure-rinse methods sometimes employ a low-sudsing, nonphosphate detergent.
    c. Simple rinse: Spraying or squeezing water through a dispenser bottle is used to remove substances adhering to the exterior of bottles, sonde and sensor surfaces, and

equipment crevices. Contaminants are removed by dilution, physical attraction, and solubilization.

   d. Damp or dry cloth: Cloths are used to wipe off oily, chemical, and sediment substances that have adhered to equipment.

2. Chemical complex formation is used to inactivate contaminants by neutralization, chemical reaction, disinfection, or sterilization.

   a. Chemical agents: Use of chemical cleaning agents such as hydrochloric or sulfuric acid and a solvent such as methanol, whether in the field or laboratory, is understood and familiar to USGS personnel, who should follow equipment-cleaning protocols in chapter 3 of the *National Field Manual*.
   b. Sterilization: Equipment disinfection or autoclaving, when necessary, will be performed in the laboratory, following procedures given in the National Field Manual (see NFM 7.1, *http://pubs.water.usgs.gov/twri9A7/* in U.S. Geological Survey, variously dated).

Additional considerations when applying decontamination methods include:

- ASTM Type I deionized water used in cleaning/decontamination procedures must be verified by laboratory analysis to be below the method detection level for the contaminants of concern.
- For equipment-cleaning purposes, use of an untreated potable water supply is not an acceptable substitute for tap water. Tap water from any municipal or industrial water treatment system should be of the appropriate quality needed.
- To avoid possible bias to the analytical data, ensure that any residue from detergent or solvent use has been completely removed before samples are collected with the equipment.

  See Section 4.2.4 for a list of the equipment and supplies needed for equipment decontamination.

4.2.2 Contaminant Reduction Zone (CRZ): Five-Station Equipment-Decontamination Procedure

The CRZ is arranged into a series of stations or steps that facilitate and contain the equipment-decontamination process. The flowchart in figure 4, indicates a five-station setup in the CRZ, but the actual number of steps needed depends on the type and degree of contamination and the amount and type of equipment that has been affected, which in turn depends on the cleaning solutions and supplies to be used. If not dictated by an official policy, it is left to the best professional judgment of the field-team leader to decide whether an acid rinse and (or) methanol rinse is required and whether it should be performed onsite or in a laboratory.

The information that follows about the five-station setup reflects the currently accepted standard operating procedure for equipment decontamination for field sites for which containment of hazardous waste is a factor. In this project, USGS field teams will employ single-use, disposable equipment in a manner that minimizes the amount of solid waste and maximizes containment of hazardous substances and, therefore, are not expected to need the CRZ acid or methanol CRZ stations described below.

4.2.2.1 CRZ Station Setup

Begin by covering the surface of the CRZ with plastic sheeting that is sufficiently large to contain all decontamination equipment and supplies (for example, 4 ft by 10 ft). Set up stations with the equipment and supplies needed for equipment decontamination: arrange buckets, solutions, low-pressure sprayers, and other equipment and supplies to be used at each station. Typically, reused handheld sampling equipment and PPE require two to three 5-gallon buckets per station. Modify the CRZ setup as appropriate, depending on whether the equipment that requires an acid and (or) organic-solvent rinse will be decontaminated in the field or laboratory.

If decontamination of equipment will include offsite use of acid and (or) methanol (for example, in an office laboratory), wash and rinse equipment as described for Stations 1, 2, and 3(a), and store the equipment in an extra-heavy trash bag labeled "contaminated equipment" for transport to the office laboratory.

Station 1—Mechanical removal of visible contaminants: Using a brush or scraping tool, manually remove surface soil, such as mud or caked oil, from cleanable PPE and equipment (rubberized waders and gloves, buckets; any other equipment for reuse) (fig. 6).

- Scrapings may be left onsite.
- Take care to use tools and pressure suitable for cleaning the equipment without damaging it.
- Discard disposable contaminated equipment (such as nitrile gloves, stakes, bucket liners, plastic sheeting) into properly labeled solid waste canisters or heavy trash bags and seal.

Station 2—Wet wash: Fill a 5-gallon bucket with approximately 3 gallons of a solution of tap water and detergent. Use a scrub brush and the detergent solution to remove visible particulate matter and residual oils and grease. Rinse with potable water using a low-pressure dispenser. Repeat in a second bucket, if necessary.

- Capture the waste solution in a 5-gallon container.
- Contaminated, soapy wash water must be disposed of properly offsite to avoid bias to the dispersant, nutrient, or other sample analyses.

Station 3—Second wet wash, acid rinse, and inorganic-blank water rinse:

a. **Wet wash.** Fill a 5-gallon bucket with approximately 3 gallons of tap water and use a clean, well-rinsed scrub brush to clean equipment a second time. Follow this by rinsing thoroughly with deionized water, using a low-pressure dispenser. Capture the waste solutions in a 5-gallon container for proper offsite disposal. (Skip to Station 3 step (c) if no acid rinse is needed. If an acid or organic-solvent rinse will be performed offsite, skip to Station 5).
b. **Acid (or bleach) rinse.** To remove inorganic constituents and bacterial DNA, acid-rinse the equipment. Wear gloves appropriate for contact with acidic or caustic solutions. Pour

a 5-percent hydrochloric acid (pH less than or equal to 2) or a 10-percent bleach solution into an uncolored plastic basin for a 15- to 30-minute equipment soak (if needed) or rinse equipment by dispensing the acid or bleach solution through the nozzle of a squirt/squeeze bottle. If equipment requires soaking for contaminant removal, follow with a squirt-bottle-dispensed rinse. Capture all the waste solution in an acid-waste designated container for proper offsite disposal.

c. **Blank-water rinse.** Complete the work at this station by rinsing equipment thoroughly using laboratory-certified inorganic-grade blank water[7] (IBW) dispensed under low pressure. **Repeat the IBW rinse at least five times**, capturing rinsate in the designated labeled container for offsite disposal. (If a methanol rinse will not be needed, repeat the IBW rinse two times, followed by a VOC- and pesticide-grade blank water (VPBW) rinse repeated three times; skip to Station 5).

- Bleach option: Use a freshly opened bleach container.
- Thorough removal of any acid or bleach residue is essential to maintain the integrity of the samples.

Station 4—Solvent (methanol) and organic-blank water rinse:

a. **Methanol rinse.** Wear gloves appropriate for contact with organic solvents. To remove trace organic compounds, dispense laboratory-grade methanol or other organic-compound solvent from a Teflon squirt/squeeze bottle or wipe equipment down thoroughly using clean, organic solvent-wetted cloths. Place equipment on an aluminum foil-covered tray and allow the solvent to evaporate completely from the equipment. Capture liquid methanol waste in an appropriate container and keep it capped. Dispose of methanol-wetted cloths in a metal canister and keep the canister capped.

b. **Deionized- and blank-water rinses.** Fill a 5-gallon bucket with approximately 3 gallons of deionized water and scrub methanol-rinsed equipment with a clean brush. Next, fill a low-pressure rinse dispenser withVPBW and rinse equipment, capturing the rinsate in an organic-solvent storage canister for proper offsite disposal.

Station 5—Disposable equipment and PPE: Remove and discard disposable PPE, along with any disposable sampling-related equipment into a labeled rubbish can lined with a heavy-duty trash bag and seal it shut.

On-Board Stations—Equipment cleaning on boats: Sampling operations that require boat-access to a site at which it is not practical to establish on-land decontamination zones must plan, at the least, for on-board equipment cleaning procedures as described above for Stations 1 and 2. The boat must be set up with a clearly defined clean (SZ) zone and cordoned decontamination (CRZ) zone. After completing the Station 1 and 2 cleaning, the rinsed equipment is packed into

[7] USGS personnel obtain certified inorganic- and organic-grade blank water through the USGS One Stop Shop.

labeled heavy-duty plastic trash bags for transport to the onshore decontamination station. Completion of decontamination procedures should be executed at the boat launch or later at appropriate office facilities.

TAKE NOTE! *Liquid and solid wastes from decontamination efforts must be containerized in appropriate and labeled containers and disposed of in accordance with the prevailing State, local, or Federal regulations. Unified Command decontamination stations normally will accept properly containerized waste.*

Figure. 6. Photograph showing a Contaminant Reduction Zone, Station 1, the decontamination of waders. Photograph by Jason Griffith, U.S. Geological Survey.

4.2.2.2 Boat Decontamination

A decontamination plan must be in place when a boat (or other large equipment) is required to sample in oil-contaminated waters. Boats can be decontaminated offsite at IC/UC decontamination staging stations or onsite by the field team.

USGS Water Science Centers may decide to use Bureau watercraft or contract for the use of privately owned boats, known as Vessels of Opportunity (VOO). USGS personnel are responsible only for decontamination of USGS vessels. This is most conveniently accomplished at IC/UC-operated staging stations, if available. The UC or IC should be contacted in advance of the field work to arrange for vessel decontamination at such staging stations. These stations often are mobile land or water operations whose locations can change throughout a day or week**. To arrange for boat decontamination for this project:**

- Contact the Houma IC Decon Center, 985-493-3343, mc252decon@gmail.com, or the Mobile IC Decon Center, 251-455-3010, depending on the sector in which you are working. You will be directed to the nearest decontamination center.
- Information for finding VOO is available through the VOO Hotline, (866) 279-7983, (877) 847-7470, or by contacting the VOO Program Coordinator for Houma, La., at 427-773-9983 (check the current Shift Plan for contact names and numbers).

It is recommended that Bureau watercraft be rinsed with clean water and allowed to dry before mobilizing offsite, to prevent the spread of contaminants. Under some circumstances, allowance may be obtained for boats to be cleaned at a car wash after the field team completes onsite removal of oil, flora, and fauna.

Onsite boat decontamination by the USGS field team is to be avoided. Use IC decontamination stations, if possible. For onsite boat decontamination:

- Set up a decontamination pad. The decontamination pad consists of a bermed area of appropriate size to the equipment to be decontaminated, lined with 2 layers of 10-mil plastic sheeting. Berms may be constructed of 2-in. by 6-in. lumber, and the pad should contain a low spot or sump from which fluids can be pumped into the required containers for disposal (properly labeled Department of Transportation (DOT) rated containers) and subsequently transported to the IC Decontamination Station or other regulated facility that accepts hazardous waste.
- Prepare a soapy solution of potable tap water and surfactant detergent, such as Liqui-Nox or Dawn, and scrub large surfaces. Rinse with tap water under pressue. If necessary, wipe with methanol-wetted disposable cloths, then discard as hazardous waste.
- A gas-powered steam cleaner can be used on boats or any other large, heavy equipment while on the decontamination pad.

4.2.3 Post-Decontamination Procedures

Questions and general guidance with respect to the containment and disposal of hazardous waste materials should be directed to the local USGS safety officer, Bureau Safety officer, or the Safety Officer of the National Water Quality Laboratory.

1. For waste solutions generated in a high-pressure pad area (for example, onsite boat decontamination):
    a. Collect liquid and waste from the high-pressure pad and heavy-equipment decontamination area and store in appropriate drum or container. A sump pump can aid in the collection process. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.
    b. Collect high-pressure pad and heavy-equipment decontamination area solid waste and store in appropriate drum or container. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.
2. Detergents: Empty soap-and-water liquid wastes from basins and buckets and store in appropriate drum or container. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.
3. Acid solutions: Empty acid-rinse waste and place in appropriate container or neutralize with a base, such as marble chips or baking soda, and place in appropriate liquid-waste drum. pH paper or an equivalent pH test is required to ensure that the neutralization threshold of pH 6 or greater has been achieved.
4. Organic solvent (methanol): Empty methanol-rinse sprayer and methanol waste into the appropriate container, such as an empty container in which it originally was contained at the time of purchase. Consult DOT requirements for appropriate drum for solvent-rinse waste.
5. Low-pressure sprayers, rinse basins, and brushes: Place liquids generated from this process into the wash-water rinse container.
6. Place all solid waste materials generated from the decontamination area (gloves and plastic sheeting, etc.) into an approved DOT drum. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.
7. Label waste containers and make arrangements for disposal. Consult DOT regulations for the appropriate label for each drum containing waste that was generated from the decontamination process. An IC/UC staging station may be available for waste disposal.

4.2.4 Equipment

The materials and tools listed below (also listed in Appendix B) are recommended for the decontamination procedures described above.

Decontamination Reagents and Solutions

- Nonphosphate detergent, such as Liqui-Nox or Dawn
- A 5-percent hydrochloric acid solution in a rinse bottle (for inorganics)
- A 10-percent fresh bleach solution to submerge Teflon handheld equipment
- Laboratory-grade methanol in Teflon rinse bottle (for organics)
- Tap water (with and without detergent) in 5-gallon buckets and spray bottle
- Deionized water in 5-gallon buckets and inorganic blank water (IBW) and volatile-pesticide-grade organic blank water (VPBW) in spray bottles/garden sprayers
- Marble chips or baking soda (for acid neutralization)

Decontamination Tools/Supplies

- Long- and short-handled brushes
- Bottle brushes
- Drop cloth/plastic sheeting
- Kimwipes, oil-absorbent cloths (such as WypAll X70), paper towels
- 5-gallon buckets with handles and lids
- Disposable noncontaminating (Teflon) 5-gallon bucket liners
- Aluminum foil, heavy duty
- Low-pressure washer; squeeze/squirt bottles – polyethylene and Teflon
- High-pressure washer

Health and Safety Equipment

- Health and Safety PPE, as described in Section 2.4 and modified in the HASP
- Copy of the HASP
- Material Safety Data Sheets (MSDS) for all cleaning and decontamination agents to be used
- Police tape to establish EZ and CRZ boundaries

Waste Disposal

- Trash bags, heavy duty
- Trash containers
- Department of Transportation (DOT)-certified metal/plastic containment canisters or drums for transportation and storage of decontamination solutions and liquid waste
- Labels to identify the nature of the waste

5.0 Multiparameter Sondes: Preparation, Deployment, and Cleaning Procedures

Data collection for the USGS Deepwater Horizon post-landfall sampling project includes measurement of ambient physical and chemical properties of water at specified locations in nearshore and wetland environments of the Gulf of Mexico. This section of the sampling protocol addresses the special preparation and cleaning procedures needed for multiparamter sondes that might be immersed in saline, oil-laden waters, and to the protocols and procedures for sonde deployment and measurement of water properties. This section assumes a working knowledge of the standard USGS protocols for field measurements found in chapter 6 of the *National Field Manual for the Collection of Water-Quality Data* (see U.S. Geological Survey, variously dated).

Measurements of in situ water-quality properties employ multiparameter instruments containing data sondes attached to multimeter data output and recording devices. Temperature, specific conductance/salinity, pH, and dissolved oxygen concentration/percent saturation (by luminescent optical sensor) are required measurements for the USGS Deepwater Horizon Oil Spill 2010 investigation. Field-measurement sensors are to be calibrated onsite, following calibration methods and requirements described in the NFM 6.8.

The effects of oily water on the response and sensitivity of multiparameter instrument sensors may vary somewhat, depending on the instrument in use. The YSI 6-series instrument is used for illustrative purposes in this guidance. Other equipment manufacturers may have slightly different procedures to address deployment of their instruments in oil-laden waters (Appendix G includes information provided by In Situ, Inc. in addition to that provided by YSI, Inc.).

5.1 Sonde Preparation

Sonde preparation focuses on the special considerations and procedures required for the deployment and decontamination of multiparameter sondes in an oily saltwater environment. A list of the materials and supplies recommended for sonde cleaning and deployment can be found at the end of this section and in Appendix B.

The instrument type and the date, time, and method of calibration should be recorded in the field logbook; calibrations are recorded on field forms and in the meter calibration logbook, including a post-sampling calibration check.

- In situ field properties should be measured at the same location at which the water samples will be collected.
- Measurements should be completed before collecting the samples for laboratory analysis.

The YSI company recommends the following procedure before deploying the multiparameter sonde in an oil-contaminated environment:

1. Apply C-Spray nanopolymer protective coating to exterior of YSI instrument, sensors, and cable, according to the YSI instruction sheet[8] (Appendix G). (YSI reports that testing has demonstrated that C-Spray has no negative impacts on YSI optical sensors, ROX membranes, or YSI pH sensors.).
2. YSI ROX DO sensor: Spray and disperse C-Spray™ over membrane and sensor face. Allow to sit 5 minutes. Wipe excess spray off with a Kimwipe.
3. YSI pH: Spray sensor body including bulb and junction area. Allow to sit for 5 minutes. Shake off any excess spray.
4. All other optical sensors: Remove wiper, spray C-Spray onto sensor face and wait for 5 minutes. Remove excess with Kimwipe and polish sensor face with dry Kimwipe to remove streaking. Inspect wipers and replace or reinstall.
5. Calibrate the sensors after C-Spray application, using standard USGS procedures (NFM 6.8).

5.2 Methods for Sonde Deployment

Three methods for sonde deployment are outlined in the subsections that follow. The method selected depends primarily on the presence and thickness of product on the water surface and on surf conditions:

- Water surface with no visible oil or a light sheen, calm or active surf conditions.
- Water surface with definite oil sheen, distributed oil pods (for example, as “mousse” or “pancake” pods), or light sheen with more active sea conditions.
- Water with heavy, measurable oil layer or active or rough sea conditions.

The same criteria are used when selecting a sampling method, as described in Section 6. Section 6 also contains the step-by-step instructions for collecting in situ water data and samples. Field teams should expect surf conditions to be rougher than they appear; for this reason the PVC-tube method for handling the sonde (Section 5.2.3) is recommended in all but reliably calm conditions to help manage and control the distance of the sonde above the seabed.

5.2.1 Direct-Dip (Sorbent-Sweep) Method

Use: No oil or light oily sheen. This method parallels the direct-dip method for collecting water samples described in Section 6.4.3.

[8] Do not use C-Spray on instruments from other manufacturers without first consulting with that manufacturer.

While wearing appropriate PPE:

1. Clear the water surface by gently sweeping the surface with a disposable absorbent cloth to avoid dispersing surface oil into the water column.
2. Discard the soiled absorbent into a contaminant-designated trash bag.
3. Lower the sonde into the cleared water column per the step-by-step procedures given in Section 6.4 for conducting a profile and record of field measurements.
4. Remove the sonde and rinse it with distilled/deionized water (DI water). Store it safely until it can be cleaned (refer to Section 5.3).

5.2.2 Plastic Bag Method[9]

Use: Noticeable surface sheen, continuous "oil mousse," or widely distributed pods ("pancakes") of oily product on the water surface. (See Section 5.2.3 for an alternative to this method). The plastic bag method parallels the peristaltic-pump (or bailer) method used for sample collection, but also can be used if samples will be collected using the direct-dip method (see Section 6.4.3). Refer to the diagrams that illustrate this method in Appendix G.

1. Place sonde in a clean, disposable plastic bag, covering the entire sonde.
2. Cut out the bottom of the bag.
3. Use rubber bands to close the bag above and at the bottom of the sonde.
4. Place a third rubber band around the bag and body of the sonde, above the sensors.
5. If feasible, avoid deploying sonde through oil. Alternatively, gently clear the oil layer from the water surface with a disposable absorbent cloth, taking care to avoid dispersing surface oil into the water column. Drop the soiled cloth into a trash bag for contaminated waste.
6. Deploy the sonde vertically below the oil layer.
7. Carefully clear any surface oil again (see step 5) before inserting gloved hands and arms into the water. Expose the measurement sensors. Remove the lower rubber band; fold the bag up to, and secure it with, the rubber band near the center of the sonde.
8. Follow the step-by-step "*Sampler 1 – Sampler 2*" procedures described in Section 6.4.3 for conducting a measurement profile and recording the field measurements.
9. Detaching the bag from the center rubber band, lower the bag back over the sensors to avoid contact with product. Raise the sonde out of the water.
10. Remove the bag and dispose of it in a trash bag designated for contaminated waste. Wipe down the elbow-length, rubber-coated gloves and discard them along with the wipe in the contaminated-waste trash bag, or remove and store them in a dedicated trash bag for subsequent decontamination.
11. Rinse the sonde with DI water and store safely until it can be cleaned (Section 5.3).

[9] The plastic bag method for sonde deployment was adapted from procedures recommended by YSI, Inc.

5.2.3 PVC Tube Method

Use: In an active surf, or measurable thickness of free product, or densely distributed oil "pancakes." This method parallels the peristaltic pump or bailer method for collecting water samples, described in Section 6.4.2, and requires installation of a stabilizing stake to which the PVC tube is secured. Note that when working in deep wetland or marsh mud, the weight of the tube can cause progressive sinking of the stake, making this method difficult to carry out or requiring modification of the method to better suit site conditions.

1. Install the PVC tube; refer to Section 6.4.2 for detailed instructions.
2. Lower the sonde through the PVC tube, avoiding contact with product.
3. Follow the step-by-step procedures given in Section 6.4 for developing a profile and record of field measurements.
4. Remove the sonde from the tube.
5. Rinse the sonde with DI water and store safely until it can be cleaned (Section 5.3).

5.3 Instrument Decontamination

Crude oil is thick and sticky and may affect the performance intervals of the sensor membranes and wipers on multiparameter instruments, in comparison with normal conditions. The YSI company has provided the following instructions for cleaning YSI 6-series™ multiparameter instruments that become contaminated with crude oil (Appendix G). Section 5.4 lists the materials and supplies recommended for sonde and sensor cleaning. This procedure should be carried out in the CRZ.

5.3.1 Cleaning Procedure

1. Wear gloves and eye protection when handling items contaminated with crude oil.
2. Spray all contaminated areas with a degreasing agent, such as Simple Green®, for removal of surface contamination.
3. Use a soft cloth or paper towels to remove excess oil from the sonde. Remove oil-coated wiper pads and brushes from sensors in accordance with the manufacturer's instructions and discard. Work carefully when cleaning around sensors, membranes, or glass components.
4. Submerge instrument in a bucket filled with warm, soapy water.
5. Use a soft brush to wipe away remaining oil.
6. Use a small brush to clean the inside of the cell containing the temperature and conductivity sensors.
7. Discard water, rinse bucket thoroughly, and refill the bucket with soapy water. Rinse the sonde and sensors in soapy water.
8. Repeat steps 5 through 7 as many times as is necessary to remove oily residue.

9. Rinse again, in a fresh container of warm, soapy water. Rinse soap residue off of the sonde and sensors using clean tap water followed by DI water.
10. Dry the sonde gently.
11. Install new wiper pads and brushes, as instructed by the instrument manufacturer.
12. Discard oily water and oil-saturated wipers, brushes, and cloths in proper receptacles and in accordance with local regulations for hazardous materials.
13. Check the calibration of the sensors.

5.3.2 Decline in Sensor Sensitivity

The most common problems related to oil coating of sensors will be addressed by adhering to the steps for cleaning the sonde and sensors described above. However, the pH, depth, and dissolved-oxygen (luminescent/optical) sensors may require additional attention, as described below (contact the sonde manufacturer if additional guidance is needed):

- **pH:** The performance of the pH and pH/ORP (oxidation-reduction potential) sensors relies on the sensitivity of the glass bulb and reference junction. The pH sensor may require additional cleaning in warm (**35°C) soapy water while stirring the solution rapidly**.
- **ROX DO Membranes**: The DO membrane on the luminescent/optical sensor also benefits from being cleaned with a **warm, soapy water solution**. Stirring or gentle sweeps with a soft paint brush across the membrane should aid in cleaning. The calibration of the DO sensor should be checked periodically against a Winkler titration.
- **Depth:** Spray Simple Green into depth-port openings and use pipe cleaners to remove any visible dirt or contaminant.

5.4 Materials and Supplies for Sonde and Sensors Cleaning and Preparation

- Health and safety PPE, as described in Section 3.4 and modified for site-specific health and safety plans (Appendix E–2).
- Field- (onsite) calibrated multiparameter water-quality meter and sonde
- YSI C-Spray nanopolymer coating
- Calibration solutions and Winkler titration kit
- 2- to 3-ft-long by 4-in. inside diameter PVC tube (through which a sonde can fit)
- 5- to 6-ft-long metal or wooden stake to stabilize the PVC tube
- Plastic bag to cap water end of the PVC tube during tube installation
- Replacement sensor brushes and wipers; hex wrench
- Heating plate, magnetic stirrer, and stir bars
- Rubber bands, extra strength
- Gloves

- Buckets
- Soft-bristle brushes, soft paint brush, pipe cleaners, and Q-tips
- Lint-free, laboratory-grade cloths, such as Kimwipes, for delicate membranes
- Heavy-duty disposable absorbent towels, such as WypAll X70 wipers, for oil removal
- Liqui-Nox, Dawn, or other effective, nonphosphate detergent liquid
- A degreaser, such as Simple Green
- Waste-collection containers, heavy-duty trash bags, and extra disposable plastic bags

6.0 Collection of Field Measurements and Water Samples

The protocols described in this section were developed to assist field personnel in collecting water data and samples in the marine nearshore environment during USGS post-landfall sampling in the Gulf of Mexico, and should be used in addition to the standard procedures described in the *National Field Manual* (U.S. Geological Survey, variously dated) chapter 4, "Collection of Water Samples." Chain-of-custody requirements will be followed strictly in the collection, processing, transport, handling, storage, and documentation of the samples and data collected.

6.1 Objectives and Method Overview

A primary goal of the post-landfall sampling effort is that the sample data accurately represent the ambient water properties at the given sampling location at the time of sample collection. To achieve this goal it is important that the data assembled during post-landfall sampling are collected using USGS methods and protocols consistently among all sampling sites and field teams, to the degree possible and as appropriate for site conditions. However, field teams will exercise professional judgment to determine the most appropriate method for the given field conditions. Owing to the complexity of the planned sampling operations, the large variety and types of samples to be collected, and the potentially hazardous conditions that might affect health and safety when working in spill-impacted areas, **a three-person field team is recommended strongly for collection of water samples; the third person will be needed to facilitate the transfer of samples to shore and other onshore activities; a fourth team member might be required if a boat is used for access to the sampling site.**

Selection of sampling method depends on site conditions at the time of sampling, including the presence, extent, and thickness of floating product. This protocol defines two methods as preferred for collecting water samples under anticipated sampling conditions in the Gulf of Mexico:

- **Direct-Dip Method:** This method is used to collect samples when no oil is visible on the water surface or when a slight oil sheen is observed that easily can be removed for the duration of field-measurement data and sample collection.
- **Peristaltic-Pump Method:** This method should be selected for sampling under conditions when free product either is observed in the area where samples will be collected or is close enough so that it could intrude into the sampling location during field measurements and sample collection. The method involves installation of a PVC tube affixed to a stake through which the multiparameter sonde and pump tubing can be deployed.

An alternative to the peristaltic-pump method—the disposable-bailer method—is provided in Section 6.7. Field teams might elect to use the bailer method if it better fits the logistics of the field conditions encountered.

6.2 Equipment and Supplies

Cross-contamination problems are eliminated or minimized for this project by using dedicated, disposable sampling equipment to the extent possible. The sampling methods described require different sets of equipment. Selection of the sampling device should be based on its potential effect on the analyses to be performed. The equipment selected is to be certified as appropriate for its intended use, meaning that it is demonstrated that the equipment can not itself be a source of the analytes targeted for study. Equipment certification for this purpose is accomplished primarily by the use of equipment blanks, which are collected and analyzed before field work for the project begins, and that includes quality assurance of new, in addition to previously used, equipment (see Section 9). All equipment, whether disposable or nondisposable (reusable), is to be cleaned and quality assured with an equipment blank before its first field deployment, in accordance with the protocols and procedures outlined in the *National Field Manual* and this report. This requirement does not apply to equipment, such as bottles for organic-compound analyses, which have been quality assured or pre-certified by a laboratory. Tables 1 and 2 detail the containers and some key supplies to be used for water sampling during this project (see also Appendices B and D).

Contrary to standard USGS procedure, hydrochloric acid (HCl) will not be added in the field to the volatile organic compounds (VOC) sample for this project. VOC samples will be stored on ice and shipped to the TestAmerica Laboratory overnight on the day of collection to ensure that the 7-day maximum holding time for unacidified VOC samples is met. Adding acid to seawater samples with high carbonate concentration can result in either an immediate or delayed effervescence, potentially compromising the representativeness of the VOC analysis.

Table 1. Containers and supplies specific to water-column sampling.

[mL, milliliter; HNO_3, nitric acid; CIN, laboratory's analytical identification number; TAL, TestAmerica Laboratory; H_2SO_4, sulfuric acid; oz, ounce; HCl, hydrochloric acid; VOA, volatile organic analysis; BTEX, benzene toluene ethylbenzene xylenes; L, liter; TPH GRO, total petroleum hydrocarbons – gasoline-range organics; DRO, diesel-range organics; SVOC TCL, semivolatile organic compounds target compound list; NWQL, National Water Quality Laboratory; DOSS, di(ethylhexyl) sodium sulfosuccinate; DOC, dissolved organic carbon; One Stop-NFSS, U.S. Geological Survey's National Water Quality Laboratory One-Stop Shopping–National Field Supply Service]

Containers Specific to Water-Column Sampling[1]		
Sample container chemical preservative	Analysis Laboratory	Source
One 250-mL wide-mouth polyethylene bottle. Contains HNO_3	**Total metals[2] - CIN 50017 (Method 6020)** TestAmerica, Pensacola, Florida (TAL)	TAL
One 250-mL wide-mouth polyethylene bottle, brown. Contains H_2SO_4	**Total Kjeldahl Nitrogen - CIN 50068 (TKN, Method 351.2)** **Total Ammonium** **Total Phosphorus – CIN 50092 (TP, Method 365.4)** TestAmerica, Pensacola, Florida	TAL
One 32-oz, fired glass, wide-mouth jar. Contains HCl	**Oil and Grease - CIN 50136 (Method 1664A)** TestAmerica, Pensacola, Florida	TAL
Two VOA vials, 40 mL, no preservative	**VOC, BTEX - CIN 50109 (Method 8260B)** TestAmerica, Pensacola Florida	TAL
Two VOA vials, 40 mL, no preservative	**TPH GRO - CIN 50114 (Method 8015B)** TestAmerica, Pensacola, Florida	TAL
One 1-L, fired, amber glass, no preservative	**TPH DRO - CIN 50130 (Method 8015B)** TestAmerica, Pensacola, Florida	TAL
Two 1-L, fired, amber glass, no preservative	**SVOC TCL,- CIN 50117 (Method 8270D)** TestAmerica, Pensacola, Florida	TAL
Two 1-L Teflon bottle	**DOSS (Surfactant)** NWQL, Denver, Colorado (E. Furlong)	NWQL precleaned
One 125-mL, fired amber glass bottle, DOC	**Dissolved Organic Carbon, field filtered** USGS, Boulder, Colorado (G. Aiken)	One Stop-NFSS
One 1-L polyethylene bottle, acid-rinsed	Sampling bottle for collection of samples for trace metals and nutrients into pre-preserved TAL containers	One Stop-NFSS
One 500-mL, fired amber glass	Sampling bottle to collect whole water to be filtered for DOC	One Stop-NFSS

[1]Add the extra sample containers needed when the work schedule calls for collection of quality-control samples.
[2]Analyses include: Sb, As, Ba, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Ag, Tl, Zn.

Table 2. General supplies for water-column sampling.

[DOC, dissolved organic carbon; DO, dissolved oxygen; SC, specific electrical conductance; PPE, personal protective equipment; HCl, hydrochloric acid; *N*, Normality; ASR-CoC, Analytical Services Request and Chain of Custody form; ft, foot; in., inch; mil, millimeter]

Supplies Specific to Water-Column Sampling[1]		
Equipment	**Description**	**Use**
Floatation device; backpack; coolers	Device, such as an inner tube into which coolers can be inserted and floated to shore; or, backpack or field-determined alternative.	Transport bottles to shore
Filter	Pall AquaPrep disposable disk filter.	DOC
Disposable towels	Kimwipes or WypAll X70 cloths.	Oil removal
Peristaltic pump and pump tubing	Dedicated, disposable precleaned, precut 8-ft lengths of C-Flex tubing.	Sampling method and DOC sample filtration
Bailers (optional)	1.5-in. diameter, Teflon, pressurizable, disposable.	Sampling method
PVC tube	4-in. diameter, from 1.5 ft to 5 ft in length.	Sampling method
Tape measure; Wading rod	1/10 of a ft graduated.	Water column
Survey markers	Stakes, flags, or buoys and anchors.	Stake out location
Multiparameter sonde and Winkler DO kit	pH, luminescent DO, SC/salinity, temperature sensors; calibration solutions, including Winkler kit.	Field measurements
Gloves	Rubber-coated outer gloves, elbow length (minimum two pair per sampler) – nondisposable. Nitrile inner gloves, (minimum five pair per sampler per site) – disposable.	Water sampling PPE
Adhesive tape	Teflon, Duct, Electrical.	Seal sample caps/lids
pH test strips	pH test papers (for example, pHydrion papers).	Check pH of oil and grease
HCl ampoules	6 *N* HCl ampoules.	Oil and grease preservation
PPE	See Section 3, “Safety.”	Personal safety

GENERAL USE	
• Photoionization detector (vapor analyzer) • 2-pound sledge hammer; hose clamp(s) • 4-ft (or longer) wooden (disposable) or metal stakes (one per site if disposable) • Deionized water in spray bottle	• Ziploc bags 4-mil gauge; leak-proof coolers • Industrial-strength rubber bands • ASR-CoC and Field forms (Appendix F) • Wet ice and Dry ice; Trash bags, heavy duty • Aluminum foil to wrap Teflon-bottle samples

[1]Supplies for the collection of water quality-control samples are listed in Section 6.5.1.1. Refer to Appendix B for a compiled list of equipment and supplies.

6.3 Sampling Location

Water samples for this project will be collected in nearshore waters of the Gulf of Mexico and its barrier islands and wetlands. Sampling and site conditions of the Gulf Coast vary widely; however, the general criteria that influence the selection of the specific sampling location at a field site for this investigation include:

- The sampling location should be the same as, or close to, a pre-landfall sampling location (Appendix A), unless samples will be collected to meet an objective different than those for the pre-landfall effort (for example, collection of tarballs).
- The location is representative of observable physical and chemical conditions at the site. To this end, samples will be collected to represent “normal” surf and suspended sediment conditions at the time of sampling.
- Samples are to be collected in wadeable water deep enough so as to minimize resuspending bed sediments; for example, from about 2 to 3 ft deep.
- Samples should be collected at mid-depth of the water column, at 15 cm (0.5 ft) or more above the seabed to avoid entraining suspended sediments.
- Samples should be collected at 15 cm (0.5 ft) below a surface oil layer and in a manner that avoids collection or incorporation of free product in the sample, unless the sample is being collected for oil analysis.
- Sampling locations at barrier islands will be accessed by boat, but samples generally should not be collected from the boat unless necessary to maintain sample integrity. Working in wetlands having deep, mucky sediments might require sampling from a boat if personal safety is at stake.

6.4 Step-By-Step Procedures

Step-by-step procedures are given below, according to the sonde-deployment and sample-collection method that is determined by the field team as most appropriate for the onsite conditions observed (fig. 7). Field teams should customize the procedures given as best meets their need and in accordance with their professional judgment and maintenance of scientific integrity; however, each team must record in the logbook the modified procedure used and, to the extent reasonable, use the same procedure for each of their sampling sites. **Field personnel will follow standard National Field Manual protocols for checking, preserving, handling, and maintaining sample integrity, unless otherwise stipulated in this sampling protocol** (U.S. Geological Survey, variously paged). Upon collection and during transport, all samples will be kept chilled or frozen, in accordance with the laboratory instructions for the sample type. The temperature of chilled samples is not to exceed 4ºC (40ºF). All samples will be packaged and shipped for priority overnight delivery and be in compliance with strict Chain of Custody (CoC) dictates.

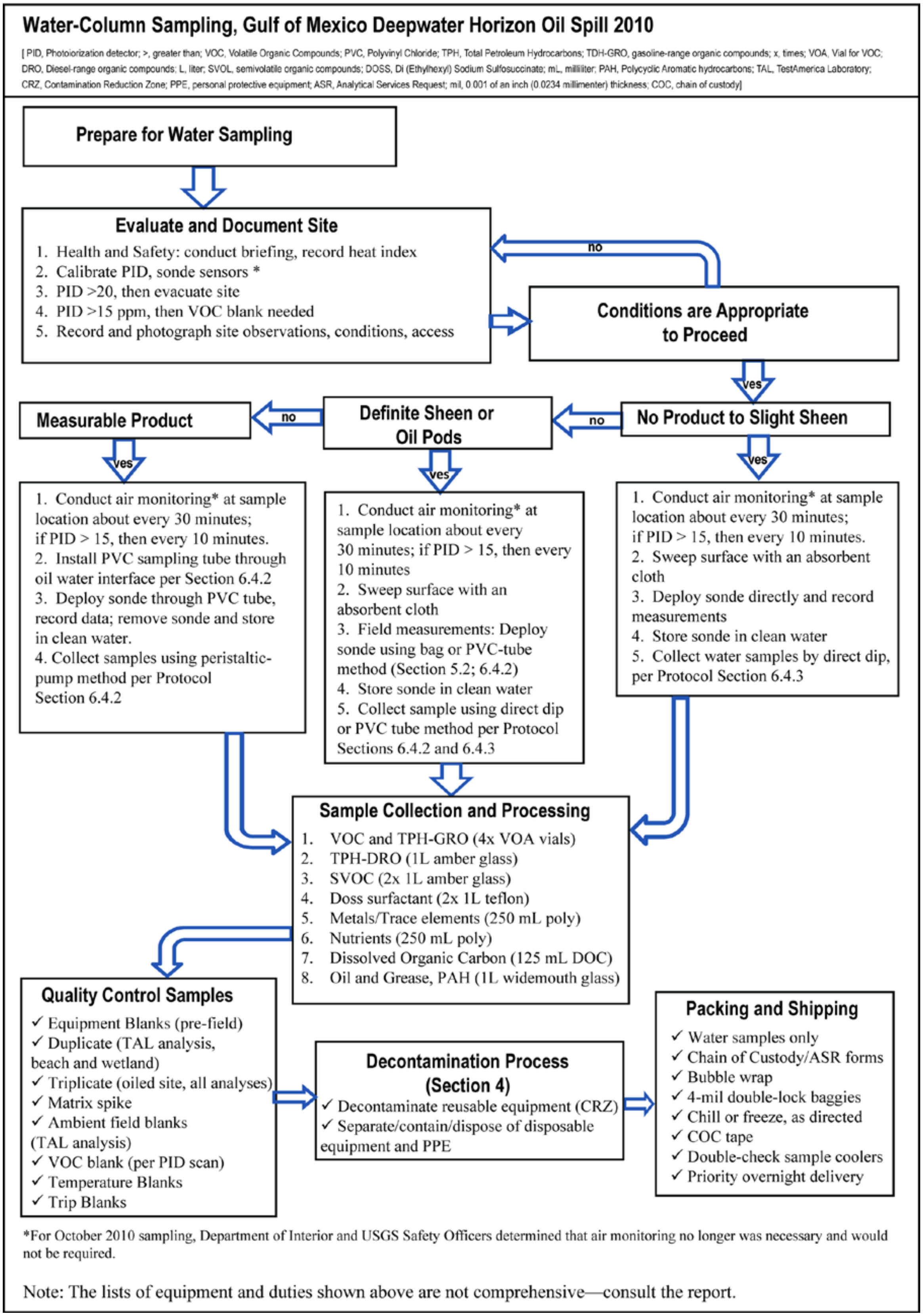

Figure 7. Flowchart showing water-column sampling, Gulf of Mexico Deepwater Horizon oil spill, 2010.

The protocol for determining representative field measurements of temperature, pH, specific electrical conductance/salinity, and dissolved oxygen (DO) is the same as prescribed in the *National Field Manual* (refer to chapter 6 in U.S. Geological Survey, variously paged), with the caveat that the DO reading in Gulf water should be checked against the results of a Winkler titration at least once for each Water Science Center field team. After each field deployment, check the sensor calibration and record the results. Table 3 is adapted from a similar table in the *National Field Manual* that provides the stabilization criteria for determining the final field measurements to be recorded as representing site conditions. In addition to the field measurements that will be recorded as representative of the water column for a given site, readings should be recorded at several points in the water-column profile to document the occurrence of stratification.

Table 3. Stabilization criteria for field measurements.

In situ field measurement	Stablization criteria[1]
Temperature (Thermistor thermometer)	± 0.2°C (degrees Celsius)
Specific Electrical Conductance > 100 µS/cm (microsiemens per centimeter)	± 3 percent of five or more measurements
Salinity (Conductivity sensor)	Greater of: ± 1 percent of reading or 0.1 ppt (parts per thousand)
pH	± 0.2 pH unit
Dissolved oxygen (DO) (Luminescent optical sensor)	± 0.2 mg/L (milligrams per liter)

[1] The variability of the measurement should be within the criterion value shown for five or more measurements.

6.4.1 Preparation and Order of Sample Collection

Preparing to collect samples:

1. Put on Tyvek apparel.
2. Prepare a water bucket for post-use of the multiparameter sonde (Section 5.0), and have available waste containers and Kimwipes or absorbent cloths (absorbents) for oil skimming (if needed).
3. Assemble field-measurement and sampling equipment according to the method selected (Direct Dip or Peristaltic Pump).
4. Complete labels on all bottles with indelible (non-fume-producing) ink (site, time, date, and analysis) and tape labels to bottles with wide clear tape (2-in. width). Appendix D Table D–1 describes the containers, preservatives, holding times, and laboratory requirements for each aliquot.

5. Pack sample bottles and sampling equipment in a floating cooler, backpack, or other device to transport samples to shore. Line the floating cooler, backpack, or other sample-transport device with a large plastic bag into which sample containers are placed.
6. Wear PFDs, three layers of inner nitrile gloves (or as determined by the field team), outer rubber-coated elbow- (or full-arm) length gloves, and other PPE, as appropriate.
7. Record and characterize the presence of free product, such as oil sheen, the extent of floating product, and the estimated diameter(s) and distribution of the surface oil.

    a. Determine the sonde-deployment method to be used: (1) Direct Dip, (2) Plastic Bag, or (3) PVC Tube (recommended when sampling in active surf).
    b. Determine the sampling method to be used: (1) Direct Dip or (2) Peristaltic Pump/PVC Tube (alternatively, Disposable Bailer).

8. Calibrate sonde sensors as prescribed in the *National Field Manual*, chapter 6, section 6.8 (*see* U.S. Geological Survey, variously dated). Prepare the sonde for oil immersion before starting measurements, according to the instructions given in Section 5.0.
9. Using a two-person team in proper PPE, wearing rubber outer and inner gloves, wade to the sampling location.
10. As a rule of thumb, collect samples consistently with respect to wave or current direction; that is, with ebb or flow. Record the procedure used.
11. When sampling at heavily oiled, deep-mud, or slick-surface locations, the safety of personnel must take priority, possibly necessitating sample collection from the boat instead of wading. Take the precautions needed to avoid becoming immobilized in deep mud. Avoid resuspending bed sediment.
12. Collect organic vapor readings with a PID, in the breathing zone and 6 in. above the water surface at the sampling location. Record readings on field forms or in the project logbook.
13. Record GPS location in the field logbook and on the field forms.
14. Measure and record to the nearest tenth of a foot the wave height and depth of the water column. If possible, depth of the water column should be from 2 to 3 ft.

Order of sample collection:

1. Field measurements: PID, oil thickness, and in situ water-quality properties
2. Volatile Organic Compounds – VOCs collected in VOA (volatile organic analysis) vials
3. Total Petroleum Hydrocarbon compounds – Gasoline Range (TPH-GRO)
4. Total Petroleum Hydrocarbon compounds – Diesel Range (TPH-DRO)
5. Semivolatile (SVOC) and PAH organic compounds
6. Surfactants
7. Trace metals/elements
8. Nutrients
9. Dissolved Organic Carbon
10. Oil and Grease

6.4.2 Peristaltic Pump Method

This method is selected when a definite sheen or measurable free product is observed.

- For samples to be analyzed at the TestAmerica Laboratory (TAL) in Pensacola, Fla., sample bottles for oil-and-grease, metals/trace-element, and nutrient analyses will be supplied that already contain the chemical preservative needed for the intended analysis.
- A portable peristaltic pump with battery can be transported in a sidepack or backpack to the sampling location by Sampler 1, while Sampler 2 transports and manages the sample bottles.
- The step-by-step procedure that follows describes use of a PVC tube through which the multiparameter sonde and peristaltic pump tubing are deployed.
- Maintaining the appropriate distance of the PVC tube above seabed may be difficult in soft wetland mud; if the tube is too heavy (too long), it can sink into the muck. Modify the length of the tube or the procedure as needed.

To collect samples using the peristaltic pump method:

1. **Install the PVC tube**

    a. Drive a 5- to 6-ft stake 1 to 2 ft or more into the bottom material with the sledge hammer.
    b. Cover the bottom end of the PVC tube with a plastic bag.
    c. Lower the plastic-covered end of the PVC tube through the water surface, keeping it at least 1.5 ft above seabed and ensuring that product does not get inside the tube. Fasten the tube to the stake using Velcro straps or cable ties.
    d. Remove the protective plastic bag from the end of the PVC pipe.

2. **Field measurements**

    a. The multiparameter sonde must have been calibrated and prepared per Section 5 of this document and in accordance with USGS standard protocols (NFM chapter 6, section 6.8).
    b. Lower the sonde through the PVC tube to approximately mid-depth of the water column, but at least 0.5 ft above seabed.
    c. Measure and record the depth of sensors below the water surface to one-tenth of a foot.
    d. Check for stratification within the water column by recording measurements at about 0.5 ft above and below the “mid-depth” site measurement, if possible. Be sure to keep the sonde at least 0.5 ft above seabed to avoid contact with suspended sediment.
    e. Move the sensors to mid-depth of the water column. Employing NFM protocols, record stabilized measurements for pH, SC/salinity, DO, and temperature (table 3) on field forms. This comprises the record of in situ measurements for this site. Check the DO value of the Gulf water against a Winkler titration at one sampling site.

f. Remove the sonde from the PVC pipe for a calibration check of the sensors. Store the sonde in clean potable water until the appropriate decontamination or cleaning process can be completed (see Section 5).

3. **Prepare sampling equipment** (do not field-rinse containers)

   a. *Sampler 2:* Remove the protective wrap from the intake end of the disposable, precleaned pump tubing and lower tubing through the PVC tube to the desired depth for sample collection.
   b. *Sampler 1*: Adjust and secure the location of the tubing intake end. Wipe down and remove rubber-coated elbow- or arm-length gloves; discard wipe and disposable gloves in the trash bag or container dedicated to such waste; store reusable gloves and soiled equipment in appropriately labeled containers for subsequent decontamination.
   c. *Sampler 2*: Wearing nitrile gloves, turn on the pump and adjust it to a slow but steady rate of flow. Circulate water for a 3-volume tubing field rinse.

4. **Collect VOC and TPH-GRO samples**

   For VOC samples ➔ use 2 VOA vials. For TPH-GRO ➔ use 2 VOA vials.

   a. *Sampler 1*: Uncap the first VOA vial and hold it for *Sampler 2*.
   b. *Sampler 2*: Fill VOA vial and cap to overflowing, leaving a meniscus in both.
   c. *Sampler 1*: Pour water from cap into VOA vial while capping the vial, so as to exclude air and prevent bubbles from forming. Cap VOA vial; invert and tap vial to check for bubbles. If bubbles are observed, uncap vial and repeat steps 4b and c until no bubbles are observed.
   d. *Sampler 1 and 2*: Repeat steps 4 a – c until the 4 VOA vials have been collected successfully.
   e. *Sampler 2*: Clean and dry each vial, ensure cap is on securely, wrap or place vials in foam sleeves, place in doubled ziploc bags, and store on ice in the appropriate cooler (vial caps should be sealed using Teflon tape when back on shore).

5. **Collect TPH-DRO and SVOC samples** (adapt the *Sampler 1 – Sampler 2* technique but leave at least 1 inch of headspace)

   a. One 1-L baked glass amber for TPH-DRO.
   b. Two 1-L baked glass amber for SVOC.

6. *Sampler 2*: Dry each container, check labels, ensure cap is securely tightened, place glass containers in foam or bubble sleeves, place each sample container in doubled ziploc bags, and store on ice in the appropriate cooler.

7. **Collect Surfactant samples**

   a. Two 1-L Teflon for Surfactant (USGS-NWQL).

b. Using the same *Sampler 1 – Sampler 2* technique, fill the first Teflon bottle to three-quarters of capacity to allow for expansion when frozen. Cap it securely and repeat this procedure with the second Teflon bottle.
c. *Sampler 2:* Dry each bottle, ensure cap is securely tightened, check label, wrap in aluminum foil and then into doubled ziploc bags. Store on dry ice or in wet ice until samples can be frozen and placed in the appropriate cooler.

8. Collect Total Metals/Trace Element and Total Nutrient samples, adapting the *Sampler 1 – Sampler 2* technique as follows

a. *Sampler 1:* Fill a 250-mL pre-preserved polyethylene bottle for Total Metals/Trace Elements and a 250-mL brown polyethylene bottle for Total Nutrients, leaving at least one-half inch of headspace and taking care to prevent loss of the preservative. Hand each sample bottle to *Sampler 2*.
b. *Sampler 2*: Dry each container, check labels, and ensure that the cap is securely tightened. Invert each bottle at least three times to distribute the preservative. Place each sample container in doubled ziploc bags and store on ice in the appropriate cooler.

9. Collect the DOC sample

a. *Sampler 1*: Wearing clean gloves unwrap the AquaPrep filter and secure it onto the pump tubing.
b. *Sampler 2*: Uncap and hand the 125-mL baked glass for DOC to *Sampler 1*.
c. *Sampler 1:* Pass about 50 mL water through the filter before filling the DOC bottle to the shoulder. Cap the filtered sample and hand it to *Sampler 2*.
d. *Sampler 2:* Dry the bottle, check label, ensure the cap is securely tightened, place into foam sleeve, then into doubled ziploc bags, and store on ice in the appropriate cooler.
e. *Sampler 1:* Turn off the pump and discard tubing and used filter into a dedicated waste receptacle.

10. Collect the Oil and Grease (O&G) sample by the Direct-Dip Method

a. *Sampler 1 and 2*: Put on long rubber gloves over nitrile gloves.
b. *Sampler 2*: Uncap and hand a 1-L HCl-preserved O&G sample container to *Sampler 1*.
c. *Sampler 1:* Skim sample from the water surface into the HCl-preserved container carefully, capturing surface oil but taking care not to lose the HCl preservative (if possible), and leaving about 1 inch of headspace. Hand container to *Sampler 2*.
d. *Sampler 2:* Recap and wipe the container clean to remove oily product. Check that the lid is secured tightly and that the container is marked with the type of preservative to ensure proper labeling. Invert three times to mix. Place into bubble or foam sleeve and then into doubled ziplock bags. Store on ice.

e. *Sampler 1, 2, or 3:* Once on shore, if you suspect that preservative was lost, check the sample pH by decanting a small amount of sample and estimating pH with a pH strip. If pH is greater than 2, add contents of a HCl ampoule (2 mL of 6*N* HCl) and record this information in the logbook. Rewrap the O&G container, tape the lid, and place on ice.

11. *Sampler 2*: Remove the stake and PVC tube and return to the decontamination area (CRZ). A wooden stake can be discarded as solid hazardous waste; the PVC tube either is similarly discarded or contained for decontamination.
12. *Sampler 1:* Secure all samples and return to shore. Decontaminate sample coolers and the equipment used to bring the samples to shore.
13. Check sensor calibration after cleaning the multiparameter sonde.
14. *Samplers 1, 2, and/or 3:* Ensure that lids are appropriately taped and containers are properly labeled and protected in foam or bubble sleeves. Pack bottles in appropriate shipping coolers, in dry ice or wet ice, as instructed by the laboratory, and ship by priority overnight or following day delivery to the respective laboratories.

6.4.3 Direct-Dip Method

The direct-dip method consists of collecting water samples directly into the precleaned sampling containers at a predetermined depth below the water surface (Natural Resource Damage Assessment and Restoration Program, 2010). Procedures for measuring in situ water properties and collecting samples are given below. In the sampling scenario, *Sampler 1* collects the water samples. *Sampler 2* manages the sampling containers before and after the sample is collected.

The following description of the general procedure to be used is a departure from NFM methods—please read carefully:

TestAmerica Laboratory (TAL) in Pensacola, Fla., supplies sample bottles for oil and grease, metals/trace elements, and nutrient analyses that already contain the chemical preservative needed for the intended analysis. To prevent loss of preservative, samples for metals/trace element and nutrient analyses will not be collected directly into the TAL-provided preservative-containing sample bottle (“preserved containers”). Instead, a 1-L polyethylene RA (“raw acidified”) bottle, precleaned by the field team, will be used as the sampling device. Water is poured from the RA bottle into the appropriate TAL-supplied preserved containers. This eliminates the need for field personnel to add the chemical preservatives needed to the samples for metals and nutrient analyses.

1. **Field Measurements.** When in low-energy surf, use the Direct-Dip Method or Plastic Bag Method; for high-energy surf, the PVC-Tube Method is recommended. (Use professional judgment to evaluate field conditions and make sampling decisions.)

    a. The sonde must have been calibrated and prepared per Section 5 of this document and in accordance with USGS standard protocols (NFM 6.8).

    b. Lower the water-quality sonde to the sampling depth (follow Plastic Bag procedures in Section 5.2.2 if this method is to be used before deploying the sonde).

c. Measure and record depth of sensors below the water to one-tenth of a foot.
d. Check for stratification within the water column by recording measurements at about 0.5 ft above the seabed and below the water surface "mid-depth" site measurement, if possible. Be sure to stay at least 0.5 ft above seabed to avoid contact with suspended sediment.
e. Move the sensors to mid-depth of the water column and, using NFM protocols, record on field forms the stabilized measurements for pH, SC/salinity, DO, and temperature. This comprises the record of in situ measurements for this site. Check the DO value of the Gulf water against a Winkler titration at one of the sampling sites.
f. Remove the sonde from the water and check the calibration of the sensors. Store the sonde in a bucket of clean water until it can be cleaned properly.

2. **Prepare to collect water samples** (do not field-rinse sample containers)
    a. *Sampler 1:* With rubber outer and inner gloves on, clear the sampling area of any surface oil by carefully sweeping the area with Kimwipes or sorbent towels, such as WypAll X70, and discard absorbents in dedicated trash bag.
    b. *Sampler 1*: Remove outer gloves and store in reusable storage bag for decontamination.

3. **Collect VOC and TPH-GRO samples** (2 VOA vials per analysis)
    a. *Sampler 2* hands *Sampler 1* capped VOA vials, one at a time.
    b. *Sampler 1*: Submerge first VOA vial to the appropriate depth (between 0.5 ft and 1 ft below the water surface), uncap the vial until full, then recap under water.
    c. *Sampler 1*: Remove VOA vial from the water, invert the VOA vial, tap the bottom of the vial, and check for bubbles. If bubbles are observed, resubmerge the capped vial, uncap the vial allowing all bubbles to escape; repeat until no bubbles are observed.
    d. *Sampler 1*: Repeat steps *3a* and *b* with the next three VOA vials.
    e. *Sampler 1:* Hand each completed VOA vial to *Sampler 2*.
    f. *Sampler 2:* Double check for bubble; if bubble is present, repeat the sampling (steps *b* and *c*) process. Dry each vial with a clean absorbent towel; check to make sure the lids are tight and the sample is properly labeled. Place the vials in foam or bubble sleeves, double-bag in ziplocks, and store on ice. (Vial caps should be sealed with Teflon tape here or when back on shore.)

4. **Collect TPH-DRO, SVOC samples**
    a. *Sampler 2* gives *Sampler 1* the 1-L glass amber container for TPH-DRO.
    b. *Sampler 1:* Submerge the capped container to the appropriate depth, uncap and fill until full; recap the container and bring to the surface. Hand to *Sampler 2*.
    c. *Sampler 2*: Hand the capped container to *Sampler 1*. Dry, place in foam or bubble sleeve, double bag and store on ice.
    d. *Sampler 1*: Repeat steps *4a* through *c* to collect the SVOC samples.

e. *Sampler 2* hands *Sampler 1* the 1-L bottle for SVOC, followed by the second 1-L SVOC/PAH bottle, and repeats steps *a* through *c* for each SVOC 1-L container.

f. *Samper 2*: Once on shore, uncap the TPH-DRO and SVOC containers and decant sample to within about 1 inch of the top to leave room for expansion when chilled. Recap securely, wipe the containers clean and dry, secure the lid with Teflon tape, and check that the container is labeled properly. Replace the containers in a bubble or foam sleeve and double-bag the samples. Store on ice.

5. **Collect Surfactant samples** (no container field rinse)

a. *Sampler 2* hands *Sampler 1* the 1-L Teflon bottles, one at a time.

b. *Sampler 1:* Submerge the capped Teflon bottle to the appropriate depth, uncap, and fill to three-quarters of capacity to allow expansion when frozen (decant excess water above the water surface, if necessary, to leave sufficient headspace). Recap the container and bring to the surface. Hand to *Sampler 2*.

c. *Samper 2*: Decant some sample, if necessary. Recap, wipe the container clean and dry, check to make sure the lid is tight and the container is labeled properly, wrap in aluminum foil, double bag in ziplock bags, and store on ice or dry ice (Appendix D, Table D–1),

d. *Sampler 1 and 2*: Repeat steps *6b* and *c* with the second Teflon bottle.

6. Collect Metals/Trace Elements and Nutrients

a. *Sampler 2* hands *Sampler 1* an NWQL 1-L RA bottle, precleaned and quality-controlled at the Water Science Center, for use as a sample-collection device.

b. Sampler 1:

i. Field rinse: Submerge the capped RA bottle and uncap. Allow a sufficient volume of water to enter the bottle. Cap the bottle and bring it above the water surface to field rinse. Repeat this rinse procedure two more times.

ii. Collect sample: Submerge the capped RA bottle and uncap. Fill the bottle to near the top. Recap the container and bring to the surface.

c. *Sampler 2*: Uncap a TAL 250-mL HNO_3-preserved container for metals analysis.

d. *Sampler 1*: Uncap the RA bottle. Carefully decant sample from the RA bottle into the HNO_3-preserved 250-mL container being held by *Sampler 2*, leaving about 1 inch of headspace. Recap the RA bottle.

e. *Sampler 2*: Cap the HNO_3-preserved 250-mL container, wipe the container clean and dry, check that the lid is tight and the container is labeled properly for HNO_3 preservative, and store on ice in a protective wrap.

f. *Sampler 2*: Uncap a TAL 250-mL H_2SO_4-preserved container for nutrients (TKN, NH_4, and TP) analysis.

g. *Sampler 1*: Uncap the RA bottle. Carefully decant sample from the RA bottle into the H_2SO_4-preserved container being held by *Sampler 2*, leaving headspace. Discard any remaining sample from the RA bottle.
h. *Sampler 2*: Cap the H_2SO_4-preserved container. Wipe the container clean and dry, check that the lid is tight and the container is labeled properly for H_2SO_4 preservative, and store on ice in a protective wrap.

7. **Collect DOC sample**
Sampler 2 hands *Sampler 1* an NWQL-fired 500-mL amber bottle labeled "TOC."

a. *Sampler 1:* Submerge the capped NWQL bottled to the appropriate depth, uncap and fill until almost full.
b. *Sampler 2:* Secure AquaPrep filter to the discharge end of the pump tubing. Hand inlet end of tubing to *Sampler 1*.
c. *Sampler 1:* Insert pump tubing into 500-mL DOC sampling container, and turn pump on at a low pump rate. Pass three tubing volumes of sample through the tubing for a field rinse; attach the filter and pass about 50 mL of sample water through the filter.
d. *Sampler 2:* Uncap the preserved DOC bottle. After tubing and filter field rinse, hold the discharge end of the filter over the DOC bottle and fill to shoulder. Recap firmly. Wipe the container clean and dry, check that the lid is tight, check that the "DOC" label is intact, and store on ice in a protective wrap.
e. *Sampler 1:* Shut down the pump and discard extra sample to its source. Remove and discard pump tubing and RA sampling bottle.

8. **Collect Oil and Grease (O&G)** (no container field rinse)

a. *Sampler 1 and 2*: Put on long rubber gloves over nitrile gloves.
b. *Sampler 2*: Uncap and hand a 1-L HCl-preserved O&G sample container to *Sampler 1*.
c. *Sampler 1:* Skim sample from the water surface into the HCl-preserved container carefully, capturing surface oil but taking care not to lose the HCl preservative and leaving about 1 inch of headspace. Hand container to *Sampler 2*.
d. *Sampler 2:* Recap and wipe the container clean to remove oily product. Check that the lid is secured tightly and that the container is marked with the type of preservative to ensure proper labeling. Invert three times to mix. Place into bubble or foam sleeve and then into doubled ziplock bags. Store on ice.
e. *Sampler 1, 2, or 3:* Once on shore, if you suspect that preservative was lost, check the sample pH by decanting a small amount of sample, estimate the pH using a pH strip; if pH > than 2, add a contents of an HCl ampoule (2 mL 6*N* HCl) and record this information in the logbook. Rewrap the O&G container, tape the lid, and place on ice.

9. Float or backpack/shoulder-pack the samples to shore, taking precautions to prevent Gulf water from wetting the samples. (Line cooler or backpack(s) with doubled clear trash bags into which samples are placed as collected; end collection by tying the bags closed).
10. Check sensor calibration after cleaning the multiparameter sonde.

6.5 Quality Control for Water Samples

Provide quality control (QC) in the field for samples that are to be collected by each Water Science Center (WSC) engaged in the response to the 2010 Deepwater Horizon oil spill in the Gulf of Mexico. QC sample types to be collected include field (ambient) blanks, replicates, and matrix spikes for the sample types indicated below (Section 7 provides information about quality-control sample types for sediment analyses). Samples will be bottled in accordance with the laboratory requirements. Table D–1 in Appendix D provides the laboratory requirements for water samples.**When collecting QC samples, the standard USGS parts-per-billion and clean-hands procedures and precautions are to be followed** (NFM chapter 4, section 4.3 in U.S. Geological Survey, variously dated**), in addition to the following caveats:**

- All sampling equipment is to be precleaned according to USGS protocols (NFM chapter *3 in* U.S. Geological Survey, variously dated*)* and quality assured by collecting equipment blanks according to USGS protocols (NFM chapter 4; see also Section 9 of this report). Laboratory-certified blank water, including volatile- and pesticide-compound-grade deionized water (VPBW) and inorganic-analyte-grade deionized water (IBW) is obtained through the USGS National Field Supply Services (One-Stop Shop).
- To quality assure the equipment used for the peristaltic-pump sampling method:
  - Lengths of sample tubing are cut, prepared, and dedicated to one field site;
  - Each length of tubing must be thoroughly cleaned before use per NFM 3 procedures;
  - **The tubing must not come in contact with methanol**;
  - Each WSC collects an equipment blank for one length of tubing per WSC.
- Use the TAL-supplied sample bottles with preservative (“pre-preserved” containers) for the respective metals/trace-elements, nutrients, and oil/grease samples.
- As soon as possible, and before starting sampling at the first site, collect an equipment blank (tubing blank) for each of the analyses shown below (also shown in Appendix D, Table D–1). Ship equipment-blank samples to the respective laboratories immediately, requesting a quick turnaround. Collection of an equipment blank is a one-time requirement for each of the coastal Water Science Centers (unless laboratory results indicate a quality-assurance problem).
- For this project, it will not be necessary to use an enclosed (sample-processing) chamber when collecting field blanks. Field blanks should be exposed to onsite atmospheric conditions; that is, they are all ambient blanks (the length of atmospheric exposure should mimic the environmental sampling process). On the other hand, equipment blanks should be collected within an enclosed chamber or glove box in the office laboratory.

- Ensure that sample bottles or any other of the supplies, equipment, or materials to be used in the field have not come in contact with or proximity to methanol. Methanol storage and use, either onsite, during transport, or in the office, must be completely sealed and separated from sampling equipment and supplies. A logbook entry should document how methanol isolation has been accomplished.
- Samples for VOC analyses will be collected in duplicate in VOA vials, instead of in triplicate.

6.5.1 Blank Samples

Each Water Science Center should process one complete set of equipment blanks once before environmental sampling begins. Equipment-blank samples should be collected in a sample-processing chamber, using IBW for inorganic sample analyses and VPBW for organic sample analyses, as appropriate.

6.5.1.1 Equipment Blanks

Equipment blanks are prepared in the office laboratory under clean and controlled conditions. The equipment blanks are to be collected well before project field work begins to allow time for these samples to be analyzed by their respective laboratories and for the results to be evaluated. Should laboratory results indicate the presence of a constituent or compound that is targeted for study, the Water Science Center team first should consult with other Centers engaged in this project to determine if similar problems have been found. The field team is accountable to review their cleaning and sampling procedures, how the equipment was handled and stored, repeat the cleaning and blanking procedure for each piece of equipment separately, and review analytical results for the new set of equipment-blank samples until they are satisfied that they understand and have solved the problem. These requirements are described in NFM chapter 4.3.

When collecting equipment blanks, follow standard USGS protocols and procedures (NFM chapter 3) to clean sample tubing, containers for unfiltered (raw) acidified samples (RA bottles), and disposable filters. Put on nitrile gloves and rinse gloved hands three times with about 1 L of IBW. Change gloves with each major change in procedure. Leave sufficient headspace in each of the samples being collected and refer to Appendix D, Table D–1 for preservation and shipping requirements. Referring to Appendix D, Table D–1:

- TAL analyses
    1. Pump three tubing volumes of IBW through tubing as an initial rinse; then fill the RA bottle.
        - Pour IBW sample from RA bottle into one 250-mL polyethylene container acidified with HNO_3 for metals analysis.
        - Pour IBW sample from RA bottle and into one 250-mL polyethylene container acidified with H_2SO_4 for nutrient analysis.
    2. Pump three tubing volumes of VPBW through tubing. Collect:
        - VOC and GRO samples in 40-mL vials, two vials per sample.
        - TPH-DRO sample in 1-L amber glass container.

- SVOC sample in two 1-L amber glass containers.
- Oil & Grease sample in 1-L clear, widemouth glass container.

- NWQL Denver surfactant analysis—Fill 1-L Teflon bottle with VPBW.
- USGS-Boulder DOC analysis:
  - Within processing chamber, attach AquaPrep filter to pump tubing.
  - Rinse filter with 50 mL of VPBW.
  - Collect VPBW in 125-mL amber DOC bottle.

Equipment-Blank Supplies

- 1-L acid-rinsed (RA) bottle from NWQL Oil Spill Kit*
- C-flex tubing, approximately 8 feet in length*
- Pall AquaPrep filter from NWQL Oil Spill Kit*
- Portable peristaltic pump
- Nitrile gloves
- Inorganic Blank Water (IBW) (estimate three bottles)
- Organic Blank Water (VPBW) (estimate four 12-L bottles)
- 125-mL DOC bottle from NWQL Oil Spill Kit
- 1-L Teflon bottle from NWQL Oil Spill Kit
- 250-mL H_2NO_3-preserved bottle from TAL site-sample set
- 250-mL H_2SO_4-preserved bottle from TAL site-sample set
- For cleaning solutions and solution-treatment and disposal materials, refer to Appendix B.

* Equipment for which an equipment blank is planned.

6.5.1.2 Ambient Field Blanks

Select the site at which to collect one complete set of ambient field blanks. Ambient blanks should be collected before collecting environmental samples and while at the sampling location, as follows:

1. Check and apply labels – the container (bottle) for each blank analysis requires a unique sample ID that must appear on the container label and be recorded on the CoC form, using the same procedure as for an environmental sample.
2. Purge peristaltic pump tubing with three tubing volumes of freshly opened, laboratory-certified, Volatile/Pesticide-grade Blank Water (VPBW).
3. Ambient Blank for VOCs – Check PID measurements. An ambient blank should be collected once per day at field sites where PID measurements exceed a reading of 15 ppmv total VOCs in the Exclusion Zone.
   - Fill two VOA vials and caps to overflowing with VPBW for VOC analysis and two VOA vials for TPH-GRO analysis.

- Cap securely, invert, tap, and check for gas bubbles. Check sample and hand bubble-free sample to partner.
- Partner checks labels, packages sample, and chills samples in the same manner as environmental VOC and TPH-GRO samples.
- Ship overnight, on the same day as sample collection.

4. Fill the remaining organic-sample containers – **except for DOC** – with VPBW. Pass completed sample set to partner to check caps/labels, wrap, and place on ice in the appropriate cooler.
5. Remove and store the filter and tubing into clean, colorless ziplock bags, keeping them clean for later filtration of the environmental sample for DOC analysis.
6. Purge peristaltic pump tubing with three tubing volumes of freshly opened, laboratory-certified, Inorganic-grade Blank Water (IBW).
7. Fill the set of inorganic-sample bottles with IBW, using the TAL pre-preserved bottles in the following order:
   - Nutrients (TKN, NH_4, and total P).
   - Total metals/trace elements.
8. Pass inorganic samples to partner to check caps/labels, wrap, and place on ice in the appropriate cooler.
9. DOC – Rinse the tubing by passing one tubing volume of VPBW to waste. Install the AquaPrep filter and field rinse by passing about 50 mL of VPBW through the filter to waste. Fill an **unpreserved** DOC bottle with VPBW. **Do not preserve this sample**. Pass to partner to check cap and label, wrap, and place on ice in the cooler for the USGS Boulder, Colo., laboratory.
10. Ensure that a TAL-provided trip blank and a temperature blank are included in every cooler that is shipped to TAL.

6.5.2 Replicate Samples and Matrix Spikes

Water samples for matrix-spike, duplicate, and triplicate analyses are collected sequentially, as described below. Sequential replicates (duplicate and triplicate samples) consist of samples collected one after the other close in time and space. Consult Appendix D for preservation and shipping requirements that apply to this project specifically.

Ensure that the correct QC method code is on the Analytical Services Request (ASR) form specifically designated for QC samples. If more than one QC sample is included, distinguish with time steps.

Sites designated for collection of duplicate, triplicate, and matrix-spike samples

- **Duplicates –** ***for TAL samples only***. Collect one set of duplicates per WSC, per site type (beach and wetland).

- **Triplicates – *for all Research and TAL samples.*** Triplicates are collected **only at oiled sites**. Collect one set of triplicates per WSC, and for only one site type (beach or wetland).
- **Matrix spikes – *for TAL spiking and analysis***. Matrix spikes are collected **only at non-oiled** (“clean”) sites. Collect one set of matrix spikes per WSC, per site type (beach and wetland), for the following analyses:
  - SVOC, water sample: 2 extra 1-L amber bottles needed for matrix-spike analysis.
  - TPH-DRO, water sample: 2 extra 1-L amber bottles needed for matrix-spike analysis.

Procedure for Replicate and Matrix-Spike Sample Collection

1. Collect the environmental sample first, followed immediately by collection of a set of duplicate samples at one beach and one wetland site, for TAL analyses only.
   a. At a clean (non-oiled) beach and wetland site, collect matrix-spike samples for TPH-DRO and SVOC analyses by TAL.
   b. At one oiled site only, collect a set of samples in triplicate for analyses by TAL and all the USGS research laboratories.
2. Follow identical sample-collection procedures for the replicate and matrix-spike samples as for the environmental sample, but ensure that the samples are properly labeled and coded for sample type (environmental, duplicate, or matrix spike):
   - VOC/BTEX (no preservative).
   - TPH (GRO Carbon 6 to Carbon 10) (no preservative).
   - TPH-DRO ➔ **add matrix-spike sample** (MS/MSD) collected at one non-oiled beach site and one non-oiled wetland site.
   - SVOC (no preservative) ➔ **add matrix-spike sample** (MS/MSD) collected at one non-oiled beach site and one non-oiled wetland site.
   - Total metals/trace elements.
   - Nutrients (TKN, total ammonium, and total P).
   - Oil & Grease (pre-preserved bottle).
   - DOC (filtered, no preservative).

6.6 Sample Handling and Storage

Once all samples have been collected:

1. Tape caps and check labels on the sample vials/bottles (containers) as instructed in Appendix D, table D–1. Check that cap is fastened securely.
2. Wipe any petroleum or mud off the outsides of the containers and place the full containers into bubble envelopes, then double bag in ziplock bags, place on ice, protect from contact with ice meltwater, and place in the appropriate shipping coolers.
3. Record collection of sample on multiple ASR forms to manage the chain of custody in individual coolers to the appropriate laboratories (refer to Table D–1 in Appendix D).

ASR forms should be sealed in doubled ziplock bags and taped to the inside lid of the respective cooler.

4. If feasible, take photos of the containerized, labeled samples.
5. **Chain of Custody:** Follow the detailed instructions given in Section 8.

    - Remember to record all pertinent data in the project logbook and on the appropriate field form(s) and sign them.
    - Be sure to attach custody seals to the cooler prior to shipment.

6.7 Addendum: Disposable-Bailer Sampling Method

The disposable-bailer method may serve as a suitable alternative to the peristaltic-pump method, depending on site conditions. It requires repeated deployment of the disposable Teflon bailer. In the case where the PVC tube has been deployed, 1.5-in.-diameter disposable bailers may be used to collect water samples through the PVC tube, instead of using the peristaltic-pump method.

Use bailers with sealable tops (pressurizable type) that allow the bailer to remain closed while being submerged to the depth of sample collection.

The bailer is deployed after completing field-measurement procedures for sites with floating product, with *Sampler 1* collecting the water samples and *Sampler 2* managing the sample containers/bottles before and after the each sample is collected in its appropriate container. Sample containers for organic-compound analyses and bottles that contain preservative are not field rinsed. For this method the RA sample-collection bottle is not necessary, as the sample is discharged directly from the bailer into the HNO_3-preserved container for metals analysis and into the H_2SO_4-preserved container for nutrients analysis.

1. *Sampler 1 and Sampler 2*: Remove outer and inner rubber gloves and collect samples wearing inner nitrile gloves. (Each sample collector wears three pairs of inner nitrile gloves.)
2. *Sampler 2*: Remove the disposable bailer from its sealed bag and store the release valve in a safe, clean location for easy access. Sampler 2 puts a clean aluminum foil swatch over the upper pressure port on the bailer and adds a short “leash” with a loop to attach to the wrist of *Sampler 1*.
3. *Sampler 1*: Submerge the bailer to sampling depth, keeping the top pressure port covered using a plastic bag secured by a rubber band to the bailer, to ensure that only water from the chosen sampling depth enters the bailer. At the chosen depth, remove the bag and open the pressure port to allow water to enter the bailer.
4. *Sampler 1*: Raise the bailer out of the water and present the lower water inlet/outlet port to *Sampler 2,* while keeping the upper pressure port sealed.
5. *Sampler 2*:

    a. Prepare to collect two VOC and two TPH-GRO samples. Attach or insert VOA sampling attachment to bailer outlet port (*Sampler 1*: keep upper pressure port sealed).

b. *Sampler 2*: Uncap first VOA vial and place under outlet port.
c. *Sampler 1:* Open pressure port to fill VOA vial and cap to overflowing, leaving each with a meniscus.
d. *Sampler 2*: Empty water from cap into VOA vial while capping the vial, so as to prevent bubbles from forming. Cap VOA vial, invert and tap vial, and check for bubbles. If bubbles are observed, *Sampler 2* will uncap vial, collect additional water from bailer in cap, and repeat step *5d* until no bubbles are observed.
e. *Samplers 1 and 2*: Repeat steps *5a – d* until the four vials for VOC and TPH-GRO analyses have been collected successfully.
f. *Sampler 2*: Clean and dry each container, ensure cap is on securely, place them into foam or bubble sleeves, place then into doubled Ziploc bags, and store on ice in the appropriate cooler. Remove vials and seal caps with Teflon tape when on shore; replace vials into their protective sleeves, ziplock bags, and ice.

6. *Sampler 1*: Repeat steps 3 and 4 as needed before continuing to Step 7.
7. *Sampler 2*: Uncap, place under outlet port, and fill (leave headspace) and cap the following bottles to within 1 inch of the top while *Sampler 1* opens the pressure port:

   a. One 1-L baked amber glass bottle for TPH-DRO.
   b. Two 1-L baked glass bottles for SVOC.

8. *Sampler 2*: Clean and dry each container, ensure cap is on securely, wrap in bubble or foam sleeve, place in doubled Ziploc bags, and store on ice in the appropriate cooler.
9. *Sampler 1:* Hand *Sampler 2* the first of two 1-L Teflon bottles for the surfactant sample.

   a. *Sampler 2*: Uncap and place under outlet port while *Sampler 1* opens the pressure port.
   b. Fill the bottle to two-thirds of capacity to leave room for expansion of the sample when frozen. Recap the bottle securely, place in foam or bubble sleeve, and place on ice.
   c. Samplers 1 and 2, repeat steps a and b with the second Teflon bottle.

10. *Sampler 1*: Hand *Sampler 2* the 250-mL HNO_3-preserved polyethylene container for Total Metals/Trace Elements.

    a. *Sampler 2*: Uncap, place under outlet port.
    b. *Sampler 1*: Open the pressure port. Fill container carefully, leaving headspace and avoiding loss of preservative. Recap and hand to *Sampler 2*.
    c. *Sampler 2*: Dry the container, check that container is labeled to indicate HNO_3 preservative, and check that cap is securely tightened. Invert three times to mix, place into doubled ziplock bags, and store on ice.

11. *Sampler 1:* Hand *Sampler 2* the 250-mL H_2SO_4-preserved polyethylene container for Nutrients (TAL). *Samplers 1 and 2* follow the same procedures as described in Step 10.

12. *Samplers 1 and 2:* Prepare to collect the 125-mL baked-glass DOC sample by installing the AquaPrep filter onto the bailer outlet. Field rinse the filter (but not the bottle) by passing about 50 mL of sample through the filter. Then fill the DOC bottle to the shoulder with sample filtrate, cap securely, place bottle into bubble or foam sleeve, then into doubled ziplock bags, and store on ice. (USGS-Boulder).
13. Remove and discard bailer in dedicated waste receptacle.
14. Oil and grease is collected by the direct-dip method (no container field rinse):
    a. *Samplers 1 and 2*: Put on long rubber gloves over nitrile gloves.
    b. *Sampler 2*: Uncap and hand a 1-L HCl-preserved Oil and Grease sample container to *Sampler 1*.
    c. *Sampler 1*: Skim or scoop sample from the water surface into the HCl-preserved container carefully, capturing surface oil but taking care not to lose the HCl preservative (if possible), and leaving about 1 inch of headspace. Hand container to *Sampler 2*.
    d. *Sampler 2*: Recap and wipe the container clean to remove oily product. Check that the lid is secured tightly and that the container is marked with the type of preservative to ensure proper labeling. Invert three times to mix. Place into bubble or foam sleeve and then into doubled ziplock bags. Store on ice.
    e. *Samplers 1, 2, or 3*: Once on shore, if you suspect that preservative was lost, check the sample pH—decant a small amount of sample, check pH with a pH strip; if pH is greater than 2, add a vial of 6 N HCl and record this information in the logbook. Rewrap the O&G container, tape the lid, and place on ice.
15. Remove the wooden (or metal) stake and PVC tube and return to the decontamination (CRZ) area. Discard the stake and PVC tube into appropriate receptacles for hazardous waste.
16. Secure all samples, returning to shore. Decontaminate sample coolers and equipment used to bring the samples to shore.
17. Pack bottles in appropriate shipping coolers, in dry ice or wet ice, as instructed by the laboratory, and ship for priority overnight delivery to the respective laboratories.

7.0 Sediment Samples

Standard and project-specific procedures are described in this section that will be used for collecting samples of sediment or other solids from an oil-impacted shoreline environment. These procedures are intended to be implemented in addition to standard USGS sampling and quality-assurance protocols as described in the *National Field Manual* (refer to NFM chapter 8 in U.S. Geological Survey, variously dated). Chain of Custody (CoC) requirements will be followed explicitly for the collection, processing, transport, handling, storage, and documentation of the samples and data collected.

The type of sediment deposits characteristic of a given sampling location influences its susceptibility to oil-related contamination. Moreover, differences in sediment types correspond with various interferences and matrix effects that can bias laboratory analyses. Contaminants are more likely to be concentrated in finer-grained sediments and in sediments having high organic-material content. Organic-rich sediments are typical of wetland areas, in contrast to the typically coarser and “cleaner” sediments found on beaches and in other erosional zones. The particle size and organic content of the sediments are related directly to the velocity and flow characteristics of the water body in contact with site sediments. A description of the sediment deposits and profile observed at the sampling site should be recorded in the project logbook with respect to relative particle size, sorting, and the presence of either naturally occurring or anthropogenic (such as possible oil-spill related) organic-matter content.

Sediment samples for this project are to be analyzed for metals and other trace elements; organic compounds including PAH, SVOC, and Oil and Grease; benthic invertebrates; and ambient populations of hydrocarbon-degrading microorganisms, and will undergo analysis of porewater toxicity as well as oil-fingerprinting analyses of tarball and bulk-sediment hydrocarbons. Overview and Preparations

7.1 Objectives and Method Overview and Preparations

Samples are to be collected in a manner such that they accurately represent ambient conditions at the time of sampling. The extent of apparent oil penetration into the nearshore beach (swash) sediments at sampling locations is to be determined and documented. Swash-zone sediments are subject to scouring, resuspension, and deposition from surf action; therefore, swash-zone samples will be collected from an area and at a depth horizon to which oil might have penetrated.

For the purpose of this study, wet sediment samples will be collected at the land/water interface (swash zone) on beaches and from bottom materials of streams that dissect wetland areas. Swash and wetland sediments are collected in the exclusion zone (EZ, Section 4), a cordoned-off area large enough to allow two sets of benthic invertebrate samples (three samples per set) to be collected from about 0.5 to 1 m apart. Sediment coring, collection, and homogenization of a bulk (composite) sample will follow the procedures described below and as required by site conditions at the time of sampling.

1. Plan sampling with consideration of weather and tidal conditions, if possible. The variability of tidal range may affect the viability of sample locations at mid to high tides. In addition, sediments in the land/water interface may differ substantially at different

stages of tide. If possible, sample collection should be conducted at comparable tidal stages as those collected during the pre-impact sampling at a given location.

2. Perform a general site survey prior to site entry, in accordance with the HASP (Section 4 and Appendix E).
3. Prepare dedicated sets of equipment for each site and as appropriate for the planned analysis (see Appendix D, Table D–2, for sediment sampling). This equipment will have been previously quality controlled by collecting and analyzing blank-water samples of the appropriate grade for a full suite of the same organic and inorganic constituents for which samples will be analyzed.

    a. Precleaned or certified-clean sample containers. WhirlPaks used for the bacteria samples must be certified and maintained as sterile.
    b. Precleaned and quality-assured Teflon bags, for lining the bucket in which a bulk composite of sediment will be prepared. These are to be autoclaved and kept sterile in autoclaved bags for transport to the field.
    c. Polycarbonate and Teflon coring devices and Teflon scoops, spoons, and spatulas that have been certified or quality assured as clean of target analytes and wrapped to ensure they are kept clean and contanminant-free during packaging and transport to the field site. If used to collect the bacteria sample, these must be autoclaved prior to use.
    d. Precleaned, Teflon-bag-lined, 2.5-gallon bucket in which to composite a bulk sediment sample.

4. Install stakes or flagging and police-barrier tape to identify and mark the boundary of the sampling location (EZ) and CRZ. If necessary, the proposed sampling location may be adjusted based on site access, property boundaries, and surface obstructions.

    a. Record GPS data for the sampling locations (sample markers are temporary).
    b. Document specific site and sediment characteristics, including the extent and description of any observed contaminant.
    c. Photograph the location and a profile of the trench or core at which samples are to be collected. **Take site photos facing north, south, east, and west, close-ups, and a view looking directly down at the sediment-collection area.** Photos should be date-and-time stamped and labeled with site ID and an arrow indicating the orientation and direction toward which the photo was taken. When photographing the core or trench profile, include a ruler or other marker to indicate scale and, if not obvious, which side is up.

5. After sampling, scoops/spades/spoons/spatulas and core tubes either are disposable and appropriately discarded or, if designated for reuse, are to be cleaned of surface contamination in the CRZ and stored in ziplock bags for transport to the office laboratory where they will be cleaned using the chemical agents appropriate for the equipment type and degree of contamination, per routine USGS decontamination protocols. Rinsate

blanks are collected periodically to verify the efficacy of the cleaning procedure for any equipment that will be reused.

7.2 Equipment and Supplies

The intent of this protocol, as applied to the USGS response to the Deepwater Horizon oil spill, is to use quality-assured, precleaned sampling and single-use disposable equipment at each sampling site to the extent possible (table 4 and table 5). Precleaned Teflon equipment will be used primarily to collect and composite beach and wetland sediments. Any equipment that will be reused will be cleaned and quality assured as described in Section 4 of this report.

Sample integrity is dependent on proper selection and use of sampling equipment, laboratory containers and preservatives, and the decontamination procedures use for cleaning of equipment that can contact the sample to be collected. The equipment and supplies selected for sample collection, processing, and handling shall meet the specifications of the analyses to be performed (see table 4 below and the information provided in Appendix B).

Table 4. Containers and preservatives specific to sediment collection.

[BGC, baked glass container; CIN, laboratory's analytical identification number; HEM, N-hexane extractable material; NFSS, USGS National Field Supplies Service; PAH, polycyclic aromatic hydrocarbons; SVOC, semivolatile organic compounds; TCL, target compound list; mL, milliliter; oz, ounce; L, liter]

Sample Container/ Chemical Preservative	Type of Analysis Laboratory	Container Source[1]
One 250- mL certified BGC. No preservative.	**Tar ball degradation** R. Rosenbauer, USGS, Menlo Park, Calif.	One Stop - NFSS I-Chem or equivalent
Six 500 -mL sterile plastic containers. Three cores only preserved with 10-percent sodium-borate buffered formalin.	**Benthic invertebrates** A. Demopoulos, USGS, Gainesville, Fla.	One Stop - NFSS
One 18-oz (532-mL) WhirlPak, sterile. No preservative.	**Microoganisms** J. Lisle, USGS, St. Petersburg, Fla.	One Stop - NFSS
Two 1-L wide-mouth BGC. No preservative.	**Pore-water toxicity** R. Carr and J. Biedenbach, USGS, Corpus Christi, Tex.	One Stop - NFSS
Two 500-mL certified BGC. No preservative.	**Oil fingerprint** R. Rosenbauer, USGS, Menlo Park, Calif.	One Stop - NFSS I-Chem or equivalent
One 18-oz (532-mL) WhirlPak, beach sand; or, Two 18-oz (532-mL) WhirlPak, fine-grained wetland sediments. No preservative.	**Trace metals and nutrients**[2] A. Horowitz, USGS, Norcross, Ga.	One Stop - NFSS
One 8-oz wide-mouth glass container. No preservative.	**Oil & Grease (Method HEM, CIN 50137)** **SVOC TCL (Method – 8270, CIN 50117)** TestAmerica, Pensacola, Fla. (TAL)	TAL - Pensacola
One 4-oz wide-mouth clear glass container. No preservative.	**PAH and Alkylated PAH (Method 8270C, CIN 50641)** TestAmerica, Pensacola, Fla. (TAL)	TAL - Pensacola

[1] NFSS items are available as an oil-spill kit (Q613fld).
[2] Analysis includes: Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Li, Mn, Hg, Mo, Ni, P, Se, Ag, Sr, Tl, Sn, U, V, Zn, Al, C (inorganic + organic), Organic C, Fe, N, S, Ti.

Note: Add the extra sample containers needed when the work schedule calls for the collection of quality-control samples.

Table 5. Supplies for sediment sampling.

[ASR-CoC, Analytical Services Request -Chain of Custody; cm, centimeter; gal, gallon; in, inch; mil, 1/1000th of an inch in thickness]

Supplies Specific to Sediment Sampling[1]	
√	3-gal Teflon bucket liners, cleaned
√	2.5-gal plastic bucket
√	Polycarbonate tube, 2.5-in (6.5 cm) inside diameter, 6 to 12 in (about 15 to 30.5 cm) long
√	10-percent formalin solution saturated with sodium borate -- benthic invertebrate sample preservation
√	Teflon core tubes, 1.5-in diameter by 12-in length
√	Disposable or cleaned Teflon®, sampling scoops, plate; and spades or spatulas
√	Plastic sheeting for homogenization and containerization area
√	Laboratory forceps, metal or Teflon
General Supplies	
√	Barricade (police) tape for Exclusion and Contamination Reduction Zones
√	Digital camera
√	Tape measure
√	Survey stakes or flags
√	Nitrile gloves
√	Photo Ionization Detector (vapor analyzer)
√	Deionized water in spray bottle
√	Ziploc bags 4-mil gauge; leak-proof coolers
√	Wet Ice and Dry Ice, Trash bags, heavy duty
√	ASR-CoC and Field forms (Appendix F)

[1]Refer to Appendix B for a completed list of sampling equipment and supplies. Refer to Section 7.5.1.1 for supplies for sediment quality-control sampling.

7.3 Site Process and Order of Sample Collection

Sediment sampling occurs after water samples have been collected and appropriately packed in coolers. The third team member should begin immediately to facilitate sediment-sampling preparations as water sampling winds down. A synopsis of sampling requirements for each type of sample analysis is shown in figure 8 and summarized in Appendix D, table D–2. Go to Section 7.4 for the step-by-step procedures to be used for this project.

7.3.1 Initial Site Process

After entering the EZ and before collecting sediment in the Teflon-lined bucket:

Wearing nitrile gloves, remove any thick layer of product from the beach surface by blotting it with an absorbent cloth to expose sand surface. Change gloves.

- Remove large rocks, sticks, shells, and tar balls (greater than 2 mm). Change gloves.
- Collect a 9-in. core, using the PVC or a Teflon tube, following the procedures detailed in Section 7.4. This core is used only to document strata characteristics and the presence of visible oil; sediment from this core is not to be used for or combined with sample being prepared for laboratory analysis.

With the exception of the samples for analysis of benthic invertebrates and tar balls, a bulk sample will be collected and homogenized in a 2.5-gallon Teflon-bag-lined bucket, from which subsamples will be collected for the rest of the sediment analyses.

- **Beach sediment.** Samples of beach sediment are collected from the top 9 to 10 in. of the swash zone, using a Teflon core tube or Teflon scoop to fill a 2.5-gallon Teflon-lined bucket to about three-quarters capacity.
- **Wetland sediment.** Wetland sediments are collected from the top 4 to 6 in. of submerged sediment, using a Teflon scoop to fill a 2.5-gallon Teflon-lined bucket to about three-quarters capacity.

After collecting each sample:

- Use a Kimwipe or cloth to clean the outside of the container.
- When capping sample jars, wipe the container and lid threads free of sediment before sealing the container closed. This prevents possible leaks and loss of sample. Tape the lid as instructed by the analyzing laboratory.
- Referring to Appendix D, Table D–2:
  - Place the container into a foam or bubble sleeve and then into doubled ziplock bags. Seal the ziplock bags.
  - Store all samples immediately on dry or wet ice, as specified by the analyzing laboratory.
- Follow CoC instructions explicitly (refer to Section 8).

7.3.2 Order of Sample Collection

1. **Tar balls –** One 250-mL laboratory-certified glass jar. Chill.
2. **Benthic invertebrates –** Six 500-mL plastic jars – 1 core per jar; 3 cores equal one sample set. Preserve as directed. Chill.
3. Collect subsamples from the bulk sample:
    a. **Toxicity**[10] **–** Two 1-L wide-mouth glass jars. Chill, do not freeze.
    b. **Microorganisms –** One 18-oz (532 mL) Whirl-Pak. Freeze.
    c. **Oil Fingerprint –** Two 500-mL wide-mouth jars, fired. Freeze.
    d. **Metals/Trace Elements and Nutrients –** One 18-oz (532 mL) WhirlPak for beach sand; two 18-oz WhirlPaks for fine-grained (for example, wetland) sediments. Chill, do not freeze.
    e. **PAH/Alkylated PAH –** One 4-oz wide-mouth jar. Chill.
    f. **Oil and Grease/SVOC/percent moisture –** One 8-oz wide-mouth clear glass. Chill.

TAKE NOTE! *Protect samples from contacting ice meltwater during transport: Seal the ice in doubled bags and place each sample into a separate doubled ziplock bag.*

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[10] Toxicity analysis of pore water in the bulk sediment sample is dependent on maintaining good moisture content. The order in which the sample for toxicity analysis should be collected therefore depends on the professional judgment of the field team to ensure sufficient moisture content in this sample.

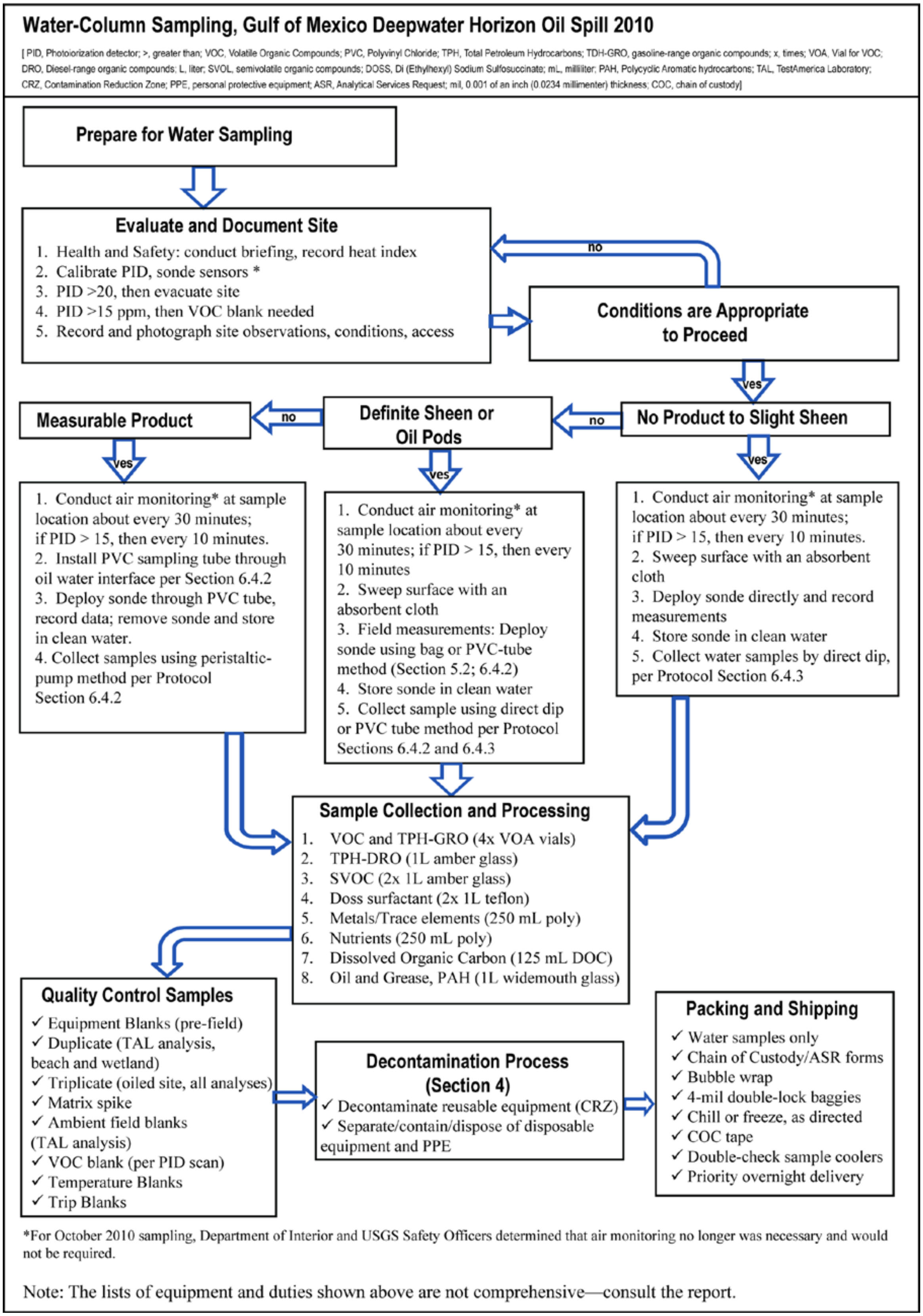

Figure 8. Flowchart showing sediment sampling, Gulf of Mexico Deepwater Horizon oil spill, 2010.

7.4 Step-By-Step Procedures

Deploy to the swash EZ if at a beach site (or to a boat if needed for site access) with the necessary equipment. Before preparing to sample swash-zone sediments in a beach environment, field personnel are to collect a 9-in (about 23 cm) to 10-in core to capture a depth profile, as follows (this step could be accomplished by digging a trench in lieu of collecting a core, field conditions permitting):

1. Press a coring tube (PVC or Teflon) into the swash-zone sediments to collect a core of 9 to 10 in from land surface. Dig around the tube to allow for sliding a spatula or Teflon plate across the tube bottom(to hold the sediment in the tube while the tube is extracted).
2. Carefully extrude the core from the core tube onto a plastic sheet. Measure and describe distinct or mixed horizons and the pattern of any apparent oil infiltration; take detailed photographs of the core (be sure to include a measurement reference) and record observations in the logbook. Slice the core in half lengthwise and record observations.

7.4.1 Tar-Ball Sample Collection

1. Tar-ball specimens should be thumbnail to palm size. These can be collected from anywhere at the beach or wetland site. Photograph each specimen in situ (before its removal).
2. Remove tar ball(s) using a Teflon scoop or metal forceps.
3. Place specimens in a 250-mL laboratory-certified clean glass jar (a 125-mL jar may be used, if available).
4. Store and ship frozen to the USGS, Menlo Park, Calif., laboratory.
5. Record a description of the collection location; for example, swash, low/mid/high tide, GPS coordinates. Photograph the collection area before and after collection.

7.4.2 Benthic Invertebrate Sample Collection

Sampling for benthic invertebrates requires collection of two sets of samples (three separate cores per sample set) at each site, collected approximately 0.5 to 1 m apart in the EZ. To obtain the sample for benthic invertebrates, a 2.5-in (6.4-cm) inner diameter, 15-cm-long polycarbonate core tube is used to collect a core sample of the top 5 cm of the sediment profile. Each core is extruded into a separate container. Only one set of samples is preserved chemically. Both must be kept chilled. The specific steps for collecting these samples follow:

1. Put on disposable nitrile gloves.
2. Remove the precleaned disposable coring device from the protective packaging.
3. Push the polycarbonate coring device exactly 2 in (5 cm) into the sediment (to the set-mark on the side of the core tube).
4. Carefully slide a precleaned spatula (without slots) under the core tube to enclose the sample. Endeavor not to disturb the sediment inside the coring device.
5. Carefully remove excess sediment and any oil from the outside of the coring device with a clean Kimwipe.

6. Extrude and gently tap the core into a 500-mL plastic jar.
7. Inspect the inside of the coring device and spatula surface and use forceps to remove and place any remaining organisms into the container.
8. Repeat steps 3 through 7 five times to complete collection of two (three-core) sample sets.
9. **Sample set 1:** To three of the jars that comprise one sample set, add 10-percent formalin supersaturated with sodium borate preservative. Cap each jar securely (after clearing jar and lid threads of sediment) and invert each jar several times to evenly disperse the preservative.
10. **Sample set 2**: Do not add chemical preservative to the second (three-core) sample. Ensure that jar and lid threads are clear of sediment, and cap each securely.
11. Wrap duct tape around the lids to seal each jar; wrap each jar in a Kimwipe or paper towel and place in doubled ziplock bags.
12. Label the sample jars with the date and time – **each offset by 2 minutes** – and the name of the collector and the site identifer. Record the collection of the sample in the logbook and on the ASR/CoC and field-notes forms.
    a. For Sample set 1, write "10% buffered formalin" on the label of each jar.
    b. For Sample set 2, write “unpreserved sample” on the label of each jar.
13. Place samples on ice to keep chilled at or below 4°C and ship overnight to the USGS, Gainsville, Fla., laboratory). If there is any delay in shipping or keeping samples chilled at 4°C, keep samples on dry ice and place in a freezer upon return to the office; ship frozen the following day.
14. Replace outer pair of gloves with a clean pair in preparation for the next sample.

7.4.3 Bulk Sample Collection

A bulk sample will be collected and homogenized as a composite and subsampled for chemical or microoganism analyses, as described below. Remember to use an absorbent cloth to blot up any oil that might be pooled on the surface of the sampling area. Teflon bucket liners (large Teflon bags) are used to line the bucket and contain the bulk sample and should be used in a manner to ensure that contact with the sample is restricted to the inside, quality controlled, and autoclaved portion of the liner. The liners are discarded after each use. The step-by-step procedures described below should be customized to fit the conditions experienced by the field team; however, any procedure used that deviates from this protocol is to be documented in detail in the logbook. Before beginning sample collection, review the project plan and site objectives and determine if replicate samples are required (see Section 7.5.2). Plan accordingly. To the degree possible, field teams should maintain consistent sampling procedures among all sites.

7.4.3.1 Collecting the Bulk Sample

Line a clean 2.5-gallon bucket with precleaned and sterile Teflon bags (doubled), wearing precleaned gloves and inserting the bag to ensure that the outside of the bag lines the bucket and the quality-controlled interior will contain the sediments.

Beach site:

1. Push a 30.5-cm (12-in) Teflon core tube vertically into the top 23 to 25.5 cm (9 to 10 in) of sediment.
2. Dig around the perimeter so that a Teflon plate can be slipped under the bottom of the core and contain the water-laden sediments until the core can be emptied into the Teflon-lined bucket. Since the toxicity analysis of the sediment porewater is to be performed for this project, take care to retain the water in the sample.
3. Repeat steps 1 and 2 above until the bucket has been filled.
   a. Using the Teflon scoop and avoiding contact with your gloved hand, homogenize the sample after emptying every one to two cores into the bucket. Take care to sample and homogenize in a manner that maintains the moisture content of the sample and minimzes evaporation.
   b. Continue until the bucket is filled to about three-quarters of capacity.
   c. Collect the sample for toxicity analysis first, ensuring that a high moisture content is retained in the sample. Keep the bulk sample homogenized after removal of each subsample.

Wetland site:

1. Using a sterile Teflon scoop, collect the top 4 to 6 in. of wetted sediment so that the bulk sample represents the sampling area; empty the sediment into the bucket.
2. Maintaining a wetted condition is critical when collecting sample for toxicity analysis, as it is the porewater that is extracted for the analysis. Since toxicity analysis is included in this project, decanting of excess water should be minimized. (For projects for which this is not a concern, decant excess water from the Teflon scoop carefully so as to avoid loss of fine sediments before emptying sediment into the bucket.)
3. Using the Teflon scoop and avoiding contact with your gloved hand, homogenize the sample after emptying every two or three scoops into the bucket.
4. Repeat steps 1 through 3 above until the bucket is about three-quarters full.
5. Collect the sample for toxicity analysis first, ensuring that a high moisture content is retained in the sample. Excess water can be decanted after collecting the toxicity sample, if necessary, but taking care to prevent loss of fines from the bulk sample. Keep the bulk sample homogenized after removal of each subsample.

7.4.3.2 Subsampling the Bulk Sample

1. Move from the swash or wetland sampling area to a dry, plastic-lined area appropriate for sample containerization.
   a. If the sampling site was accessed by boat, the sampling team must determine how much of this phase of the sampling operation can be carried out on the boat (preferred), or if it must be carried out onshore.
   b. The sample should not be allowed to dry.

2. Wipe off the bucket before setting it down on top of clean plastic sheeting. Change gloves.
3. Check if QC samples are to be collected and ask *Sampler 3* to set up additional containers, if needed.
4. *Sampler 2:* Hand the subsampling tool to *Sampler 1* and uncap and hold the container for *Sampler 1* to fill.
5. *Sampler 1*: Remix the bulk sample thoroughly, so as to be completely homogenized. Mix for about 5 minutes, in a manner to prevent evaporation of the moisture content.
6. *Sampler 2*: Select the tool for subsampling and the sample container, as appropriate for the sample analysis, and hand it to *Sampler 1*. Uncap and hold the container for *Sampler 1* to fill with sediment.
7. *Sampler 1*: Fill the sample container, leaving headspace as described below for the analysis of interest (refer also to Table D–2 in Appendix D).
8. *Sampler 2*: Hand the container and cap to *Sampler 3*.
9. *Sampler 3*: Remove any sediment, mud, or oily substance from the outside of the container, paying attention to the cap and container threads; secure the lid to the container by taping around the lid to seal it to the container. Wipe container dry; affix, fill out, and check label; place container in bubble or foam sleeve, double bag in ziplock, and put the sample into the appropriate shipping cooler.
10. *Samplers 1, 2 and 3*: Continue steps 3 through 7 until all samples have been collected and stored on ice. Each analysis requires specific containers and volumes of sediment as described in the steps that follow. Fill all required sample containers with homogenized sample volumes as specified:

    a. **Toxicity in Pore water**[11]: Two 1-L wide-mouth clear glass jars. Fill jars with high-moisture content sediment, to bottom of threads. Seal lids with electrical tape. Chill samples at or below 4°C; do not freeze.
    b. **Microoganisms**: Using sterile equipment, fill an 18-oz. (532 mL) Whirl-Pak and seal in another WhirlPak. Freeze sample.
    c. **Oil Fingerprint**: Two 500-mL amber glass, lab-certified wide-mouth jars. **Fill jars to about 80 percent of capacity; keep jars upright.** Freeze samples on dry ice.
    d. **Metals/Trace Elements and Nutrients** (TP, TN, TS): Collect about 1 kg for sand-sized sample into two 18-oz. (532 mL) WhirlPak bags; collect about 500 g for mud and fine-grained sediments into one 18-oz. (532 mL) WhirlPak. Seal each sample in another WhirlPak. Chill, do not freeze.
    e. **SVOC TCL**: One 8-oz wide-mouth TAL glass jar. Fill jar and tape lid. Chill.
    f. **PAH /Alkylated PAH**: One 4-oz fired wide-mouth TAL jar. Fill jar and tape lid. Chill.

[11] The sample for toxicity analysis requires high moisture (porewater) content. Professional judgment of field personnel should be used to determine whether, given existing field conditions, this requirement is best achieved by collecting the toxicity subsample first or last.

g. **Oil and Grease**: One 8-oz fired wide-mouth TAL jar. Fill jar and tape lid. Chill.

7.4.4 Wrap-Up Procedures

1. Record the collection of sample in the field logbook. Multiple ASR field forms are needed to manage the CoC in individual coolers to the appropriate laboratory. Examples of the ASR/CoC forms needed for each laboratory are in Appendix F. Refer to Table D–2 in Appendix D for a list of laboratory addresses and contacts, and container and shipping requirements.
2. Return excess soil from the composite (bulk) container to the point of collection. Rinse sediment and debris from the bucket.
3. Deploying to the CRZ, remove and discard all disposable PPE, used Teflon bags and other sampling gear, the ground sheeting, and decontamination liquid and solid materials into designated and properly labeled receptacles.
4. Complete the decontamination process as described in Section 4.0. If site access was by boat, complete as much of the decontamination process as possible on board.

7.5 Collection of Quality-Control Samples

The samples to be collected for quality control of sediment collection include equipment blanks and replicates, as described below. Be careful to use the correct ASR forms that are designated for QC samples and that indicate the applicable QC method code. If more than one replicate sample is included, distinguish between replicates with time steps. Consult Table 2 of Appendix D for preservation and shipping requirements.

7.5.1 Equipment Blanks

Blank samples (rinsate blanks) will be collected for quality assurance of the sediment collection and processing equipment. The bucket liner, sediment scoop, and core tube and plate are rinsed with IBW and VPBW for inorganic and organic analyses, respectively. The rinsate is collected in the containers used for water samples. Detection of analytes targeted for this project in the rinsate water is considered a sensitive indication of possible contamination from the equipment to the environmental sediment sample.

7.5.1.1 Supplies for equipment blanks

- Two (2) Teflon bucket liners (disposable)
- Teflon scoop(s), Teflon plate, and Teflon core tube
- Nitrile gloves
- 2.5-gal plastic bucket
- Inorganic Blank Water (IBW) (estimate three bottles)
- Organic Blank Water (VPBW) (estimate four 12-L bottles)
- 250-mL H_2NO_3-preserved bottle from TAL
- 250-mL H_2SO_4-preserved bottle from TAL
- 18-oz (532-mL) Whirlpak and 500-mL glass jar to contain water-filled Whirlpak

- Four (4) VOA vials from TAL, 2 for VOCs and 2 for TPH GRO
- 8-oz wide-mouth glass jar from TAL for Oil-and-Grease analyses
- 4-oz clear glass jar from TAL for PAH/Alk. PAH
- 250-mL glass jar from NWQL for oil-fingerprint analysis
- Two (2) 1-L glass jars from NWQL for toxicity analysis
- 1-L Teflon bottle for surfactant analysis*
- 125-mL bottle for DOC analysis*
- Cleaning solutions and solution-treatment and disposal materials: Refer to NFM 3.

* For these analyses, research scientists have requested blank samples of sediment equipment for surfactant and DOC analyses, in addition to those representing equipment used for collection of water samples.

7.5.1.2 Collection of Equipment Blanks for Sediment-Sampling Equipment

Follow standard USGS protocols and procedures (NFM chapter 3) for cleaning the Teflon equipment for sediment sampling listed above, with the following modification for precleaning the Teflon scoop, core tube, and core plate: Replace the 5-percent HCl-solution rinse with a 10-percent by volume bleach-solution rinse; thoroughly remove the bleach residue from this equipment with multiple rinses with sterile IBW or VPBW (see Section 4).

Leave sufficient headspace when filling sample containers to allow for expansion of the chilled samples. Equipment-blank samples should not be frozen.

To collect sediment-equipment rinsate blanks:

1. Put on nitrile gloves; be prepared to change gloves with each change in procedure.
2. Line the bucket with a cleaned, sterile Teflon liner.
3. Prepare to collect VPBW for rinsate samples for organic analyses. Place a Teflon rectangle (core plate), scoop, tube, and another bucket liner into the lined bucket.
4. Open a fresh bottle of VPBW and use about 1-liter of VPBW to rinse your gloves, the extra liner, and each piece of Teflon equipment. Place the loose equipment into the extra liner (keeping it in the lined bucket), discard the water in the bucket, and repeat the VPBW rinse on each piece of equipment two more times.
5. Transfer the Teflon equipment from the liner to the lined bucket. Use the extra liner as a clean surface on or in which to place the scoop.
6. Pour about 6 liters of VPBW into the lined bucket. Using clean-hands/dirty-hands techniques (NFM chapter 4) and the Teflon scoop, fill the following sample containers, refilling the bucket with VPBW as needed:

    - 18-oz Whirlpak in glass jar — Microorganisms
    - 8-oz glass amber — Oil & Grease
    - 4-oz clear glass — PAH/Alkylated PAH
    - Two 500-mL glass jars — Oil Fingerprinting
    - Two 1-L glass jars — Toxicity

- 1-L Teflon bottle — Surfactant/dispersant
- 125-mL DOC glass bottle – Dissolved organic carbon

7. Empty the equipment and VPBW from the bucket, placing equipment in clean, protected environment.
8. Open a fresh bottle of IBW. Rinse gloves, bucket, Teflon bucket liner, and all the Teflon equipment three times with IBW.
9. Place liner and all the Teflon equipment except the scoop and second liner back in the bucket and fill with IBW. Place the Teflon scoop on or in the extra rinsed Teflon bucket liner.
10. Using clean-hands/dirty-hands techniques, fill the sample containers using the Teflon scoop, as follows:

    - 250-mL preserved polyethylene bottle for metals/trace elements
    - 250-mL preserved bottle for nutrients

7.5.2 Replicate Samples

As a rule of thumb, collect at least twice as much material as is required. Homogenize the material and containerize as described below into two individual sample containers. Label each container with its unique sample, site, and (or) station identifier and record the original and duplicate as separate samples on the CoC/ASR.

- **Duplicates –** for TAL ananlysis only**. Collect one set of duplicates, per WSC, per site type (beach and wetland).**
  - Oil & Grease and SVOC analyses: Collect one sample in addition to the first environmental sample in an 8-oz wide-mouth jar.
  - Alkylated PAH/PAH: Collect one sample in addition to the first environmental sample in a 4-oz wide-mouth jar.
- **Triplicates –** for TAL and each research laboratory. **Triplicates are collected only at oiled sites.** Collect one set of triplicates, per WSC, and for only one site type (beach or wetland), as follows:
  - Oil & Grease and SVOC analyses: Collect two samples in addition to the first environmental sample in 8-oz wide-mouth jars.
  - Alkylated PAH/PAH: Collect one additional sample in a 4-oz wide-mouth jar.
    - Benthic Invertebrates: Collect an additional 12 cores, each extruded into a 500-mL plastic jar. Preserve six of the cores with buffered formalin.
    - Oil Fingerprint: Collect additional bulk sediment samples into four 500-mL fired glass wide-mouth jar.
    - Trace Elements and Nutrients: Collect additional bulk samples by filling two 18-oz (532-mL) Whirlpaks for fine-grained material; if the sediment is coarse grained, fill four additional 18-oz (532-mL) Whirlpak samples.

- Microorganisms: Collect additional bulk samples by filling two 18-oz (532-mL) Whirlpaks.
- Pore-water toxicity: Collect additional bulk samples by filling four 1-L wide-mouth glass jars.

8.0 Chain of Custody and Documentation Requirements: Labeling, Packaging, and Shipping

8.1 Method Summary

Samples collected for the post-landfall oil spill require legally defensible data. The following protocols for field documentation, sample labeling, packaging, and shipping incorporate the use of standard chain-of-custody (CoC) procedure as applied to environmental samples. The instructions and procedures provided in this section comprise a summary of *Standard Operating Procedure for Chain of Custody Samples*, Office of Environmental Measurement and Evaluation, USEPA New England - Region 1 (U.S. Environmental Protection Agency, 2002a). However, the exact chain-of-custody requirements to be implemented can depend also on the unique characteristics of a specific operation; field teams should verify CoC protocols with their Unified Command and other administrative contacts before the start of field work.

8.2 Field Procedures

Field personnel are legally responsible for the care and custody of the samples collected until the samples are transferred to a laboratory or otherwise properly dispatched.

- As few people as possible should handle the samples.
- Each sample container must be labeled, at a minimum, with a station number and identifier, date and time of collection, and sampler's name.
- Sample labels are to be completed for each sample using indelible ink (such as non-erasable black or blue "rite-in-the-rain" ballpoint pen). If weather conditions prohibit use of a ballpoint pen and a pencil is used instead, this must be noted in the field logbook. **Sharpies® or other similar pens that emit fumes are prohibited from use.**

8.2.1 Field Logbooks and Other Documentation

The field logbook (logbook) will provide a means for recording field observations and the data-collection activities performed. Logbooks are to be bound, paginated field survey books or notebooks, preferably with "rite in the rain" properties.

Logbook entries should be as detailed as needed so that personnel going to the site at a later date can reconstruct a particular situation without reliance on memory.

- At the beginning of each day, record the date, start time, weather, names of all sampling team members present, level of personal protection being used, and the signature of the person making the entry. Assign a temporary site ID if a station ID has not been established for the sampling site.
- Include a record of the names of visitors to the site and additional field-sampling or investigative personnel, and the purpose of the visit.
- Record measurements made and samples collected, along with a detailed description of the location of data collection.

- All entries will be made in ink as described above, and no erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark and the entry will be initialed and dated.
- Logbook entries and field record sheets must include site and station identifier (ID), date, time, and names or initials of all persons handling the sample in the field.

Field forms have been customized for this project (Appendix F) and can be used to supplement logbook entries, although their use will not substitute for recording the major onsite activities and data entries according to CoC protocol. The equipment used to collect samples will be noted on these field forms, along with the time of sampling, sample description/purpose, depth at which the sample was collected, sample volume, and number of containers and sample-preservation procedures. Duplicate field samples receive separate and unique site identifiers (ID) if the corresponding station IDs have not yet been set up; sample, site, and (or) station ID numbers are recorded field forms. Equipment used to determine field-measurement data are identified by make, model, and serial or unique ID number along with the date and time of calibration or calibration checks.

Photographs are to be taken from multiple perspectives (north, northwest, south, etc.) to document the general condition and characteristics of the field site and of the specific location of sample collection. If possible, photographs should be stamped with the GPS coordinate information for both field-site and sample-collection location

8.2.2 Labeling Sample Containers

Sample labels shall be completed for each sample collected for analysis, using waterproof ink, as described above. When working under the jurisdiction of the Natural Resource Damage Assessment and Restoration Program, labeling conventions and sample nomenclature may differ from those routinely used within the USGS; ensure that correct nomenclature protocols are in place. Figure 9 provides an example of a sample label. The information to be recorded on the sample tag or label includes:

- Site and Station ID numbers.
- Date: A six-digit number indicating the year, month, day of collection.
- Time: A four-digit number indicating the local standard or daylight time datum (EST, EDT, CST, CDT) time of collection using the military or 24-hour time convention; for example, 0954.
- Station Name (descriptive).
- Site Description.
- Name of personnel collecting and handling the sample(s) (provide full name).
- Parameter (analyte) and sample preservation: the sample analysis to be conducted and how the sample is preserved using physical and/or chemical means.
- Comments: Pertinent observations of any site conditions that might affect the quality of the analysis.

Site ID:_______________ **Station ID:______________**

Lab:__________________ **Station Name: __________**

Sample Type:___________ **Project No:_____________**

Media:_________________
Analysis:____

Preservative:__________________

Location:____

Sample Date:_________________ **Sample Time:_________________**
Sample ID: __________________ **Depth:_______________________**
Sampled By:____

Comments/Site Description:____
____
____

Figure 9. Example of a sample label.

Due to the evidentiary nature of samples collected during environmental investigations, possession of the sample must be traceable from the time the samples are collected until they are introduced as evidence in legal proceedings. This chain of custody (CoC) will be documented using the Analytical Services Request (ASR) form to inform the laboratory of the analyses being requested for each sample and to document sample possession and custody. One signed copy of the ASR form should remain with the sampler and two copies should be transported with the sample aliquots to each laboratory.

It is the intent of this protocol to follow USEPA policy regarding sample custody and CoC protocols, as described in *Sample Custody*—NEIC Policies and Procedures, EPA-330/9-78-DDI-R, revised June 1985. This custody procedure is in three parts: sample collection, laboratory analysis, and final evidence files. Final evidence files, including originals of laboratory reports and electronic files, are maintained under document control in a secure area. A sample or evidence file is under your custody when:

- It is in your possession, or
- It is in your view, after being in your possession, or
- It was in your possession and then locked up to prevent tampering, or
- It is in a designated and documented secure area.

To maintain a record of sample collection, a CoC/ASR record will be completed for each sample destined for laboratory analysis and for the transfer of samples among sample custodians, shipping courier, and the laboratory. Examples of standard CoC/ASR forms for water and sediment samples that are shipped to TestAmerica Laboratory, Pensacola, Fla., are provided in Appendix F.

Sample CoC/ASR procedures require that the possession and handling of the sample from the moment of its collection through analysis be documented by written record. The record must clearly reflect the movement of the sample through the CoC/ASR to ensure the sample has been positively controlled and has not been tampered with in any way. Each time the samples are transferred, the signatures of the person relinquishing and receiving the samples, as well as the date and time of transfer, will be documented.

8.2.3 Transfer of Custody and Sample Shipment

Samples are to be properly packaged for shipment (see Appendix D) and dispatched to the appropriate laboratory for analysis. Samples must be accompanied by a properly completed CoC/ASR form at all times.

- The CoC/ASR form is **signed and dated with the time of transfer by a member of the field team** who has verified that those samples indicated on the CoC/ASR form are indeed being shipped.
- The station name, ID, and locations are listed on the CoC/ASR form.
- A separate signed custody record is enclosed in each sample box or cooler.

After packaging is complete, the shipping containers are secured with strapping tape and custody seals for shipment to the laboratory. The **custody seals must be signed and dated either by a member of the field team or by those designated and certified by the Unified Command**, and placed over the lid edge for fixed-base laboratory samples. The preferred procedure also includes using a custody seal attached to the front right and back left of the cooler. **Ensure that strapping tape does not cover and hide the CoC tape.**

All samples are shipped by an appropriate courier (for example, Federal Express). Samples are transported daily or the next day from the sampling or storage location to the courier location for subsequent shipment to the laboratory. If the courier will not sign the CoC form, this should be noted on the form with the time of transmittal to the courier. **A designated member of the field team should track the time of shipment and progress to its destination until its arrival is confirmed by the laboratory.** Upon receipt of the samples at the laboratory, the receiver will complete the transfer by dating and signing the CoC/ASR form. If shipped by commercial courier, the air bill number and shipping data will be transcribed to the CoC/ASR form in the appropriate signature/date block. A copy of the air bill is to be kept with the field copy of the CoC/ASR form to reflect specific shipping information.

The custodian of the evidence file will maintain the contents of evidence files for each investigation, including all relevant records, reports, logs, field notebooks, pictures, subcontractor reports, correspondence, laboratory logbooks, and CoC forms.

- Each project evidence file will be stored in a secure, limited-access area and under custody. A copy of the CoC/ASR shall be kept by the sample team.
- Analytical laboratories will retain all original raw analytical data information (both hard copy and electronic) in a secure, limited-access area and under custody of the laboratory-designated project manager.
- Sample collection points, station identification numbers, and sampling dates documented in the field logbooks will be verified with the information written on the sample label and (or) CoC/ASR form.

8.2.3.1 Packaging Samples

Equipment and material requirements to properly handle, ship, and maintain custody of samples as described in the preceding sections include the following:

- Teflon, duct, and electrical tape for sealing lids on sample containers and vials (as directed)
- Chain-of-Custody forms
- Properly labeled sample containers
- Indelible black ink marker
- Custody seals, moisture-proof; can adhere to wet coolers
- Approved, undamaged coolers of various sizes with drains sealed
- Temperature check sample
- Ziplock bags (assorted sizes for samples and ice)
- Plastic trash bags
- Bubble wrap or foam sleeves
- Ice – wet and dry
- Courier airbills
- Laboratory contact information
- Nylon reinforced strapping tape
- Any special requirement courier labels (hazardous materials, caustic, etc.)
- Lockable storage areas (to maintain sample custody, may be locked vehicle, office, etc.)
- Coolers for shipping samples: clean, leak-proof. To avoid loss of shipping labels from “sweating” coolers, it is recommended that the sender and recipient address be written in indelible marker on the outside of the cooler.

Lids or caps on sample containers are to be taped with Teflon, electrical, or duct tape, as directed by the receiving laboratory to help prevent leakage. Glass containers will be wrapped with plastic insulating material (such as foam or bubble wrap) to prevent contact with other sample containers or the inner walls of the cooler; containers also are to be sealed in doubled ziplock bags. Similar containers for the same location may be sealed in the same set of ziplock bags (for example, VOC and TPH-GRO vials).

Sample identification from each container shall be compared to the entries on the CoC/ASR form to ensure bottle labels and CoC entries match. Once this is confirmed, the samples can be packed as described. Wet ice is required to be bagged in doubled bags and sealed to prevent leakage from melting ice.

Samples will be packaged in thermally insulated, rigid coolers, according to DOT specifications (173 Subparts A and B and 172 Subparts B, C, and D). Environmental samples and field quality-control blanks to be submitted to the analytical laboratory will be placed in a shipping cooler along with ice and temperature blanks. After a cooler is filled, the appropriate CoC/ASR form will be placed inside a resealable plastic bag and taped to the inside lid of the cooler, and the outer surface of the cooler will be cleaned. Any leaking cooler will be held by the courier and sample holding times could be missed.

TAKE NOTE! *The bubble or foam wrap on glass sample containers might prevent the sample from being appropriately chilled or frozen. Sufficient ice must be in contact with the wrapped container to ensure thermal preservation of the sample.*

The cooler shall be secured with CoC tape and custody seals, followed by using a minimum of three complete wraps of nylon-reinforced strapping tape on each end of the cooler and to help secure, but not hide, the CoC tape and seals. Signed custody seals must be applied, at a minimum, at the front and back of the cooler such that the seal would be broken if the top is opened or removed. An example of a custody seal is shown in figure 10.

Figure 10. Example of a custody seal.

8.2.3.2 Shipping Samples

Whenever possible, ship samples to the laboratory overnight on the day of collection. Pay strict attention to holding-time limitations for the given sample type; for example, the holding time of the VOC and TPH samples, collected in VOA vials, is 7 days from collection to analysis. Check laboratory hours of operation—keep in mind that the laboratory might not receive samples on Saturdays, Sundays, or holidays. The integrity of chilled samples sent late on a Thursday or on a Friday could be compromised if not received by the laboratory in time to be unpacked and refrigerated.

- Check the planned arrival time before selecting the courier service.
- Courier services will not accept or deliver leaky boxes or coolers. Securely tape the outside of shipping coolers to help prevent leaking.

- Do not exceed maximum weight and size restrictions set by the courier service.
- Comply with the courier service's requirements for meeting U.S. Department of Transportation regulations for transporting hazardous substances.
  - Identify any samples that require special shipping procedures (for example, samples to be shipped on dry ice).
  - Send chilled and frozen samples to the laboratory by the fastest means possible.
  - Obtain instructions and authorization from the laboratory before sending any highly contaminated or potentially hazardous samples to the laboratory for analysis.
- Shipping of sediment samples for this project must conform to Federal regulations and procedures. Do not ship sediment samples in coolers containing samples of water, tissue, or media other than sediments.

TAKE NOTE! *Avoid overfilling the shipping coolers. Packing the coolers too tightly can cause breakage of the cooler and its contents, especially when containing frozen samples and dry ice.*

9.0 Quality Assurance and Quality Control for Field Sampling

The purpose of this section is to address the topic of quality assurance (QA) as it applies in general to USGS sampling efforts in response to the Deepwater Horizon oil spill and to describe the actions and protocols to be implemented for quality-control (QC) samples collected after landfall of the oil spill. The standard operating procedures referred to in this section follow those given in the *National Field Manual for the Collection of Water-Quality Data* (U.S. Geological Survey, variously dated) and may need to be modified according to circumstances encountered in the field or because of changes or redefinition of data-quality objectives for the sampling effort. The rationale for deviation from this protocol must be documented in field logbooks at the time of sampling.

9.1 Quality-Assurance Requirements

The USGS defines quality assurance (QA) as those procedures used to control the nonquantifiable components of a project, including the development and use of this Sampling Protocol. Examples of key components of QA for this project and for water-quality projects in general that are required to fulfill the objectives of this project are listed below.

- Standard, scientifically valid and appropriate methods and protocols for the collection of in situ environmental field measurements and water and sediment data are used and documented. Data must be produced in such a manner so as to ensure that site conditions are represented accurately at a time and location that fulfill project and data-quality objectives.
- Adherence to strict protocols is critical for documenting site conditions and field activities, including implementation of those requirements for maintaining a legal record of chain of custody for all samples that are collected; for example, properly entering data in bound, paginated, project-dedicated logbooks and on field data sheets and laboratory request forms.
- Equipment that contacts the sample must be constructed of materials that cannot itself become a source of sample contamination. In other words, the equipment used must not be capable of releasing measurable concentrations of the same analytes that are targeted for study. In this regard, it is recommended that all sample containers be quality assured and, when appropriate, carry certification of laboratory-grade cleanliness.
- Equipment cleaning and decontamination procedures are required that have been tested and are known to be appropriate and effective for work in crude-oil-contaminated land and aqueous environments.
    - Protocols for removal of the cleaning and decontamination agents used on equipment must be followed strictly so the cleaning process itself does not become a source of contamination to the sample. For example, methanol must be allowed to evaporate completely from all equipment surfaces, nooks, and crannies; only nonphosphate detergents will be used, and subsequently these and any acid solutions must be rinsed thoroughly from all equipment surfaces.

- Standard hazardous-waste handling and disposal procedures (described in Section 4), involve the proper containment and disposal of contaminated materials, including the waste fluids and materials from equipment decontamination. Such procedures are meant to ensure that cross contamination of samples does not occur among and between sites and that contamination is not transferred offsite to public or private areas.

- Disposable equipment that has been precleaned and quality assured will be used, where and when possible, in order to prevent the possibility of cross-contamination between sampling sites and to minimize the need for onsite equipment decontamination by use of organic solvents and acids.
- Field personnel are aware of those routine procedures that might affect the ambient environment in which samples are collected. For example,
  - When boats are used, boat motors and bilge pumps should be turned off during the sampling operation and retrieval and decontamination of sampling equipment, to avoid creating an additional and not ambient source of contamination.
  - Storage—permanent and transient—of gasoline or other petroleum-based products and methanol and methanol-infused rags or clothing must be kept in a secure area that is separate and downwind of the sample-collection, sample-processing/preservation, and packaging areas.
- Collection and analysis of QC samples, such as blank, replicate (samples collected in duplicate, triplicate, etc.), and spike samples, whose purpose it is to assess the quality of environmental data by generating a set of data that will be used to estimate the magnitude of the bias and variability resulting from the procedures used for obtaining the samples.
  - For blank samples: Laboratory-certified blank water of the appropriate grade is obtained, stored, transported, and used in accordance with standard USGS procedures: inorganic-grade blank water (IBW) for metals/trace-element and nutrient analyses and nitrogen gas-purged volatile/pesticide-grade blank water (VPBW) for each of the organic-compound analyses.
  - Matrix spikes, prepared at the laboratory by laboratory personnel.
- Mandated training for all field personnel to ensure that health and safety regulations and sampling and data-collection methods are understood and appropriately implemented.

9.2 Summary of Quality-Control Sampling for the USGS Response to the Deepwater Horizon Oil Spill

Quality-control samples are to be collected and analyzed along with environmental samples to assist in identifying the occurrence, source, and magnitude of sample contamination (field and laboratory) and as a measure of variability in the analytical composition of samples collected. Analysis of the unimpaired sediments collected during the pre-landfall phase of this project will serve as a baseline against which to compare analytical results from the post-landfall samples.

In order to provide useful information, QC samples must be collected, prepared, and analyzed in the same manner and using the same materials as were used for environmental samples. Failure to do so is likely to result in invalid or indeterminate interpretations of the QC data and can compromise the scientific defensibility of the data.

9.2.1 Frequency and Distribution

Quality control for the coastal samples will rely primarily on the collection of replicate and specified types of blank samples at a frequency of not less than one (1) in 10 samples by each Water Science Center, or as otherwise prescribed in Sections 6.5 and 7.5 for the QC sample type.

Additional (extra) QC samples should be collected according to the best professional judgment of the field team leader as needed to account for the bias and variability of unanticipated site conditions; for example: (1) the potential for cross contamination of the samples from the environment may be much greater at sites with a more visible presence of oil, alerting the sampler to the need to collect a precautionary blank sample; (2) a PID scan may signal heightened concern for bias to VOC samples, resulting in collection of an ambient-condition blank (ambient field blank).

The specific sites at which various types of QC samples are collected and the frequency of visiting these sites is to be determined by USGS Water Science Center team leaders after the start of post-landfall sampling.

9.2.2 QC Sample Types

Quality-control samples for specified water and sediment analyses as described in Section 6.5 and Section 7.5, respectively, will be collected by each USGS Water Science Center.

- **Blank samples:**
  - One set of **equipment blanks** before deploying to the field. For sediment equipment, rinsate blanks will be collected by using and subsequently analyzing laboratory-certified blank water in which sediment equipment has been immersed.
  - One set of **ambient field blanks** will be collected for water analyses by the TestAmerica Laboratory (TAL), Pensacola, Fla., to determine the potential for sample contamination from ambient (environmental) field conditions occurring during the time of sample exposure to the atmosphere.
  - The laboratory provides trip blanks for quality control of VOC and TPH-GRO water analyses to determine if the integrity of these samples was comprised as a result of the sample-transport process.
  - Temperature blanks are included in each sample cooler and checked by the receiving laboratory to ensure that sample-preservation requirements with respect to temperature have been met.

- **Replicate and matrix-spike samples:**
  - **Duplicate samples**: One set each of water and sediment samples are to be collected by each Water Science Center at one beach and one wetland site, and will be sent to TAL, Pensacola, to be analyzed only for those analyses for which TAL has been contracted. Duplicates are not to be collected for the research laboratories unless specifically requested.
  - **Triplicate samples**: One set each of water and sediment samples are to be collected at one site with visible oil-related contamination, selected by the Water Science Center, and sent to each research laboratory and TAL for a full suite of analyses.
- **Laboratory matrix-spike samples**: Water samples are to be collected at one Center-selected site at which no oil-related contamination is evident. The sample is fortified (spiked) at TAL and analyzed for semivolatile organic compounds (SVOCs) and diesel-range total petroleum hydrocarbons TPH-DRO).

In summary:

- **Water Samples** (Section 6.5)
  - Equipment blanks **–** for analyses by TAL and selected Research labs
  - Ambient field blanks –1 site per WSC – TAL analyses only.
  - Trip blanks **–** provided by TAL, for VOC and GRO coolers
  - Temperature Blanks **–** provided by TAL, all coolers
  - Duplicates –1 site per WSC, per site type (beach or marsh) –TAL analyses only
  - Triplicates –1 OILED site per WSC –TAL and Research Lab analyses
  - Matrix spikes –1 CLEAN site per WSC, per site type –TAL (SVOC, TPH-DRO analyses)
- **Sediment Samples** (Section 7.5)
  - Equipment (rinsate) blanks – water for analyses by TAL & selected Research labs
  - Duplicates –1 site per WSC, per site type (beach, wetland) –TAL analyses only
  - Triplicates –1 OILED site per WSC –TAL and Research Lab analyses
  - Temperature Blanks **–** provided by TAL, all coolers

9.3 Definitions and Description of Typical Quality-Control Sample Types

The information that follows provides a general overview of quality-control sample types, some of which may not relate directly to the work outlined for this project.

9.3.1 Field Replicates

Field replicates are used to assess the variability associated with sample heterogeneity, sample methodology, and analytical procedures. Two or more field samples are obtained from one location, either concurrently or sequentially (one after the other). Following collection, they are treated as separate samples throughout the remaining sample handling and analytical processes.

- Split Replicates consist of a composite or homogenized sample that is split into equal volumes using appropriate, quality-assured methods, and placed into the appropriate containers. (For this project, no water samples will be prepared as split replicates.)
- Sequential Replicates consist of samples collected separately but close in time (one after another). Spatial distance among sequential replicates can depend on the media and the intended analysis.
  - For sediment to be analyzed for VOCs, for example, it is advised that distinct and nonhomogenized samples be collected from 1 to 3 feet apart. (For this project, sediment samples will not be collected for VOC analysis.)
  - For water sampling, sequential replicates are collected as close in time and space as possible. (For this project, sequential replicates will be collected for water samples only.)
  - Each container is assigned a unique sample identifier, and labeled and recorded on the CoC/ASR as separate samples.

9.3.2 Matrix Spikes

Matrix-spike samples are used to evaluate interference from the environmental matrix on the performance of the analytical method. A replicate set of sample containers are collected for sediment and/or water and identified as spike samples for each analysis for which a matrix spike is to be requested. The sample generally is fortified with the spiking solution in the laboratory. Each container is assigned a unique identifier, and each is labeled and recorded on the CoC/ASR as separate samples. (For this project, sediment samples will not be collected for matrix-spike analysis.)

9.3.3 Field Blanks

A field blank is a category of QC sample that is prepared in the field to assess cross contamination caused (a) by inadequate decontamination procedures or contamination of a sample from a source not associated with the sample matrix, such as sampling equipment or sample-handling and transport procedures, or (b) ambient atmospheric conditions at the time of sampling (ambient blank). Since samples for this project are collected primarily using precleaned, dedicated, disposable equipment few, if any, field blanks will be collected. Blank samples, therefore, will focus on collection of ambient field blanks to determine the potential for sample contamination from ambient field conditions occurring during the time of sample exposure to the atmosphere.

- **Field blanks generally are collected at a rate of one (1) in every 10 to 20 samples for a given analyte, or at a greater frequency**, depending on ambient field conditions or decontamination-related requirements and project approach and objectives.
- Ambient field blanks are to be collected before collecting environmental samples while at the sampling location. For this project, ambient field blanks will be collected for VOCs when organic-vapor concentrations exceed 15 ppmv (determined by PID scan).

- A rinsate blank may be collected to test the suitability of reused equipment after it has been decontaminated. Decontamination of equipment to be reused can be accomplished either on site or in the office laboratory, according to the best judgment of field personnel (Section 3.0 of this protocol). All equipment must be rinsed and appropriately containerized before being transported from the field site.

9.3.4 Equipment Blanks

Equipment blanks are required to test the suitability of new, disposable (single-use) equipment as well as reusable equipment. Equipment blanks are collected in the office or laboratory to ensure a clean and controlled sampling environment that is protected from ambient (such as airborne) contaminants. A one-time equipment blank per type of equipment is collected by each Water Science Center before sampling begins (see Sections 6.5 and 7.5 for collection of water and sediment equipment blanks, respectively.) This protocol does not apply to laboratory-supplied sample containers that are certified clean for the chemical constituents of interest.

Equipment blanks (in some cases these are the same as rinsate blanks) are obtained by collecting blank water of the appropriate type from or through sampling equipment after having gone through an established cleaning procedure (refer to NFM chapter 3 in U.S. Geological Survey, variously dated) and before its first use in the field. The purpose of the equipment blank is to ensure that the equipment itself and the prescribed equipment-cleaning or decontamination procedures are not potential sources of contamination to the samples that the equipment will contact.

Equipment blanks are collected well before project field work begins to allow time for these samples to be analyzed by their respective laboratories and for the results to be evaluated. Should laboratory results indicate the presence of a constituent or compound that is targeted for study, the Water Science Center team first should consult with other Centers engaged in this project to determine if similar problems have been found. The field team is accountable to review their cleaning and sampling procedures, how the equipment was handled and stored, repeat the cleaning and blanking procedure for each piece of equipment separately, and review analytical results for the new set of equipment-blank samples until they are satisfied that they understand and have solved the problem. The protocols and procedures related to collection of equipment blanks for this project are the same as those used routinely for USGS water-quality projects and as documented in chapter 4, section 4.3 of the National Field Manual (see U.S. Geological Survey, variously dated).

9.3.5 Source-Solution, Temperature, and Trip Blanks

- A source-solution blank may be collected for VOC analysis to document if the composition of the blank water, as received and stored before transport to the field, was free of measurable concentrations of the VOCs to be analyzed.
- Temperature blanks will ensure that sample-preservation requirements with respect to temperature have been met.
- Trip blanks for VOC analyses are collected to determine if the integrity of these samples could have been comprised by the sample-transport process.

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11.0 Acronyms, Abbreviations, and Chemical Symbols

Ag	Silver
Al	Aluminum
As	Arsenic
ASR	Analytical Services Request
ASTM	ASTM International. (An organization for standardization of technical scientific and industrial methods)
atm	Atmospheric unit
B	Boron
Ba	Barium
Be	Beryllium
BGC	Baked glass container
BP	British Petroleum Global Company
BTEX	Benzene, toluene, ethylbenzene, and xylenes
C	Carbon
Cd	Cadmium
CDT	Central Daylight Time
CFR	Code of Federal Regulations
Co	Cobalt
CO_2	Carbon dioxide
CoC	Chain of custody
CPR	Cardiopulmonary Resuscitation
Cr	Chromium
CRC	Contamination Reduction Corridor
CRZ	Contamination Reduction Zone
CST	Central Standard Time
Cu	Copper
Decon	Decontamination
DI water	Distilled/Deionized Water
DNA	Deoxyribonucleic acid
DO	Dissolved oxygen
DOC	Dissolve Organic Carbon
DOI	Department of the Interior
DOT	Department of Transportation
DRO	Diesel-range organics
DWH	Deepwater Horizon

EDT	Eastern Daylight Time
EST	Eastern Standard Time
EZ	Exclusion zone or Hot zone
Fe	Iron
FWS	U.S. Fish and Wildlife Service
GOM	Gulf of Mexico
GPS	Global Positioning System
GRO	Gasoline-range organics
HASP	Health and Safety Plan
HazWOper	Hazardous Waste Operations and Emergency Response
HCl:	Hydrochloric acid
$HF/HClO_4$	Hydrofluoric acid/perchloric acid
Hg	Mercury
HI	Heat Index
HNO_3	Nitric acid
H_2SO_4	Sulfuric acid
IBW	Inorganic-grade blank water
IC	Incident Command
ID	Identifier
JHA	Job Hazards Analysis
LEL	Lower Explosive Limit
Li	Lithium
MeOH	Methanol
mil	$1/1000^{th}$ of an inch in thickness
Mn	Manganese
Mo	Molybdenum
MOCC	Motorboat Operator Certification Course
MS/MSD	Matrix-spike samples
MSDS	Material Safety Data Sheet
N	Nitrogen
N	Normal (normality of a chemical reagent)

NFM	*National Field Manual for the Collection of Water-Quality Data* (U.S. Geological Survey Techniques of Water-Resourses Investigations, book 9, section A)
NFSS	National Field Supply Services of the USGS National Water-Quality Laboratory
NH_4	Ammonium
Ni	Nickel
NIST	National Institute of Standards and Technology
nm	Nanometer
NMR	Nuclear magnetic resonance
NOAA	National Oceanic and Atmospheric Administration
NWQL	National Water Quality Laboratory (USGS)
O&G	Oil and Grease
ORP	Oxidation-reduction potential
OSHA	Occupational Safety and Health Administration
OWQ	Office of Water Quality (USGS)
P	Phosphorus
PAHs	Polycyclic Aromatic Hydrocarbons
Pb	Lead
PEL	Permissible Exposure Limit
PFD	Personal Floatation Device
PID	photoionization detector
PPE	Personal Protective Equipment
ppm:	parts per million
ppmv	parts per million by volume
PVC	Polyvinyl Chloride
QA	Quality assurance
QC	Quality control
QW	Quality of water
RA	Raw, acid-rinsed (sample container)
ROX	Reliable Oxygen Sensor (YSI Company)
S	Sulfur
Sb	Antimony
SC	Specific Electrical Conductance
Se	Selenium
SI	International System of Units (Système international d'unités)
SMIS	Safety Management Information System

Sn	Tin
Sr	Strontium
SVOC	Semivolatile organic compounds
SZ	Support Zone (sometimes referred to as a safety zone)
TAL	TestAmerica Laboratory
TC	Total carbon
TCL	Total carbon loss
Ti	Titanium
TIC	Total inorganic carbon
TKN	Total Kjeldahl Nitrogen
Tl	Thallium
TN	Total nitrogen
TOC	Total organic carbon
TP	Total Phosphorus
TPH	Total Petroleum Hydrocarbons
TS	Total sulfur
U	Uranium
UEL	Upper Explosive Limit
UC	Unified Command
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
V	Vanadium
VOC	Volatile Organic Compounds
VOA	Volatile organic analysis (vials for VOCs)
VOO	Vessels of Opportunity
VPBW	VOC- and Pesticide-grade Blank Water (laboratory certified)
WSC	Water Science Center of the U.S. Geological Survey
Zn	Zinc

Appendix A. Collection of Baseline Samples in Response to the Deepwater Horizon Oil Spill and Location of Pre- and Post-Landfall Sampling Sites

Appendix A–1. Plan for Collection of Baseline Water and Sediment Samples: Response to the Deepwater Horizon Oil Rig Explosion, Gulf of Mexico, April 2010, by the Texas, Louisiana, Mississippi, Alabama, and Florida Water Science Centers of the U.S. Geological Survey

Contents

Background

In response to the April 20, 2010, oil and natural gas explosion at the British Petroleum (BP) Deepwater Horizon oil rig and the subsequent oil spillage into the northern Gulf of Mexico, U.S. Geological Survey (USGS) Water Science Centers in Texas, Louisiana, Mississippi, Alabama, and Florida began coordinating efforts to collect samples from State and Department of the Interior lands that could experience severe environmental damage as a result of oil from this spill coming ashore. This document describes the USGS plan and protocol for collecting sediment and water samples from coastal beaches, wetlands, and barrier islands for the purpose of characterizing baseline chemical conditions and assessing other environmental indicators. A sediment sample at each site will be collected for anlaysis of benthic invertebrates. Sample collection will be coordinated through USGS Regional Executive Area Offices (South Central Area, Southeast Area), and the USGS Office of Water Quality.

Objective and General Approach

The overall objective is to collect sediment and water samples before oil from the Deepwater Horizon spill arrives on shore (pre-landfall samples) and to analyze the samples to provide a baseline characterization of current chemical and specific biological conditions in those priority areas of the northern Gulf of Mexico that are at highest risk for oil contamination. Historic oil that is present will be identified by analyzing oil “fingerprints” and by examining results of analyses for polycyclic aromatic hydrocarbons (PAHs), oil and grease, trace metals, volatile organic compounds, surfactants, dissolved organic carbon, and benthic invertebrates (table A–1). In addition, bacterial populations capable of digesting oils and nutrients will be identified.

Sediment and water will be collected from typical Gulf of Mexico environments, ranging from coastal wetlands to barrier islands and coastal sand beaches. All the samples will be collected at or near the land/water interface, as described below. Suitable sampling sites include wetlands, barrier islands, and shoreline beaches that can be sampled before oil from the Deepwater Horizon spill reaches them (that is, pre-landfall of the oil). No samples are to be collected from revetment sites or areas where treated pilings are present.

The methods to be used for collecting field data will follow the protocols described in the USGS *National Field Manual for the Collection of Water-Quality Data* (U.S. Geological Survey, variously dated; *http://water.usgs.gov/owq/FieldManual/*), which includes standard procedures to prevent sample contamination (chapter 4, p. 13–24) and procedures for use, cleaning, and storage and maintenance of the equipment and supplies used to carry out this field work (chapter 3). These methods are mandated to prevent or identify potential sources of sample contamination. A minimum of 2 weeks of training and experience in the use of these standard USGS protocols and procedures is required for all personnel participating in this data-collection effort.

Data Collection

The data to be collected include field observations; measurements of in situ water properties; and water, sediment, and invertebrate samples. Sample handling and shipping procedures will be in strict compliance with chain-of-custody requirements.

- **Sample analysis and laboratories**. The sample analyses and the laboratories at which the analyses will be performed are listed in table A–1. Brief descriptions of the laboratory and research methods used for sample analysis are compiled in Appendix C of this report.
- **Safety.** All field and laboratory personnel should follow safety guidelines provided by their Water Science Center that relate specifically to this sampling effort, in addition to the standard protocols described in chapter 9 of the *National Field Manual* (U.S. Geological Survey, variously dated; *http://water.usgs.gov/owq/FieldManual/Chap9/content.html*). Field personnel should be aware that, by wearing the appropriate gloves for the sample collection, they will be protecting themselves from possible exposure to flesh-eating bacteria whose presence has been documented in the coastal areas of the Gulf of Mexico. Furthermore, personnel are advised to use antibacterial soap if their skin is compromised by cuts or scratches during the collection of samples.

Documentation

Site location, onsite observations, measurements of field properties, and the procedures used in the collection and preservation of water, sediment, and benthic invertebrate samples will be documented on field forms and in field notes. Data must be entered into the USGS National Water Information System (NWIS) and other databases that might be prescribed—data entry is to be timely, accurate, and quality assured. The procedures listed below are required, in addition to those described in chapter 4 of the *National Field Manual* at *http://water.usgs.gov/owq/FieldManual/chapter4/pdf/Chap4_v2.pdf*, p. 25–29 (see U.S. Geological Survey, variously dated:

- The field team will use a Wide Area Augmentation System (WAAS) enabled GPS unit to record the location of each sampling site.
- Field notes are to include comments regarding weather, wind speed, wave height, apparent health of vegetation, any organisms present and their conditions, the presence of possible contamination, water color, observed sediment grain size (sand, silt, clay, etc.), and the amount of organic detritus present at the site.
- Photographs will be taken at all sites as follows: the first photograph will be taken facing north 0º, then east 90º, then south 180º, and then west 270º.

Quality Assurance and Quality Control

Onsite and equipment preparations, sample collection and preservation, and physical measurements of water quality will be conducted according to protocols described in the USGS *National Field Manual*. Samples of sediment and samples of water will be collected in triplicate and one field blank (water) will be collected at 10 percent of the sites for each of the USGS Water Science Centers on the Gulf of Mexico. The field blank is essentially a bottle blank, because no sampling equipment other than the sample bottle will be used for collecting water samples.

In Situ Water-Quality Measurements

Dissolved oxygen concentrations, pH, specific electrical conductance/salinity, and water temperature will be measured in situ at each site using a calibrated multiparameter data sonde; methods described in chapter 6 of the *National Field Manual* at *http://water.usgs.gov/owq/FieldManual/Chapter6/Ch6_contents.html* (U.S. Geological Survey, variously dated) will be implemented. All calibration data (including adjustments and calibration checks) for the multiparameter instruments used to determine field measurements must be recorded in field notes and in meter logbooks. Final in situ measurements will be recorded on official field and analytical services request forms.

Water Samples

Water samples will be analyzed for selected inorganic and organic compounds, including di(ethylhexyl) sodium sulfosuccinate (DOSS) (a primary component of the Corexit surfactant used to disperse oil released by the Deepwater Horizon explosion). All water samples will be collected near the land/water interface using the "direct dip" sampling method. Sample bottles will be dipped at the water's surface so as to give an accurate representation of any oil present at the site and in water deep enough to avoid resuspension of bottom material during sample collection. Each sample for a designated analysis will be collected and preserved in bottles of the type described in chapter 5 of the *National Field Manual* at *http://water.usgs.gov/owq/FieldManual/chapter5/html/Ch5_contents.html* (U.S. Geological Survey, variously dated) or by the laboratory performing the analysis. Bottles used for the collection of samples for analysis of oil and grease should not be field rinsed before obtaining the sample to prevent overrepresentation of oil in the sample. All water samples will be accurately labeled, appropriately preserved with the prescribed chemical treatments, placed in an ice cooler, and chilled to maintain a temperature at or below 4ºC (without freezing) until the samples have been received at the designated laboratory. The 125-mL sample for dissolved organic carbon (DOC) analysis will be collected as a wholewater sample and kept chilled at 4ºC until it is filtered at the designated laboratory.

Sediment Samples

Sediment samples must be packaged and shipped separately from water samples (see "Shipping and Chain of Custody").

Bulk Sediment Samples

Sediment samples to be analyzed for microorganisms, toxicity, oil fingerprints, oil and grease, and selected inorganic and organic chemical components (table A–1) will be collected from a bulk sample. The bulk sample will be collected at the land/water interface (also called the swash zone) from the surface of the bed to a depth of 4 to 6 inches (in) using either a precleaned Teflon scoop or a grab sampler. A sufficient volume of sediment will be homogenized in a clean, white or uncolored plastic dish pan. The Teflon scoop will be used to mix the bulk sediment sample to form a well-mixed composite, which then will be split into the appropriate, labeled, sample containers.

- Subsamples for bacterial analyses (one sample from the swash zone and one from dry beach sand, if available) will be placed either in a 400-milliliter (mL) Whirl-Pak® bag or an appropriately sized resealable storage bag.
- Subsamples for major- and trace-element and nutrient analyses will be placed in doubled ziplock bags.
- Subsamples for toxicity, oil-and-grease, and oil-fingerprint analyses will be collected in fired glass containers, as stipulated on table A–1.

All samples will be stored in an ice chest and kept at 4ºC until shipped to the appropriate laboratory for analysis.

Benthic Invertebrate Samples

At each site, a single sediment core will be collected in the swash zone for taxonomic analysis of benthic invertebrates. To collect the sample, a coring tube (3-in or 7.6-centimeter (cm) diameter PVC pipe or plastic tube) is inserted vertically into the swash-zone substrate to a depth of 5 cm (2 in). Once the 5-cm depth is reached, the core sample is kept contained by carefully sliding a spatula (without slots) under the bottom of the coring tube. Care must be taken not to disturb the sediment inside the coring tube. Any sediment on the outside of the core tube must be carefully removed before extruding the sample into a resealable bag. Before sealing the sample bag, (a) the inside of the coring tube and spatula surface is inspected for any remaining organisms and the organisms are to be removed with a forceps and placed into the bag, and (b) as much air as possible should be expelled from the bag. The sample bags need to be chilled on ice until they can be placed in a sample freezer upon return to the office. Each sample bag must be labeled with the sampling date, name of the collector, and sampling location.

USGS Water Science Center personnel are to make the coring tool either from a 3-in.-diameter PVC pipe or plastic sample bottle, as follows. (A similar application of this device is described in Moulton and others, 2002.)

- **PVC pipe as coring tube:** Cut a PVC pipe to an appropriate length for ease of handling (for example, 4 or 6 in.). To facilitate insertion of the PVC pipe into the substrate, bevel the outer edge of the pipe. Carefully measure and mark the 2-in (5-cm) sampling depth on the inside of the pipe using a waterproof black marker.
- **Sample bottle as coring tube:** Cut the bottom off of a 3-in.-diameter plastic sample bottle. The bottle should have a relatively flat bottom and must be cut evenly so as to retain a 5-cm-high side of the bottle. Drill a small hole in the center of the bottom; this will allow air to escape when the device is inserted into the sediment. When using this device, vertically insert the device into the sand (with the bottom side up) until the bottom is flush with the substrate. Carefully slide a spatula under the device to hold the sample in this core device until the sample can be extruded into a sealable plastic bag.

Shipping and Chain of Custody

Analytical services request (ASR) forms and chain of custody (CoC) forms appropriate for the laboratory to which samples are shipped must be filled out completely and signed per requirements. Each Water Science Center must use its user code to track data and charges; for example, Louisiana must designate user code LA and Texas must designate user code TX.

All samples will be shipped using CoC requirements and the appropriate CoC forms, CoC tape, and CoC shipping labels. The cooler lid must be taped completely and the tape signed before being shipped. The CoC form used by the USGS National Water Quality Laboratory (NWQL) can be downloaded at *http://wwwnwql.cr.usgs.gov/htmls/cocform.pdf* and CoC tape can be purchased by USGS employees through the USGS One Stop Store using item number Q150FLD.

Sediment samples are to be shipped according to U.S. Department of Agriculture (USDA) guidelines for shipping regulated soils. Sediment samples **must not** be shipped in coolers with other media (such as water or tissue). The required USDA permit is to be included with all sediment samples being shipped to a laboratory.

Table A–1. Sample analyses and laboratories for baseline data collection.

[USGS, U.S. Geological Survey; PAHs, polycyclic aromatic hydrocarbons; VOCs, volatile organic compounds; TPH GRO + BTEX, total petroleum hydrocarbons –gasoline-range organics plus benzene, toluene, ethylbenzen, and zylenes; VOA, volatile organic analysis; NA, not applicable; TN TP TS, total nitrogen, total phosphorus, total sulfur; DOC, dissolved organic carbon; TOC, total organic carbon; L, liter; mL, milliliter; oz, ounce]

Laboratory	Analysis	Matrix	Collection method	Laboratory schedule/ Code	Analytical method
USGS National Water Quality Laboratory (NWQL), Denver, Colo.	Semi volatiles - PAHs	Sediment	1-L glass organic bottle (wide-mouthed), 100 grams	5506, 5507	GCMS - GS O-5506-06
NWQL	Semi volatiles - PAHs	Whole water	1-L narrow amber glass organic bottle	1383	GCMS - GS O-3116-87
NWQL	Trace metals	Whole water	One 125-mL acid-rinsed bottle	2317	ICP/MS – GS I-4471-97
NWQL	VOCs	Whole water	VOC septum vials	2021	GCMS - GS O-5506-06
NWQL	Nutrients	Whole water	125-mL plastic bottle; H2SO4 (or just chill and lab will acidify)	LC2188, LC1986, LC1984	EPA 350.1/GS Method ID: I-4515-91; I-4610-91
Test America Labs, Arvada, Colo.	TPH GRO + BTEX	Whole water	Three VOA vials	50114	8015B
Test America Labs, Arvada, Colo.	Oil and grease	Whole water	Two 1-L narrow amber glass bottles	50136	1664A

Table A–1. Sample analyses and laboratories for baseline data collection.—Continued

[USGS, U.S. Geological Survey; PAHs, polycyclic aromatic hydrocarbons; VOCs, volatile organic compounds; TPH GRO + BTEX, total petroleum hydrocarbons –gasoline-range organics plus benzene, toluene, ethylbenzen, and zylenes; VOA, volatile organic analysis; NA, not applicable; TN TP TS, total nitrogen, total phosphorus, total sulfur; DOC, dissolved organic carbon; TOC, total organic carbon; L, liter; mL, milliliter; oz, ounce]

Laboratory	Analysis	Matrix	Collection method	Laboratory schedule/ Code	Analytical method
Test America Labs, Arvada, Colo.	Oil and grease	Sediment	One 500-mL amber bed glass organic bottle (wide-mouthed) (8 oz required, but bottle size not available)	50137	9071B
Dr. Arthur Horowitz, Norcross, Ga.	Trace metals, TN, TP, TS	Sediment	Colorless ziploc bags – double bagged, chilled, and kept from light – 500 grams	NA	(see Appendix C)
Columbia Environ. Research Center, Columbia, Mo. (CERC)	Toxicity	Sediment	1-L glass bed organic (wide-mouthed)	NA	(see Appendix C)
Dr. Robert Rosenbauer, Menlo Park, Calif.	Oil finger-printing	Sediment	Two 500-mL amber bed glass organic bottle (wide-mouthed)	NA	(see Appendix C)
Dr. Amanda Demopoulus, Gainesville, Fla.	Benthic invertebrates	Sediment	3-inch core 5-cm thick: ziploc bag - chill/freeze	NA	(see Appendix C)
Dr. John Lisle, St. Petersburg, Fla.	Bacteria	Land/water interface (swash)	18-oz WhirlPak or a Ziploc bag - chilled	NA	(see Appendix C)
		Dry beach sand	18-oz WhirlPak or a Ziploc bag - chilled		
Dr. George Aiken, Boulder, Colo.	DOC - (TOC collected)	Whole water (lab filtered)	One 125-mL glass DOC bottle	NA	(see Appendix C)
Dr. Robert Eganhouse, Reston, Va.	Isomeric finger-printing	Whole water	1-L glass bottle	NA	(see Appendix C)
		Sediment	8-oz wide-mouth jar		
Dr. Jeff McCoy, NWQL	Surfactant	Whole water	1-L glass bottle	NA	(see Appendix C)

Appendix A–2. Pre- and Post-Landfall Sample Analyses

Table A–2. Laboratory analyses and methods, and sample container and treatment requirements.

[LAB, laboratory; SVOC, Semi-volatile compounds; PAH, Polyaromatic compounds; NWQL, National Water Quality Laboratory; GCMS, gas chromatograph-mass spectrometry; g, gram; L, liter; TAL, TestAmerica Laboratory; oz, ounce; O&G, oil and grease; TN, total nitrogen; TP, total phosphorus; TS, total sulfur; TOC, total organic carbon; TIC, total inorganic carbon; <, less than; µm, micrometer; BGC, bottom-material glass container; mL, milliliter; poly, polypropylene plastic container; %, percent; Na, sodium; HCl, hydrochloric acid; VOC, volatile organic compounds; BTEX, benzene toluene ethylbenzene and xylenes; VOA, volatile organic analyses; LC, laboratory code (NWQL); FA, filter-acidify; TPH-GRO, total petroleum hydrocarbons – gasoline range; TPH-DRO, total petroleum hydrocarbons – diesel range; TKN, total kjeldahl nitrogen; NH_4, ammonium; H_2SO_4, sulfuric acid]

Sampling Phase	Analysis	Labora-tory	Method / lab code or schedule	Container	Treatment
Sediment					
Pre-landfall	SVOC and PAH	NWQL	GCMS-GS O-5506-06; lab codes 5506, 5507	100 g. in one 1-L glass, wide mouth	Chill.
Post-landfall	SVOC	TAL	8270D	One 8-oz glass, wide mouth (sample combined in O&G jar)	Chill.
Post-landfall	PAH	TAL	8270C SIM	One 4 oz. glass, wide mouth	Chill.
Pre-landfall	Oil and Grease	TAL	9071B (LC 50137)	One 500-mL (8 oz) glass, amber, wide mouth	Chill.
Post-landfall	Oil and Grease	TAL	1664A-HEM	One 8 oz. glass, amber, wide mouth	Chill.
Pre-landfall	Elements and TN, TP, TS, TOC, TIC	Horowitz	(Appendix C)	500 g in colorless ziplock bags, doubled.	Chill. Keep away from light.
Post-landfall	Elements and TN, TP, TS, TOC, TIC	Horowitz	(Appendix C)	Two 18 oz. WhirlPak – sediments one 18 oz. WhirlPak – <63 µm	Chill.
Pre-landfall	Toxicity	Carr and Biedenbach	(Appendix C)	One 1- L glass (BGC), widemouth	Chill.
Post-landfall	Toxicity	Carr and Biedenbach	(Appendix C)	Two 1-L glass (BGC), widemouth	Chill.
Pre-landfall	Bacteria	Lisle	(Appendix C)	One 18 oz. WhirlPak/Ziplock Swash sediments	Chill.
Pre-landfall	Bacteria	Lisle	(Appendix C)	One 18 oz. WhirlPak/Ziplock Dry beach sediments	Chill.
Post-landfall	Bacteria	Lisle	(Appendix C)	One 18 oz. WhirlPak – Swash sediments	Freeze.

Table A–2. Laboratory analyses and methods, and sample container and treatment requirements.—Continued

[LAB, laboratory; SVOC, Semi-volatile compounds; PAH, Polyaromatic compounds; NWQL, National Water Quality Laboratory; GCMS, gas chromatograph-mass spectrometry; g, gram; L, liter; TAL, TestAmerica Laboratory; oz, ounce; O&G, oil and grease; TN, total nitrogen; TP, total phosphorus; TS, total sulfur; TOC, total organic carbon; TIC, total inorganic carbon; <, less than; µm, micrometer; BGC, bottom-material glass container; mL, milliliter; poly, polypropylene plastic container; %, percent; Na, sodium; HCl, hydrochloric acid; VOC, volatile organic compounds; BTEX, benzene toluene ethylbenzene and xylenes; VOA, volatile organic analyses; LC, laboratory code (NWQL); FA, filter-acidify; TPH-GRO, total petroleum hydrocarbons – gasoline range; TPH-DRO, total petroleum hydrocarbons – diesel range; TKN, total kjeldahl nitrogen; NH_4, ammonium; H_2SO_4, sulfuric acid]

Sampling Phase	Analysis	Labora-tory	Method / lab code or schedule	Container	Treatment
Sediment—continued					
Pre-landfall	Benthic Invertebrates	Demopoulos	(Appendix C)	3-inch core, 5-cm diameter, in ziplock bags.	Chill/Freeze.
Post-landfall	Benthic Invertebrates	Demopoulos	(Appendix C)	Three 500-mL poly, widemouth Three 500-mL poly, widemouth	10% formalin-Na borate. Chill. Chill-unpreserved.
Pre-landfall	Oil Fingerprint	Rosenbauer	(Appendix C)	Two 500-mL glass, amber, wide mouth (BGC)	Chill/Freeze.
Post-landfall	Oil Fingerprint	Rosenbauer	(Appendix C)	Two 500-mL glass, amber, widemouth, I-Chem BGC	Freeze.
Whole Water					
Pre-landfall	SVOC	NWQL	GCMS-GS O-3116-87; LC 1383	One 1-L glass, fired, amber	Chill.
Post-landfall	SVOC	TAL	8270D	Two 1-L glass, fired, amber	Chill.
Pre-landfall	PAH	NWQL	1383	One 1-L glass, fired	Chill.
Pre-landfall	Oil and grease	TAL	1664A	Two 1- L glass, fired, amber	Chill.
Post-landfall	Oil and grease	TAL	1664A	One 1-L glass, wide mouth	Preserved to pH2 with HCl. Chill.
Pre-landfall	VOC (with BTEX)	NWQL	GCMS – GS O-5506-06; LC 2021	Three 40-mL VOA septum vials	Chill.
Post-landfall	VOC with BTEX	TAL	8260B	Two 40-mL VOA septum vials	Chill.

Table A–2. Laboratory analyses and methods, and sample container and treatment requirements.—Continued

[LAB, laboratory; SVOC, Semi-volatile compounds; PAH, Polyaromatic compounds; NWQL, National Water Quality Laboratory; GCMS, gas chromatograph-mass spectrometry; g, gram; L, liter; TAL, TestAmerica Laboratory; oz, ounce; O&G, oil and grease; TN, total nitrogen; TP, total phosphorus; TS, total sulfur; TOC, total organic carbon; TIC, total inorganic carbon; <, less than; µm, micrometer; BGC, bottom-material glass container; mL, milliliter; poly, polypropylene plastic container; %, percent; Na, sodium; HCl, hydrochloric acid; VOC, volatile organic compounds; BTEX, benzene toluene ethylbenzene and xylenes; VOA, volatile organic analyses; LC, laboratory code (NWQL); FA, filter-acidify; TPH-GRO, total petroleum hydrocarbons – gasoline range; TPH-DRO, total petroleum hydrocarbons – diesel range; TKN, total kjeldahl nitrogen; NH_4, ammonium; H_2SO_4, sulfuric acid]

Sampling Phase	Analysis	Labora-tory	Method / lab code or schedule	Container	Treatment
Whole Water—continued					
Pre-landfall	TPH-GRO with BTEX	TAL	8015B	Three 40-mL VOA septum vials	Chill.
Post-landfall	TPH-GRO	TAL	8015B	Two 40-mL VOA septum vials	Chill.
Post-landfall	TPH-DRO	TAL	8015B	One 1-L glass, fired, amber	Chill.
Pre-landfall	Trace metals	NWQL	ICP/MS – GS I-4471-97; LC 2317	One 125-mL poly, acid-rinsed (FA)	
Post-landfall	Trace metals	TAL	6020	One 250-mL poly, acidified	Chill.
Pre-landfall	Nutrients	NWQL	EPA 350.1/GS Method ID; I-4515-91; I-4610-91; LC 2188, 1986, 1984	One 125-mL poly	Add H_2SO_4 or request lab to acidify. Chill.
Post-landfall	Nutrients (TKN, NH_4, TP)	TAL	351.2; 365.4	One 250-mL poly, preserved	Preserved to pH 2 with H_2SO_4.
Pre-landfall	Dissolved organic carbon	Aiken	(Appendix C)	One 125-mL glass, fired, TOC	Filter at laboratory. Chill.
Post-landfall	Dissolved organic carbon	Aiken	(Appendix C)	One 125-mL glass, fired, DOC	Filter in field. Chill.
Pre-landfall	Surfactant	McCoy, NWQL	(Appendix C)	One 1-L glass, fired	Chill/Freeze.
Post-landfall	Surfactant	Furlong, NWQL	(Appendix C)	Two 1-L Teflon	Freeze. Keep from light.

Appendix A–3. USGS Gulf of Mexico Pre-Landfall and Post-Landfall Sampling Sites, 2010 Oil Spill.

Map No.[1]	Station ID	Site Name ("DWH GOM Oil Spill" + name)	Lat-dd	Long-dd	Sample Date: Post-Landfall	Sample Date: Pre-Landfall
		FLORIDA				
FL-1	302144086581200	Gulf IS NS nr Navarre, FL	30.362389	-86.970167	10/4/2010	5/11/10
FL-2	302258086263400	Henderson Bch SP nr Destin, FL	30.382944	-86.442778	10/5/2010	5/11/10
FL-3	301926086091800	Grayton Bch SP nr Seaside, FL	30.324056	-86.155056	10/5/2010	5/12/10
FL-4	300729085440900	St. Andrews SP nr Panama City,FL	30.124722	-85.736028	10/11/2010	5/12/10
FL-5	294645085243000	St. Joe P SP nr Port St. Joe, FL	29.779167	-85.408528	10/13/2010	5/13/10
FL-6	294152084460300	St George IS SP nr E Point, FL	29.697861	-84.767750	10/6/2010	5/13/10
FL-7	300427084105000	St. Marks NWR nr St. Marks, FL	30.074194	-84.180444	10/7/2010	5/18/10
FL-8	290740083031200	Piney Pt Bch at Cedar Key, FL	29.127750	-83.053361	*not sampled*	5/18/10
FL-9	285425082412600	Fort IS Gulf Bch nr Chassah., FL	28.907194	-82.690778	*not sampled*	5/19/10
FL-10	273728082441800	Fort DeSoto Pk nr St Pete, FL	27.624444	-82.738333	*not sampled*	5/17/10
FL-11	263132082114000	Captiva IS Bch nr Captiva, FL	26.525639	-82.194222	*not sampled*	5/20/10
FL-12	255609081440700	Tiger Tail Bch at Marco IS, FL	25.936139	-81.734583	*not sampled*	5/21/10
FL-13	251329081101100	NW Cape Sable Bch nr Flamingo,FL	25.224806	-81.169972	*not sampled*	5/22/10
FL-14	243737082522500	Dry Tortugas National Park, FL	24.627139	-82.873639	*not sampled*	5/20/10
FL-15	254002080092000	B Baggs Cape nr Key Biscayne, FL	25.667417	-80.155528	*not sampled*	6/1/10
FL-16	260454080063400	Lloyd Bch at Ft Lauderdale, FL	26.081694	-80.109444	*not sampled*	5/26/10
FL-17	264921080021700	MacArthur Bch at W Palm Bch, FL	26.822583	-80.038056	*not sampled*	5/27/10
FL-18	244345081000600	Coco Plum Bch nr Marathon, FL	24.729250	-81.169972	*not sampled*	5/24/10
FL-19	265722080045400	BLM Tract1 nr Jupiter Inlet, FL	26.956111	-80.081667	*not sampled*	6/16/10
FL-20	265722080045500	BLM Tract2 nr Jupiter Inlet, FL	26.956111	-80.081944	*not sampled*	6/16/10
FL-21	243902081332700	BLM Tract1 nr Park Key, FL	24.650556	-81.557500	*not sampled*	6/9/10
FL-22	243703081323700	BLM Tract2 nr Sugarloaf Key, FL	24.617500	-81.543611	*not sampled*	6/9/10
FL-23	243700081322300	BLM Tract3 nr Sugarloaf Key, FL	24.616667	-81.539722	*not sampled*	6/9/10
FL-24	273605082454900	BLM Tract at Egmont Key, FL	27.601389	-82.763611	*not sampled*	6/14/10

Appendix A–3. USGS Gulf of Mexico Pre-Landfall and Post-Landfall Sampling Sites, 2010 Oil Spill.—Continued

Map No.[1]	Station ID	Site Name ("DWH GOM Oil Spill" + name)	Lat-dd	Long-dd	Sample Date: Post-Landfall	Sample Date: Pre-Landfall
		FLORIDA—continued				
FL-25	300223085260800	BLM Lathrop Bayou nr Panama City, FL	30.038944	-85.435472	10/12/2010	6/10/10
FL-26	244325081351500	Marvin Key at Great White Heron NWR, FL	24.709806	-81.644639	*not sampled*	7/7/10
		ALABAMA				
AL-1	301338088193500	West Dauphin Island, AL	30.227425	-88.326394	10/13/2010	5/8/10
AL-2	301455088110300	Dauphin Is., AL	30.2488145	-88.184168	10/7/2010	5/9/10
AL-3	301448088044000	Dauphin Is., AL	30.2468703	-88.077777	10/6/2010	5/9/10
AL-4	301329088003000	Fort Morgan, AL	30.2249263	-88.00833	10/12/2010	5/8/10
AL-5	301349087541600	Fort Morgan, AL	30.2304815	-87.904438	10/13/2010	5/8/10
AL-6	301428087434900	Gulf Shores AL	30.241314	-87.730265	10/14/2010	5/8/10
AL-7	301608087345400	Orange Beach AL	30.269091	-87.581649	10/14/2010	5/8/10
AL-8	301353087561600	BLM-1, AL	30.2315927	-87.937772	10/13/2010	5/24/10
AL-9	301343087520200	BLM-2, AL	30.2288147	-87.867214	10/14/2010	5/24/10
AL-10	301341087495200	Fort Morgan BLM-3, AL	30.228259	-87.831102	10/14/2010	5/24/10
		LOUISIANA				
LA-22	294432090083100	Jean Lafitte National Park, LA	29.7422222	-90.141944	10/13/2010	5/14/10
LA-23	294406091511300	Cypremort Point, LA	29.735	-91.853611	10/5/2010	5/13/10
LA-24	292046090254500	Lake Felicity, LA	29.3461111	-90.429167	10/12/2010	5/18/10
LA-25	293808092460200	Rockefeller Refuge Beach, LA	29.6355556	-92.767222	10/7/2010	5/13/10
LA-26	291507090551800	Sister Lake, LA	29.2519444	-90.921667	10/8/2010	5/17/10
LA-28	293424091321600	Point Chevreuil, LA	29.5733333	-91.537778	10/5/2010	5/13/10
LA-29	294324089432500	Crooked Bayou, LA	29.7233333	-89.723611	10/13/2010	5/18/10
LA-30	294108089234500	Mississippi R. Gulf Outlet, LA	29.6855556	-89.395833	10/13/2010	5/7/10
LA-31	291537089570100	Grand Isle Bch at State Park, LA	29.2602778	-89.950278	10/14/2010	5/10/10
LA-32	291914089105500	Mississippi R. at Main Pass, LA	29.3205556	-89.181944	10/7/2010	5/7/10
LA-33	293518089364300	Breton Sound, LA	29.5883333	-89.611944	10/13/2010	5/7/10

Appendix A–3. USGS Gulf of Mexico Pre-Landfall and Post-Landfall Sampling Sites, 2010 Oil Spill.—Continued

Map No.[1]	Station ID	Site Name ("DWH GOM Oil Spill" + name)	Lat-dd	Long-dd	Sample Date: Post-Landfall	Sample Date: Pre-Landfall
		LOUISIANA—continued				
LA-34	300907089144500	Miss. Sound at Grand Pass, LA	30.1519444	-89.245833	10/11/2010	5/7/10
LA-35	285951089085600	Mississippi R. at South Pass, LA	28.9975	-89.148889	10/7/2010	5/7/10
LA-36	285615089235600	Mississippi R. at SW Pass, LA	28.9375	-89.398889	10/14/2010	5/7/10
LA-46	294456093394801	East Sabine, LA	29.7488889	-93.663333	10/6/2010	5/10/10
LA-6 (Bat06)	292708089521400	Bay Jimmy at NE Barataria Bay, LA	29.4522222	-89.870556	8/23/2010	not sampled
		MISSISSIPPI				
MS-37	301309089044700	South Cat Island Beach, MS	30.2191667	-89.079722	10/14/2010	5/7/10
MS-38	301227088582000	West Ship Island Beach, MS	30.2075	-88.972222	10/14/2010	5/7/10
MS-39	301358088533300	East Ship Island Beach, MS	30.2327778	-88.8925	10/11/2010	5/7/10
MS-40	301425088440600	West Horn Island Beach, MS	30.2402778	-88.735	10/12/2010	5/8/10
MS-41	301321088353300	East Horn Island Beach, MS	30.2225	-88.5925	10/12/2010	5/8/10
MS-42	301208088253600	Petit Bois Island Beach, MS	30.2022222	-88.426667	10/13/2010	5/8/10
MS-43	301858089141000	Pass Christian Beach, MS	30.3161111	-89.236111	10/8/2010	5/8/10
MS-44	302336088535800	BIloxi Beach, MS	30.3933333	-88.899444	10/7/2010	5/8/10
MS-45	302034088325200	Pascagoula Beach, MS	30.3427778	-88.547778	10/14/2010	5/8/10
		TEXAS				
TX-47	294057093572301	Texas Point, TX	29.6825	-93.956389	10/6/2010	5/10/10
TX-48	295542093521701	Sabine Lake, TX	29.9283333	-93.871389	*not sampled*	5/10/10
TX-49	293324094220601	High Island, TX	29.5566667	-94.368333	10/7/2010	5/10/10
TX-50	293429094332101	East Bay nr Anahuac, TX	29.5747222	-94.555833	*not sampled*	5/10/10
TX-51	291815094461001	Galveston Island, TX	29.3041667	-94.769444	10/13/2010	5/10/10
TX-52	294408094501101	Trinity Bay nr Beach City, TX	29.7355556	-94.836389	*not sampled*	5/11/10
TX-53	292318094430901	Bolivar Peninsula, TX	29.3883333	-94.719167	10/7/2010	5/11/10
TX-54	292937094544001	Galveston Bay nr Eagle Pt, TX	29.4936111	-94.911111	*not sampled*	5/11/10

Appendix A–3. USGS Gulf of Mexico Pre-Landfall and Post-Landfall Sampling Sites, 2010 Oil Spill.—Continued

Map No.[1]	Station ID	Site Name ("DWH GOM Oil Spill" + name)	Lat-dd	Long-dd	Sample Date: Post-Landfall	Sample Date: Pre-Landfall
TEXAS—continued						
TX-55	291251094571401	West Bay, Galveston Is SPk, TX	29.2141667	-94.953889	10/14/2010	5/11/10
TX-56	290512095063101	San Luis Pass, TX	29.0866667	-95.108611	10/5/2010	5/11/10

[1] At *http://www.usgs.gov/oilspill/* scroll down to "Sampling Efforts." This will take you to the interactive Google Earth (KMZ) link for the maps identifying these sampling sites where data for the sites can be accessed.

Appendix A–4. Maps Showing Locations of USGS Sampling Sites

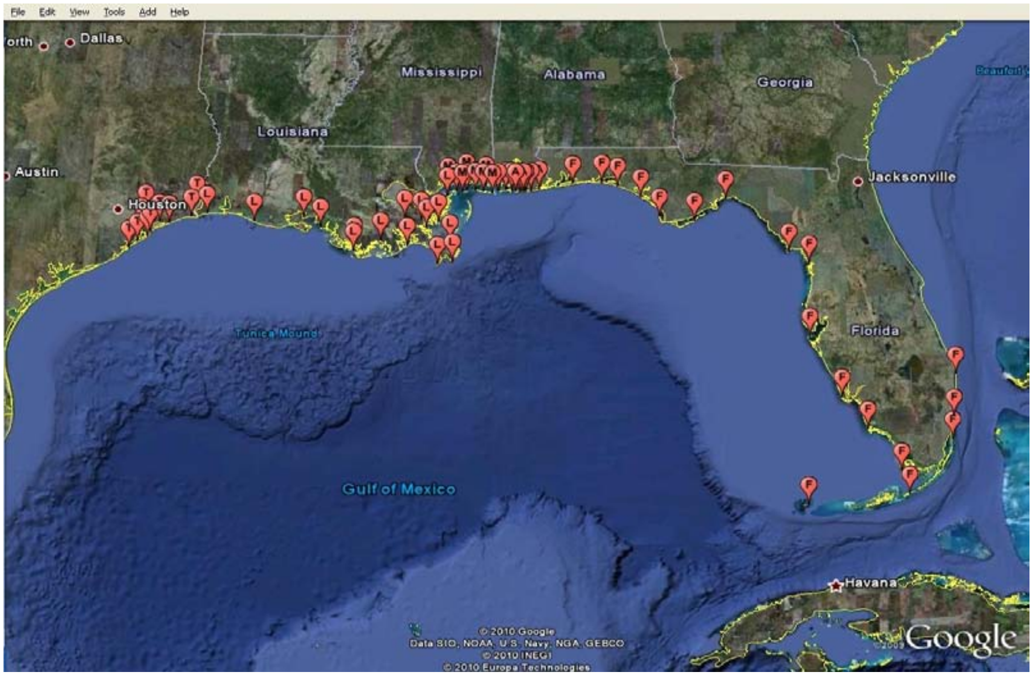

Figure A–4.1. Locations of the 70 USGS baseline (pre-landfall) sampling sites (shown in red).

Figure A–4.2. Locations of the USGS post-landfall sampling sites along the Florida coastline (shown in white).

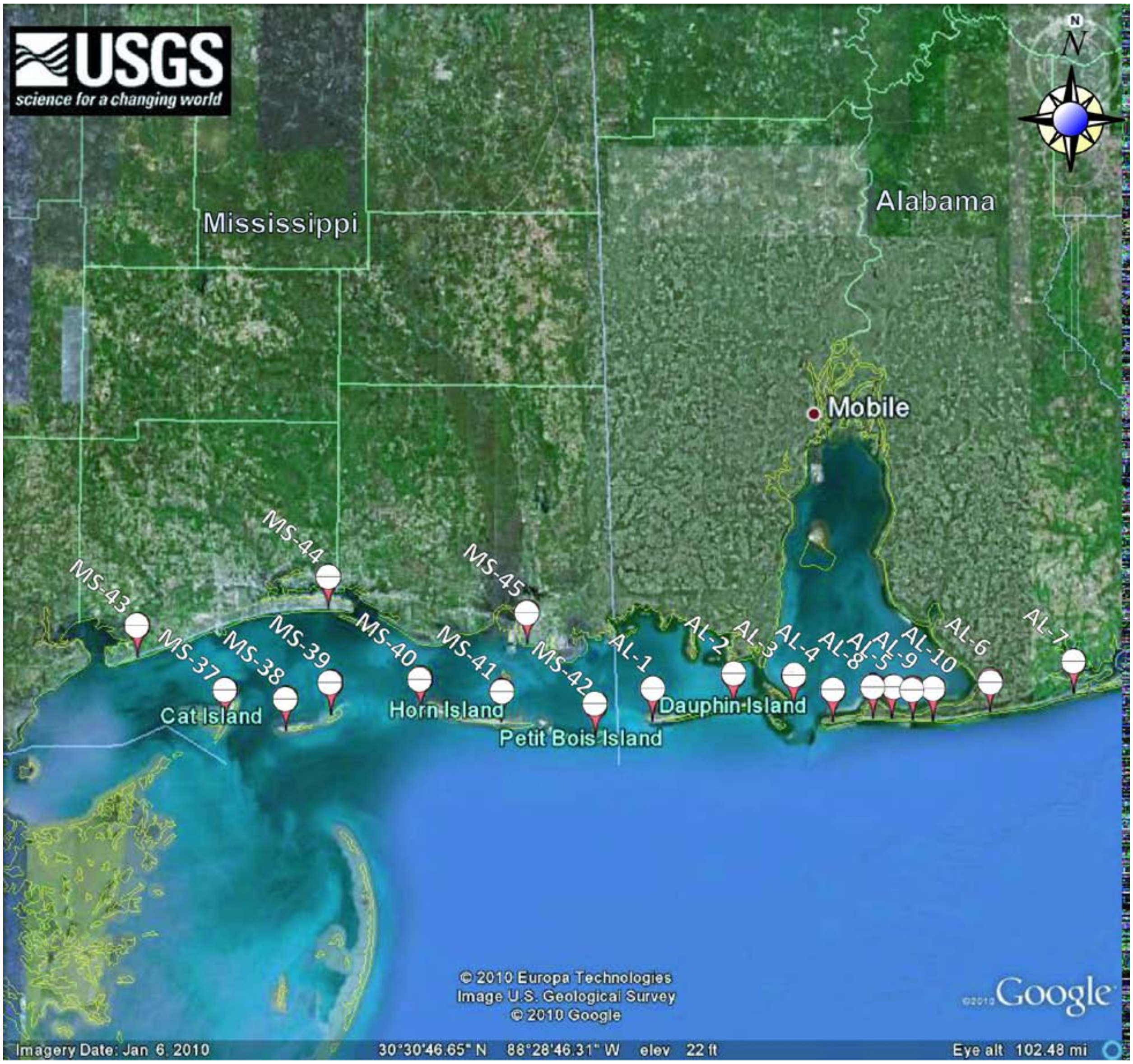

Figure A–4.3. Locations of the USGS post-landfall sampling sites along the Alabama and Mississippi coastlines (shown in white).

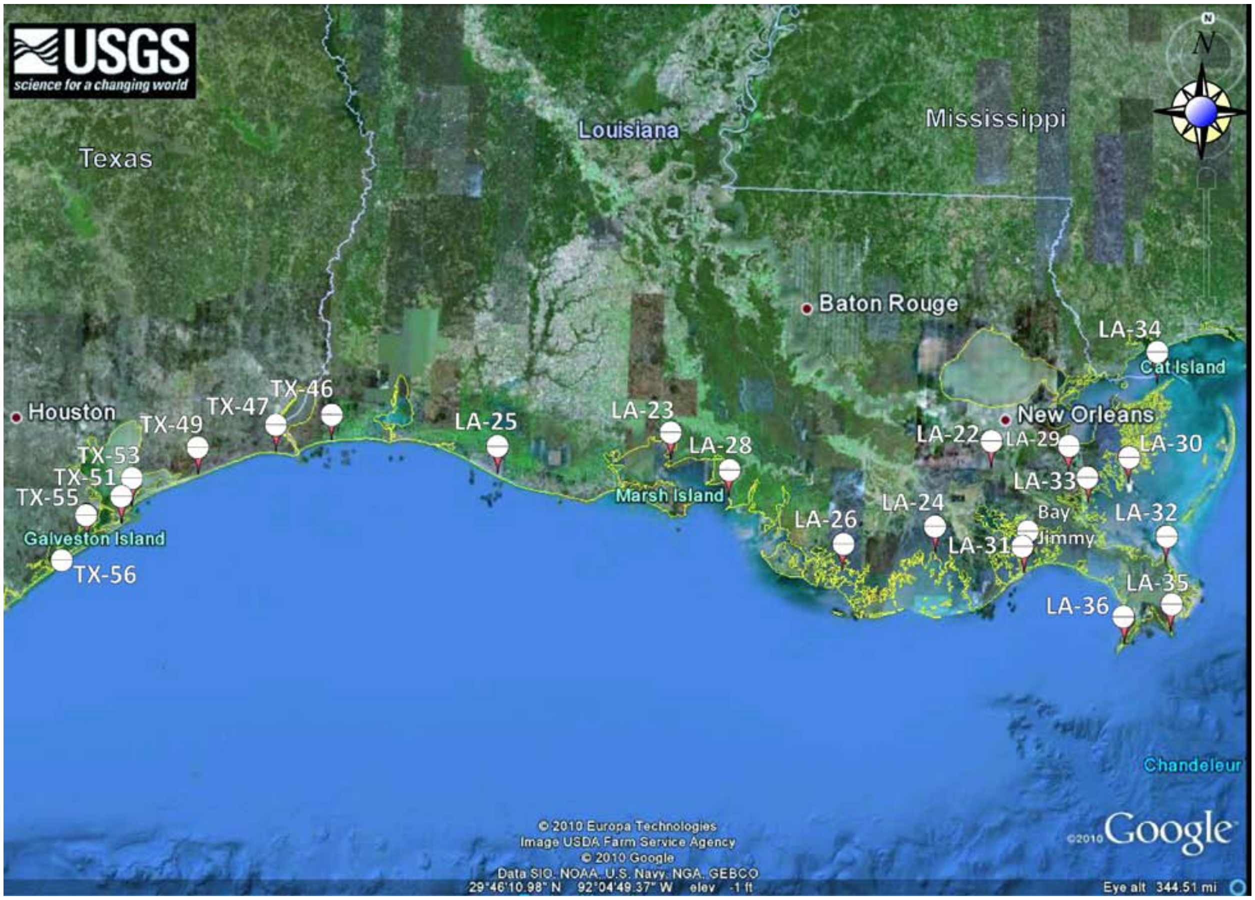

Figure A–4.4. Locations of the USGS post-landfall sampling sites along the Louisiana and Texas coastlines (shown in white).

Appendix B. Field Supplies Recommended for the October 2010 Oil-Spill Sampling.

[GOM, Gulf of Mexico; #, number; e.g., for example; DEET, *N*,*N*-Diethyl-*meta*-toluamide;HCl, hydrochloric acid; ASR/CoC, Analytical Services Request/Chain of Custody; EZ, exclusion zone; CRZ, contaminant reduction zone; poly, polyethylene; DOT, U.S. Department of Transportation; DO, dissolved oxygen; SC, specific electrical conductance; NFM, USGS *National Field Manual for the Collection of Water-Quality Data*; NWQL, USGS National Water Quality Laboratory; TAL, TestAmerica Laboratory; WSC, USGS Water Science Center; OWQ, USGS Office of Water Quality; mil, 1/1000th of an inch in thickness]

General Field Equipment/Supplies	Description	Description/Source/Comment
Personal Protective Equipment (PPE)		
Photoionization Detector (PID) with calibration gases	With or without explosimeter	Rent or purchase
Safety glasses/goggles	Laboratory/field safety	GSA/open market
Elbow/shoulder length rubber-coated gloves	PPE – field safety	http://www.labsafety.com/search/rubber+shoulder/24543486/2056/?GoButton=Go&isredirect=true
Disposable nitrile gloves	Laboratory/field safety	USGS One-Stop Shop (access restricted to USGS)
Tyvek pants and(or) coveralls	PPE – field safety	http://www.labsafety.com/search/tyvek+pants/24532559/
Latex overboots (waterproof)	PPE – field safety	Open market
Duct or Chemron tape	PPE – field safety	Open market
PFD (cleanable) – Type 5-Revere Model 280 Work Vest	Nylon buckle closure, modified as described in Section 3.4	Model #10967776; http://www.portsupply.com/webapp/wcs/stores/servlet/TopCategoriesDisplay?langId=-1&storeId=50005&catalogId=10001
PFD - Type 3	PPE – field safety	USGS standard issue
Waders/ hip boots (rubberized)	PPE – field safety	Open market
Sterile latex surgical gloves	PPE – field safety	Fisher Scientific, catalog # 19-014-641
Insect repellent (noncontaminating)	PPE – field safety	Without DEET
Steel-toes shoes/boots & hard hat	PPE – field safety	As specifically required by the work task.
Cleaning/Decontamination Supplies		
Marble chips or baking soda		Neutralization of acid solutions
Nonphosphate detergent and degreaser	Examples: Liqui-Nox, Dawn, Simple Green	Open market
Spray bottles		Open market
Buckets, three to five	5-gallon, with lids and handles	Open market
Long handled brushes		Open market
Short handled brushes		Open market
Bottle brushes		Open market
Soft paint brush		Open market
Cotton swabs, pipe cleaners		Open market
Plastic sheeting	Cover CRZ	Open market
Kimwipes, WypAll X70 cloths	Water sampling and cleaning	Open market
Roll of police-barrier tape	To delineate EZ, CRZ	Open market

Appendix B. Field Supplies Recommended for the October 2010 Oil-Spill Sampling.—Continued

[GOM, Gulf of Mexico; #, number; e.g., for example; DEET, *N*,*N*-Diethyl-*meta*-toluamide;HCl, hydrochloric acid; ASR/CoC, Analytical Services Request/Chain of Custody; EZ, exclusion zone; CRZ, contaminant reduction zone; poly, polyethylene; DOT, U.S. Department of Transportation; DO, dissolved oxygen; SC, specific electrical conductance; NFM, USGS *National Field Manual for the Collection of Water-Quality Data*; NWQL, USGS National Water Quality Laboratory; TAL, TestAmerica Laboratory; WSC, USGS Water Science Center; OWQ, USGS Office of Water Quality; mil, 1/1000th of an inch in thickness]

General Field Equipment/Supplies	Description	Description/Source/Comment
Cleaning/Decontamination Supplies—continued		
Pressure sprayers		Open market
DOT-certified metal/plastic containers	Liquid waste	Open market
Spray/squeeze bottles/dispensers	Poly and Teflon to contain deionized and blank water	Open market
Trash bags and containers	Solid waste; cover cleaned equipment	Open market
Methanol, laboratory-grade	Pesticide grade	Open market
HCl, 5-percent solution	High-purity grade	Open market
Tap water	Potable quality	Open market
Heating plate, stir bars	Portable	Open market
Sample-Collection, Processing, Preservations		
Multiparameter instrument and sensors: Turbidity, DO, pH, Temperature, SC	See NFM Chapter 6	Open market; DO luminescent technology sensor
Calibrants for sonde sensors		Open market
YSI C-spray coating	Sonde protection	YSI, https://www.ysi.com/accessoriesdetail.php?Anti-fouling-C-Spray-Protective-Probe-Solution-129
Plastic bags, ziplock bags	Ice, sample containers	Open market
Rubber bands	Heavy duty	Open market
Aluminum foil	Cover Teflon sample bottles	Open market
Field Form	Customized for project	OWQ_Deep_Oil website (my.usgs.gov–access restricted)
GPS		
Field Logbook and indelible pen	Bound, paginated, “rite in the rain,” Poly cover	http://www.riteintherain.com/ItemForm.aspx?item=550&Category=6fd10376-a439-4797-95f0-349a58e602ea
ASR/CoC Forms	Customized for project	OWQ_Deep_Oil wiki (my.usgs.gov – restricted access)
Replacement brushes and wipers	For multiparameter sonde	Open market
Tape measure (0.01-ft graduations)		Open market
Metal or wooden stakes	PVC tube sampling method	Open market
Digital camera	Site & sample photos	Open market
Sledge hammer, spade/shovel	Site preparation	Open market

Appendix B. Field Supplies Recommended for the October 2010 Oil-Spill Sampling.—Continued

[GOM, Gulf of Mexico; #, number; e.g., for example; DEET, *N*,*N*-Diethyl-*meta*-toluamide;HCl, hydrochloric acid; ASR/CoC, Analytical Services Request/Chain of Custody; EZ, exclusion zone; CRZ, contaminant reduction zone; poly, polyethylene; DOT, U.S. Department of Transportation; DO, dissolved oxygen; SC, specific electrical conductance; NFM, USGS *National Field Manual for the Collection of Water-Quality Data*; NWQL, USGS National Water Quality Laboratory; TAL, TestAmerica Laboratory; WSC, USGS Water Science Center; OWQ, USGS Office of Water Quality; mil, 1/1000th of an inch in thickness]

General Field Equipment/Supplies	Description	Description/Source/Comment
Sample-Collection, Processing, Preservations—continued		
Bucket, 2.5-gallon, for sediment	Process sediment sample	Open market
Teflon bucket liners	Sediment collection bucket	OWQ to provide directly from manufacturer; one use per site (disposable)
Teflon bags (small)		Open market; one use per site (disposable)
Polycarbonate core tubes	Invertebrate samples	OWQ to provide directly from manufacturer
Teflon sampling scoop	Make from Teflon bottles; collect, homogenize sediments	NWQL--Constructed by WSC from Teflon bottle; clean between sites or one use per site (disposable)
Teflon coring tubes and plates	Collect and contain sediments	OWQ to provide directly from manufacturer; one use per site (disposable) or clean between sites if reused.
Peristaltic pump & pump carrier		Open market
C-flex tubing, cleaned	Cut to ~ 8-ft lengths or greater, as needed	Length required can depend on deployment method; one use per site (disposable)
WhirlPaks, 18 ounce	Bacteria, sediment metals and nutrients	NFSS oil-spill kit (Q613fld) or open market
Sample bottles/containers	See Appendix D for container requirements	Oil-spill kit from One-stop Q613FLD; TAL supplies bottles & preservatives for their analyses
Preservation chamber and chamber bag	To collect equipment blank	See NFM chapters 3, 4, 5; one use per site (disposable)
Hydrochloric acid, sulfuric acid, and nitric acid sample preservative	Chemical preservatives	Backup / extra ampoules from NWQL; not needed if sample bottles from TAL contain preservative
10-percent formalin, saturated with sodium borate	Preserve invertebrate samples	Open market
Holder/floatation device for samples	Water sampling	Open market
Winkler kit and calibration solutions	Check sonde DO	Open market
PVC tube, 4 in. diam., ~2-3 ft. long; and stainless steel O clamps	PVC-tube sampling method	Open market
pH test strips	Check oil and grease sample pH	Open market; not for official pH report
Tape: duct, electrical, Teflon	Seal lids to containers	Open market
Coolers	Non-leaking	Open market
Shipping		
Labels (sample container, shipping)		Open market
FedEx Airbills		Federal Express (FedEx)
Coolers		Open market
Wet ice (label field form “ice”)		Open market

Appendix B. Field Supplies Recommended for the October 2010 Oil-Spill Sampling.—Continued

[GOM, Gulf of Mexico; #, number; e.g., for example; DEET, *N*,*N*-Diethyl-*meta*-toluamide;HCl, hydrochloric acid; ASR/CoC, Analytical Services Request/Chain of Custody; EZ, exclusion zone; CRZ, contaminant reduction zone; poly, polyethylene; DOT, U.S. Department of Transportation; DO, dissolved oxygen; SC, specific electrical conductance; NFM, USGS *National Field Manual for the Collection of Water-Quality Data*; NWQL, USGS National Water Quality Laboratory; TAL, TestAmerica Laboratory; WSC, USGS Water Science Center; OWQ, USGS Office of Water Quality; mil, 1/1000th of an inch in thickness]

General Field Equipment/Supplies	Description	Description/Source/Comment
Shipping—continued		
Dry Ice (label field form “dry ice”)		Open market
Liners for cooler, plastic bags for ice		Open market
Foam/bubble sleeves	Bubble Bag 6' X 8"	NFSS oil-spill kit (Q613fld) or open market; *http://www.uline.com/*, catalog #S-5990
Dry-Ice stickers	Place on cooler	Open market
Nylon reinforced tape	Wrap around cooler	Open market
CoC tape	Wrap around cooler	USGS One-Stop Shop (#Q150FLD) or open market
CoC label		Open market, or prepared by WSC
Paper towels		Open market
Ziplock plastic bags-4-mil strength		Open market

Appendix C. Research Methods

Appendix	Research Method	Chief Scientist(s)
C-1. DOC	Analysis of Gulf of Mexico nearshore water samples for dissolved organic carbon quantity and quality utilizing absorbance and fluorescence spectroscopy	G.R. Aiken
C-2. Toxicity	Sediment toxicity tests of beach and wetland samples collected in response to the Deepwater Horizon oil release, Gulf of Mexico, 2010	R.S. Carr and J.M. Biedenbach
C-3. Benthic Invertebrates	Investigation of benthic invertebrates in beach and wetland samples collected pre- and post-landfall of the Deepwater Horizon oil release to the Gulf of Mexico, 2010	A.W.J. Demopoulos
C-4. DOSS	Forensic research for determination of di(ethylhexyl) sodium sufosuccinate (DOSS), an anionic surfactant in Corexit® released to the Gulf of Mexico, 2010	J.L. Gray and E.T. Furlong
C-5. Trace and Major Elements and Nutrients	Analysis of Gulf of Mexico coastal sediments for trace elements, major elements, and nutrients, pre- and post-landfall of the Deepwater Horizon oil spill, 2010	A.J. Horowitz
C-6. Bacteria	Microorganisms in pre- and post-oiled coastal sediments, Gulf of Mexico, 2010	J.T. Lisle
C-7. Oil Fingerprint	Fingerprint analysis of oil in sediment and tarballs from the northern Gulf of Mexico shoreline, 2010	R.J. Rosenbauer

Appendix C-1. Analysis of Gulf of Mexico Nearshore Water Samples for Dissolved Organic Carbon Quantity and Quality Utilizing Absorbance, Fluorescence, and Low Pressure Chromatography with xad Resins

Chief Scientist: G.R. Aiken – USGS, Boulder, Colo.

Method Description:

Dissolved organic matter (DOM) plays an important role in coastal ecosystems as a source of carbon for microorganisms. As hydrocarbon-rich oil infiltrates the Gulf of Mexico, studying the quantity and quality of DOM will provide insight as to the ecological effects of the spill. The fate and transport of the oil, as well conversion of the oil to DOM by microorganisms can be measured utilizing a variety of quantitative and qualitative techniques. Absorbance is a qualitative measure of dissolved organic carbon (DOC), and the ratio of absorbance at the wavelength 254 nm to the concentration of DOC in the water, known as the Specific Ultraviolet Absorbance ($SUVA_{254nm}$), has been highly correlated to percent aromaticity by ^{13}C NMR. Oil and oil additives contain highly fluorescent compounds that have a prolonged breakdown process. Thus, fluorescence is being used to track oil-related fluorophores by measuring Excitation-Emission Matrices (EEMs) of water samples.

For samples with chloride concentrations < 0.02M, DOC concentration will be analyzed using the heated persulfate oxidation method of the OI Analytical Model 700 instrument. All other samples will be analyzed on a Shimadzu TOC-V carbon analyzer which uses the combustion method of oxidation. (Aiken, 1992) Data are reported to +- 0.2 mg/L C. Absorbance scans (wavelengths 200 to 800 nm, every 1 nm) will be measured on an HP8453 UV-Vis Spectrophotometer, which utilizes a photodiode array. Absorbance data produced are unitless and are reported to +- 0.002. $SUVA_{254nm}$ will then be calculated for each sample. (Weishaar and others, 2003) Fluorescence EEMs will be measured on a JY Horiba Fluoromax-3 or Fluoromax-4. Samples will be excited every 5 nm from 240 to 450 nm, and emission scans will be collected every 2 nm from 300 to 600 nm (Murphy and others, 2010).

- Aiken, G.R., 1992, Chloride interference in the analysis of dissolved organic carbon by the wet oxidation method: Environmental Science and Technology, v. 26, p. 2435-2439.
- Murphy, K. R.; Butler, K. D.; Spencer, R. G. M.; Stedmon, C. A.; Boehme, J. R.; Aiken, G. R., The measurement of dissolved organic matter fluorescence in aquatic environments: An interlaboratory comparison. *Environ. Sci. Technol.* **2010,** *44*, 9405–9412.
- Weishaar, J.L., Aiken, G.R., Bergamaschi, B.A., Fram, M.S., Fujii, R., and Mopper, K., 2003, Evaluation of specific ultraviolet absorbance as an indicator of the chemical composition and reactivity of dissolved organic carbon: Environmental Science and Technology, v. 37, no. 20, pp. 4702-4708.

Appendix C-2. Sediment Toxicity Tests of Beach and Wetland Samples Collected in Response to the Deepwater Horizon Oil Release, Gulf of Mexico, 2010

Chief Scientists: R.S. Carr and J.M. Biedenbach – USGS Columbia Environmental Research Center, Marine Ecotoxicology Research Station, Corpus Christi, Tex.

Method Description:

Fertilization and embryological development tests with the sea urchin, Arbacia punctulata. These tests will compare the toxicity of the test samples with a reference sample. We have specific standard operating procedures for all our methods (unpublished). The precision of these tests has been described in Carr and Biedenbach 1999. A phase one toxicity identification evaluation (TIE) will be performed using the fertilization or embryological development tests on any available toxic post-impact samples to determine the class or classes of chemicals contributing to the observed toxicity (EPA, 1996).

- Carr, R.S. and J.M. Biedenbach. 1999. Use of power analysis to develop detectable significance criteria for sea urchin porewater toxicity tests. *Aquat. Ecosyst. Hlth. Mngmt.* 2:413-418.
- EPA. 1996. Marine Toxicity Identification Evaluation (TIE): Phase I Guidance Document. EPA/600/R-96/054. Office of Research and Development, Washington, D.C.
- A citation for the porewater method in general is :
  - Carr, R.S. 1998. Sediment porewater testing. In: *Standard Methods for the Examination of Water and Wastewater, section 8080, 20th Edition*, Clesceri, L.S., A.E. Greenberg, and A.D. Eaton (eds.), American Public Health Association, Washington, DC., pg. 8-37 to 8-41.
- A citation for abbreviated description of the sea urchin porewater tests is:
  Carr, R.S., P.A. Montagna, J.M. Biedenbach, R. Kalke, M.C. Kennicutt, R. Hooten, and G. Cripe. 2000. Impact of storm water outfalls on sediment quality in Corpus Christi Bay, Texas. *Environ. Toxicol. Chem.* 19:561-574.

Appendix C-3. Investigation of Benthic Invertebrates in Beach and Wetland Samples Collected Pre- and Post-Landfall of the Deepwater Horizon Oil Release to the Gulf of Mexico, 2010

Chief Scientist: A.W.J. Demopoulos – USGS, Gainesville, Fla.

Method Description:

See: Demopoulos, AWJ; Smith, C.R., 2010, Invasive mangroves alter macrofaunal community structure and facilitate opportunistic exotics in Marine Ecology-Progress Series 404: 51-67 2010.

Appendix C-4. Forensic Research for Determination of Di(Ethylhexyl) Sodium Sufosuccinate (DOSS), an Anionic Surfactant in Corexit Dispersants Released to the Gulf of Mexico, 2010

Chief Scientists: J.L. Gray and E.T. Furlong – USGS National Water Quality Laboratory, Denver, Colo.

Method Description:

The purpose of this forensic research is development of an analytical method to analyze for residual concentrations of di(ethylhexyl) soldium sufosuccinate (DOSS), a primary surfactant component in the Corexit® dispersants used by BP in addressing the Deepwater Horizon oil spill to the Gulf of Mexico in 2010. Standards for surfactant compounds formulated into Corexit® 9500 and 9527, as well as reference samples of Corexit® dispersants, are being used to determine retention-time data and reference mass spectra for the DOSS in the Corexit® dispersants.

The following publications illustrate the forensic approach for liquid chromatography:

- Ferrer, I, Schroder, H., and Furlong, E., "Atmospheric Pressure Ionization Mass Spectrometry - IX. LC-MS Analysis of Cationic Surfactants: Methods and Applications", in "Analysis and Fate of Surfactants in the Aquatic Environment", Knepper, T., Barcelo, D. and De Voogt, P., Elsevier, p. 353-383, 2003.
- Furlong, E., Ferrer, I., Gates, P., Cahill, J. and Thurman, M., "Identification of Labile Polar Organic Contaminants by Atmospheric-Pressure Tandem Mass Spectrometry", in Liquid Chromatography/Mass Spectrometry, MS/MS and Time of Flight MS", Ferrer, I. and Thurman, M., eds., ACS Symposium Series 850, p. 175-187, 2003.

Appendix C-5. Analysis of Gulf of Mexico Coastal Sediments for Trace Elements, Major Elements, and Nutrients, Pre- and Post-Landfall of the Deepwater Horizon Oil Spill, 2010

Chief Scientist: A.J. Horowitz – USGS, Norcross, Ga.

Method Description:

Bulk and a less-than 63-micrometer aliquot of bed-sediment samples are dried and analyzed for a large group of elements (listed below). The data that result are used to establish pre-oiling baseline values for the various site locations and compared with data resulting from analysis of sediments from the same locations after landfall of the oil. The data sets are analyzed to determine if there are any statistically significant chemical differences between the two data sets. The same analytical procedures have been used in previous studies that were subject to legal scrutiny and action.

Trace and major elements: Ag, Cu, Pb, Zn, Cd, Cr, Co, Ni, Ba, V, Li, Be, Mo, Sr, As, Sb, Se, Hg, Fe, Mn, Al, and Ti.

Nutrients: TN, TP, TS, TC, TOC, AND TIC.

- For all chemical elements other than As, Sb, Se, and Hg, 500-mg aliquots, are digested with a combination of $HF/HClO_4$/*aqua regia* in Teflon® beakers at 200°C; the resulting salts are solubilized using 50 mL of 2 percent HCl.
- Ag, Cd, and Pb are determined by flame atomic absorption spectrometry (AAS) using mixed salt standards and background correction.
- All the other constituents are determined by inductively coupled plasma-atomic emission spectroscopy (ICP-AES) using a lutetium internal standard and interelement correction factors.
  - Aliquots from the same digestion are used for As, Sb, and Se by hydride generation ICP-AES.
  - Hg is analyzed using separate 500-mg aliquots digested with LeFort *aqua regia* at 140°C; quantification is by cold vapor, employing an AAS as the detector.
  - TC and TN are determined by passing the combustion products of separate 250- to 500-mg sample aliquots through a gas chromatograph, with a thermal conductivity detector in a C/N/S analyzer.
  - TOC also is determined by combustion, but in a C/S analyzer that quantifies the evolved CO_2 with an infrared detector after pretreatment with 10 percent volume-to-volume HCl to remove inorganic carbonates.

- Horowitz, A.J., Elrick, K.A., and Smith, J.J., 2001, Hydrological Processes, 15, 1107-1132.
- Fishman, M.J. and Friedman, L.C., 1989, Methods for Determination of Inorganic Substances in Water and Fluvial Sediments, USGS TWRI Book 5, 545 p.

Appendix C-6. Microorganisms in Pre- and Post-Oiled Coastal Sediments of the Gulf of Mexico, 2010

Chief Scientist: J.T. Lisle – USGS, St. Petersburg, Fla.

Method Description:

Phase 1 of this work focuses on using polymerase chain reaction (PCR) and denaturing gradient gel electrophoresis (DGGE) to provide a genetic “fingerprint” of the microbial communities that naturally inhabit the coastal sediments that have not been contaminated with oil from the Deepwater Horizon/BP event. Nucleic acid sequencing methods are being used to identify some of the microbial species within these communities that may or may not be capable of degrading crude oil. These microbial community fingerprints will be compared to chemical fingerprints of oil or oil-degradation products in the same samples (see oil-fingerprint research by Dr. Robert Rosenbauer, USGS, Menlo Park). Collectively, the data from these analyses will provide a microbial and geochemical baseline by which to compare the post-oiled sediment samples.

Phase 2 of this study focuses on monitoring the progress and efficiency of remediation processes along coastal zones that have been contaminated with oil. The same microbiology and geochemical methods will be used as are described for Phase 1, but the samples will be analyzed over an extended period of time. Because of the natural succession of microbial communities that preferentially degrade constituents of crude oil into smaller and less toxic by-products, the goals for this phase of the study is (1) to determine the overall rates and efficiencies of bioremediation processes, (2) which microbial genera/species are responsible for the respective steps in the overall degradation process, and (3) which oil constituents and/or degradation by-products are being preferentially degraded further or become recalcitrant to bioremediation. This approach will allow the USGS to objectively monitor the oil spill cleanup efforts along impacted coastal zone. All appropriate controls will be run to assure the reliability of the resulting data.

References that describe the microbiology and geochemical methods:

- Macnaughton, S., et al. (1999). Microbial population changes during bioremediation of an experiments oil spill. Applied and Environmental Microbiology. 65(8):3566-3574.
- Roling, W., et al. (2004). Bacterial community dynamics and hydrocarbon degradation during a field-scale evaluation of bioremediation on a mudflat beach contaminated with buried oil. Applied and Environmental Microbiology. 70(5):2603-2613.
- Alonso-Gutierrez, J., et al. (2008). *Alcanivorax* strain deteted among the cultured bacterial community from sediments affected by the Prestige oil spill. Marine Ecology Progress Series. 362:25-36.
- Gertler, C., et al. (2009). Microbial consortia in mesocosm bioremediation trial using oil sorbents, slow-release fertilizer and bioaugmentation. FEMS Microbiology Ecology. 69:288-300.

Appendix C-7. Fingerprint Analysis of Oil in Sediment and Tarballs from the Northern Gulf of Mexico Shoreline, 2010

Chief Scientist: R. J. Rosenbauer – USGS, Menlo Park, Calif.

Method Description:

The organic chemical and isotopic composition of the sediment, including biomarkers of any petroliferous component, will be determined. In brief, organic chemical analyses are carried out by gas chromatography/mass spectroscopy following accelerated microwave-assisted solvent extraction and compound fractionation by liquid column chromatography. Biomarker values are used to correlate the samples and group them according to their probable sources (Peters and others, 2008; Lorenson and others, 2009).

- Rosenbauer, R.J. and others, 2011, Petroleum Hydrocarbons in Sediment from the Northern Gulf of Mexico Shoreline, Texas to Florida, U.S. Geological Survey Open-File Report 2011-1014, 22 p., accessed online at *http://pubs.er.usgs.gov/publication/ofr20101290/*.
- Rosenbauer, R.J. and others, 2010, Reconnaissance of Macondo-1 well oil in sediment and tarballs from the northern Gulf of Mexico shoreline, Texas to Florida: U.S. Geological Survey Open-File Report 2010-1290, 22 p., accessed online at *http://pubs.usgs.gov/of/2010/1290/*.
- Lorenson, T.D. and others, 2009, Natural offshore oil seepage and related tarball accumulation on the California coastline—Santa Barbara Channel and the Southern Santa Maria Basin; source identification and inventory: U.S. Geological Survey Open-File Report 2009-1225, 116 p.
- Kvenvolden, K.A. and others, 2002. Hydrocarbons in recent sediment of the Monterey Bay National Marine Sanctuary, Marine Geology 181, 101-113.

Appendix D. Post-Landfall Shipping Requirements for Water and Sediment Samples

Table D–1. Post-landfall water samples: Laboratory, sample, shipping, and quality-control requirements.

Table D–2. Post-landfall sediment samples: Laboratory, sample, shipping, and quality-control requirements.

Tables D–1 and D–2 that follow are provided as examples only and contain information specific to USGS Deepwater Horizon, Gulf of Mexico, 2010, post-landfall sample collection.

Table D–1. Post-landfall water samples: Laboratory, sample, shipping, and quality-control requirements.

LABORATORY	CONTAINER VOLUME AND TYPE -- ANALYSIS	COLLECTION and PRESERVATION Wipe all containers clean and dry, check label before packing.	SHIPPING: FEDEX PRIORITY OVERNIGHT PROTECT SAMPLES FROM CONTACT WITH ICE MELTWATER: Double-bag and seal each sample using heavy-duty ziplock bags and double-bag the ice (total of 4-bag layer between ice and containers). ENSURE THAT COOLERS ARE LEAK-PROOF.	SHIPPING ADDRESS and CONTACT INFORMATION NOTE SHIPPING INSTRUCTIONS AND CONTACTS FOR SATURDAY DELIVERIES. When shipping on a Friday, **on airbill under "Special Handling," mark "Saturday delivery." (Do NOT mark "hold for Saturday")**	Quality Control Samples*				
					Equipment Blank Water	Equipment Blank Sediment	Duplicate	Ambient Blank	Matrix Spike (not oiled site)
Dr. Ed Furlong, NWQL, Denver, Colo.	Two 1-L Teflon bottles (from NWQL) – Surfactant	Leave sufficient headspace for freezing sample. Wipe bottles free of oil and water. Wrap in clean aluminum foil. **KEEP BOTTLE UPRIGHT.**	Keep sample bottles UPRIGHT. **FREEZE** or ship same day on ice. Include return address label and account number. Include Return-FedEx airbill with CoC paperwork.	303-236-3181; FAX 303.236.3719 paalex@usgs.gov LOGIN, National Water Quality Laboratory, USGS, Att: Furlong, Federal Center, Bldg 95, MS 407—Entrance E3, Denver Federal Center, Denver CO, 80225-0046. (**For Saturday delivery, NWQL arranges sample pickup at Fedex**)	√	√			
Dr. George Aiken, Boulder, Colo.	125-mL DOC bottle. Use 500 mL glass to collect. Analysis: Dissolved Organic Carbon	Collect raw sample in 500-mL baked amber glass. Rinse the filter with 50 mL of IPBW and 50 mL sample; fill 125-mL DOC bottle, leaving headspace. Chill and maintain at or less than 4°C without freezing. Ship overnight.	**CHILL to 4°C. Place sample bottle in foam or bubble sleeve and seal in ziplock bags.** DO NOT FREEZE. Ship chilled at 4°C. Include Return-FedEx airbill with CoC paperwork.	303-541-3009, graiken@usgs.gov USGS, Attn: Kenna Butler, Suite E127, 3215 Marine St, Boulder, CO 80303. **Address for Saturday delivery:** LOGIN, National Water Quality Laboratory, USGS, Att: Aiken/Butler, Bldg 95, MS 407--Entrance E3, Denver Federal Center, Denver CO, 80225-0046. Will be picked up at Fedex. Contact: Pat Alex, 303-236-3181, paalex@usgs.gov	√	√			

Table D–1. Post-landfall water samples: Laboratory, sample, shipping, and quality-control requirements.—Continued

LABORATORY	CONTAINER VOLUME AND TYPE -- ANALYSIS	COLLECTION and PRESERVATION Wipe all containers clean and dry, check label before packing.	SHIPPING: FEDEX PRIORITY OVERNIGHT PROTECT SAMPLES FROM CONTACT WITH ICE MELTWATER: Double-bag and seal each sample using heavy-duty ziplock bags and double-bag the ice (total of 4-bag layer between ice and containers). ENSURE THAT COOLERS ARE LEAK-PROOF.	SHIPPING ADDRESS and CONTACT INFORMATION	Quality Control Samples*				
					Equipment Blank Water	Equipment Blank Sediment	Duplicate Triplicate	Ambient Blank	Matrix Spike (not oiled site)
TAL (Test America Laboratories), Pensacola, Fla. ALL CONTAINERS (EXCEPT "RA") ARE SUPPLIED BY TAL, PLUS ONE VOC TRIP BLANK AND ONE TEMPERATURE BLANK	Two 40-mL VOA vials w/septum. Analysis: TCL VOCs (Method 8260B)	See Protocol Section 6 for collection methods. Ensure absence of bubbles in sample. **Unpreserved.** Chill to 4°C without freezing.	**CHILL to 4°C.** Place sample bottle in foam or bubble sleeve and in sealed ziplock bags. **Ship priority overnight,** protected from meltwater and in a leakproof cooler.	850-471-6227 marty.edwards@testamericainc.com Marty Edwards 3355 Mclemore Drive Pensacola, FL 32514	√	√	√	√	
	Two 40-mL VOA vials w/septum. Analysis: TPH GRO (C6-C10) (Method 8015B)	See Protocol Section 6 for collection methods. Ensure absence of bubbles in sample. **Unpreserved.** Chill to 4°C.	**CHILL to 4°C.** Place sample bottle in foam or bubble sleeve and in sealed ziplock bags. Ship with VOCs, priority overnight, protected from meltwater and in a leakproof cooler.		√	√	√	√	
	One 1-L fired amber glass. Analysis: TPH Diesel and Oil-range organics (DRO/ORO) w/ chromatograms (Method 8015B).	Unpreserved. Fill, leaving headspace. Chill to 4°C without freezing.	**CHILL to 4°C.** Bubble wrap, place in ziplock bags and seal. Ship priority overnight, protected from meltwater and in a leakproof cooler.		√	√	√	√	√

Table D1. Post-landfall water samples: Laboratory, sample, shipping, and quality-control requirements —Continued.

LABORATORY	CONTAINER VOLUME AND TYPE -- ANALYSIS	COLLECTION and PRESERVATION Wipe all containers clean and dry, check label before packing.	SHIPPING: FEDEX PRIORITY OVERNIGHT PROTECT SAMPLES FROM CONTACT WITH ICE MELTWATER: Double-bag and seal each sample using heavy-duty ziplock bags and double-bag the ice (total of 4-bag layer between ice and containers). ENSURE THAT COOLERS ARE LEAK-PROOF.	SHIPPING ADDRESS and CONTACT INFORMATION	Quality Control Samples*				
					Equipment Blank Water	Equipment Blank Sediment	Duplicate Triplicate	Ambient Blank	Matrix Spike (not blind site)
TAL (Test America Laboratories), Pensacola, Fla. ALL CONTAINERS (EXCEPT "RA") ARE SUPPLIED BY TAL, PLUS ONE VOC TRIP BLANK AND ONE TEMPERATURE BLANK	Two -L fired amber glass. Analysis: Semivolatile Organic Compounds (SVOC TCL) (Method 8270D)	Unpreserved. Fill, leaving headspace. Chill to 4ºC without freezing.	**CHILL to 4ºC**. Bubble wrap, place in sealed ziplock bags. Ship priority overnight, protected from meltwater and in a leakproof cooler.	850-471-6227 marty.edwards@testamericainc.com Marty Edwards 3355 Mclemore Drive Pensacola, FL 32514	√	√	√	√	√
	One 1-L (32 oz) clear wide mouth glass. Analysis: Oil and Grease HEM (Method 1664A)	Preserved with HCl. Fill, leaving headspace. If **HCl is lost, check that pH < 2, and add if needed. Chill to** 4ºC without freezing.	**CHILL to 4ºC**. Bubble wrap, place in ziplock bags and seal. Ship priority overnight, protected from meltwater and in a leakproof cooler.		√	√	√	√	
	250-mL poly, pre-preserved with HNO_3 for Metals/Trace Elements analysis. One 1-L RA ("raw, acidified") poly bottle from NWQL for sample collection.	Use precleaned, blanked 1-L RA bottle to collect dip sample and fill acid-preserved 250-mL poly bottle. Leave headspace. Check pH and add HNO_3 to pH < 2, if needed. Chill to 4ºC without freezing.	**CHILL to 4ºC**. Place in sealed plastic bag. Ship priority overnight, protected from meltwater and in a leakproof cooler.		√	√	√	√	

Table D1. Post-landfall water samples: Laboratory, sample, shipping, and quality-control requirements —Continued.

LABORATORY	CONTAINER VOLUME AND TYPE -- ANALYSIS	COLLECTION and PRESERVATION Wipe all containers clean and dry, check label before packing.	SHIPPING: FEDEX PRIORITY OVERNIGHT PROTECT SAMPLES FROM CONTACT WITH ICE MELTWATER: Double-bag and seal each sample using heavy-duty ziplock bags and double-bag the ice (total of 4-bag layer between ice and containers). ENSURE THAT COOLERS ARE LEAK-PROOF.	SHIPPING ADDRESS and CONTACT INFORMATION	Quality Control Samples*				
					Equipment Blank Water	Equipment Blank Sediment	Duplicate Triplicate	Ambient Blank	Matrix Spike (not oiled site)
TAL (Test America Laboratories), Pensacola, Fla. ALL CONTAINERS (EXCEPT "RA") ARE SUPPLIED BY TAL, PLUS ONE VOC TRIP BLANK AND ONE TEMPERATURE BLANK	250-mL poly, with H_2SO_4 for nutrients (TKN, NH_4, and TP)	Use precleaned, blanked 1-L RA bottle to collect dip sample and fill acid-preserved 250-mL brown poly bottle. Leave headspace. Check pH and add additional H_2SO_4 to pH < 2, if needed. Chill to 4ºC without freezing.	CHILL to 4ºC. Place in sealed plastic bag. Ship priority overnight, protected from meltwater and in a leakproof cooler.	850-471-6227 marty.edwards@testamericainc.com Marty Edwards 3355 Mclemore Drive Pensacola, FL 32514	√	√	√	√	

*All containers are filled for routine environmental and triplicate samples. Up to one triplicate sample per Water Science Center may be collected at one site with a visible oil slick or sheen. One equipment blank for water and one equipment blank for sediment is to be processed by each Water Science Center. One duplicate sample for each site type (beach or marsh) is to be collected by each Water Science Center. One ambient blank is to be processed by each Water Science Center. One matrix spike sample should be processed by each Water Science Center for one beach and one marsh site that does not appear to have been impacted by oil. **Refer to Section 6 of the protocol for details on sample collection and processing; for detailed QA/QC sampling information, refer specifically to section 6.5.**

Table D-2. Post-landfall sediment samples: Laboratory, sample, shipping, and quality-control requirements.

LABORATORY	SEDIMENT-SAMPLE CONTAINER TYPE AND VOLUME -- ANALYSIS	COLLECTION and PRESERVATION Wipe all containers clean and dry, remove sediment from container and cap threads, check label, before packing.	SHIPPING Fedex Priority Overnight PROTECT SAMPLES FROM CONTACT WITH ICE MELTWATER: Double-bag and seal each sample using heavy-duty ziplock bags and double-bag the ice (total of 4-bag layer between ice and containers). ENSURE THAT COOLERS ARE LEAK-PROOF.	SHIPPING ADDRESSES NOTE SHIPPING INSTRUCTIONS AND CONTACTS FOR SATURDAY DELIVERIES.	Quality Control Samples*	
					Equipment Rinsate Blank	Duplicate Triplicate
Dr. Amanda Demopoulos, Gainesville, Fla. (Benthic Invertebrates)	Six 500-mL poly jar. Six sediment cores, each in a 500-mL poly jar – Analysis: Benthic Invertebrates	Collect 6 sediment cores: 2-inch depth from surface; space cores approx. 1 m apart within sampling area. Extrude each core into a 500-mL jar. First 3 cores: fill to top with 10% formalin supersaturated with sodium borate and label jars "10% buffered formalin." Next 3 cores, no preservative. Seal lids with duct /electrical tape. CHILL.	CHILL to 4°C. Wrap sample jar in absorbent paper, put into double ziplock bags and seal. Tracking #'s to **ademopoulos@usgs.gov** **Note Saturday-delivery shipping address for 10/16.** Ship overnight or freeze and ship next day.	352-264-3490 **ademopoulos@usgs.gov** Dr. A. Demopoulos, USGS, Southeast Ecological Science Center, 7920 NW 71st St., Gainesville, FL 32653. **Saturday 10/16 delivery: Ship to A. Demopoulos, 5010 NW 64th Blvd., Gainesville FL 32653, 352-346-6938**		
Dr. Robert Rosenbauer, Menlo Park, Calif.	Two 500-mL I-Chem or equivalent certified fired glass widemouth fired bottle (BGC) -- Analysis: Oil Fingerprint	Freeze samples. Fill no more than 80% to allow room for expansion when frozen. Use a Kimwipe to dry jars and remove particles from threads and lid and cap tightly. Seal cap with electrical tape. KEEP JARS UPRIGHT.	FREEZE. Keep samples chilled and ship frozen on dry ice asap. Place sample jars in foam or bubble sleeves and seal in zip-locks. KEEP JARS UPRIGHT. **Saturday delivery: tracking #'s to tlorenson@usgs.gov; notify Tom Lorenson 650-642-5627**	650-329-4198; 650-575-9965 (c) **brosenbauer@usgs.gov** Dr. R. Rosenbauer, USGS, MS 999, 345 Middlefield Rd, Menlo Park, CA 94025. **For Saturday 10/16/10 delivery: Hold at FedEx Center 3750 Haven Ave., Menlo Pk., CA 94025 for pick-up by T. Lorenson tlorenson@usgs.gov 650-642-5627**	√	- √

Table D-2. Post-landfall sediment samples: Laboratory, sample, shipping, and quality-control requirements.—Continued

LABORATORY	SEDIMENT-SAMPLE CONTAINER TYPE AND VOLUME -- ANALYSIS	COLLECTION and PRESERVATION Wipe all containers clean and dry, remove sediment from container and cap threads, check label, before packing.	SHIPPING Fedex Priority Overnight PROTECT SAMPLES FROM CONTACT WITH ICE MELTWATER: Double-bag and seal each sample using heavy-duty ziplock bags and double-bag the ice (total of 4-bag layer between ice and containers). ENSURE THAT COOLERS ARE LEAK-PROOF.	SHIPPING ADDRESS NOTE SHIPPING INSTRUCTIONS AND CONTACTS FOR SATURDAY DELIVERIES.	Quality Control Samples*	
					Equipment Rinsate Blank	Duplicate Tiplicate
Dr Robert Rosenbauer, Menlo Park, Calif.	One 250-mL I-Chem or equivalent certified fired glass widemouth fired bottle (BGC) -- Analysis: Tar balls -- weathering characteristics	Collect tar balls wearing Teflon gloves, sized from thumbnails to palm-sized into 250 wide-mouth jar. CHILL to 4°C.	CHILL to 4°C. Place sample jar in foam or bubble sleeves and seal in ziplocks. KEEP JARS UPRIGHT. **Saturday delivery: notify and send tracking #'s to brosenbauer@usgs.gov**	650-329-4198 **brosenbauer@usgs.gov** **See Rosenbauer above for Sat. delivery information.** Dr. R. Rosenbauer, USGS, MS 999, 345 Middlefield Rd, Menlo Park, CA 94025		
Dr. Art Horowitz, Norcross, Ga.	One 18-oz (532-mL) or two 18-oz WhirlPak (see Collection) -- Analysis: Metals and trace elements; nutrients	Fill WhirlPak(s) from the bulk sample composite. Collect 1-kg in two 500-g WhirlPaks if sediment is sand-sized. If dominant grain-size consists of fines or mud, fill one 500-g WhirlPak. Keep in dark and chilled. DO NOT FREEZE.	CHILL, DO NOT FREEZE. Keep in dark and chilled at 4°C. Double-bag. **Saturday 10/16/2010 delivery: (1) notify Kent Elrick & email him the FedEx tracking #'s/ kaelrick@usgs.gov (2) Check *Hold Sat.* box on shipping label. (3) FedEx office: FedEx, 6650 Corners Industrial Ct., Norcross GA 30092**	770-903-9153 horowitz@usgs.gov **Saturday delivery (10/16/10) – note on address label Att: K. Elrick. FedEx to hold for Sat. pick up. Mon.– Thur. ship to:** A. Horowitz, Georgia Water Science Center, Peachtree Business Center, Suite 130, 3039 Amwiler Rd, Atlanta, GA 30360		- √

Table D-2. Post-landfall sediment samples: Laboratory, sample, shipping, and quality-control requirements.—Continued

LABORATORY	SEDIMENT-SAMPLE CONTAINER TYPE AND VOLUME -- ANALYSIS	COLLECTION and PRESERVATION Wipe all containers clean and dry, remove sediment from container and cap threads, check label, before packing.	SHIPPING Fedex Priority Overnight PROTECT SAMPLES FROM CONTACT WITH ICE MELTWATER: Double-bag and seal each sample using heavy-duty ziplock bags and double-bag the ice (total of 4-bag layer between ice and containers). ENSURE THAT COOLERS ARE LEAK-PROOF.	SHIPPING ADDRESSES NOTE SHIPPING INSTRUCTIONS AND CONTACTS FOR SATURDAY DELIVERIES.	Quality Control Samples*	
					Equipment Blank Sediment	Duplicate Triplicate
Dr. John Lisle, St. Petersburg, Fla.	**18 oz. (532** ml) in double WhirlPak (For equipment blank only—place WhirlPak sample into a widemouth jar. Analysis: Microorganisms	Use sterile equipment. Fill WhilPak from the bulk sample composite. FREEZE sample to -20°C.	FREEZE. Ship double-bagged sample overnight on dry ice. Isolate samples from meltwater. **NOTE- send tracking #s to J. Lisle jlisle@usgs.gov; use home shipping address for Saturday deliveries.**	727-803-8747 x3140 Office, **jlisle@usgs.gov** Dr. J. Lisle, USGS, Center for Coastal Watershed Studies, 600 4th Street, So., St. Petersburg, FL 33701 **For Saturday delivery, ship to: J. Lisle, 2249 Hidden Meadows Dr., Palm Harbor FL 34683, 727-512-7805**	√	- √
USGS Marine Ecotoxicology Research Station TAMU-Corpus Christi Center for Coastal Studies, Texas	Two 1-L clear or amber wide-mouth glass bottle (BGC) -- Analysis: Pore-water toxicity	Fill bottles to top from bulk sample. Use Kimwipe to remove particles from jar threads and lip, tightly close & seal cap, using electrical tape. KEEP JARS UPRIGHT IN COOLER.	CHILL at 4°C. DO NOT FREEZE. Place jars in bubble wrap, then into doubled ziplock bags; seal. **NOTE- send tracking #'s to** james_biedenbach@usgs.gov **Ship to home address for Saturday deliveries.**	**361-825-3217 (Fax)361-825-3270** **scott_carr@usgs.gov** Dr. Scott Carr james_biedenbach@usgs.gov Dr. J. Biedenbach, USGS Marine Ecotoxicology Research Ctr 6300 Ocean Dr. NRC Suite3200, Unit 5867, Corpus Christi, TX 78412. **Saturday delivery:** James Biedenbach, 2121 Dorsey St., Corpus Christi TX 78414, 361-331-7621		- √

Table D-2. Post-landfall sediment samples: Laboratory, sample, shipping, and quality-control requirements.—Continued

LABORATORY	SEDIMENT-SAMPLE CONTAINER TYPE AND VOLUME -- ANALYSIS	COLLECTION and PRESERVATION Wipe all containers clean and dry, remove sediment from container and cap threads, check label, before packing.	PROTECT SAMPLES FROM CONTACT WITH ICE MELTWATER: Double-bag, seal each sample in heavy-duty ziplock bags; double-bag ice (total of 4-bag layer between ice and containers). NO LEAKY COOLERS.	SHIPPING ADDRESS	Quality Control Samples*	
					Equipment Rinsate Blank	Duplicate Triplicate
Test America, Pensacola, Fla. ALL CONTAINERS ARE SUPPLIED BY TAL, PLUS **ONE TEMPERATURE BLANK**	One 8-oz wide mouth jar -- Analysis: Oil & Grease HEM (Method 1664A, CIN 50137), SVOC TCL (Method 8270D; CIN 50117)	Fill from bulk sample composite. Use a Kimwipe to remove any particles from threads and lip, tightly seal cap. Double bag, chill to 4°C.	CHILL at 4°C. Wrap jar in bubble wrap, place into double-bagged ziplock bags and seal. Ship overnight.	850-471-6227 marty.edwards@ testamericainc.com Marty Edwards, 3355 Mclemore Dr. Pensacola, FL 32514	√	√√
	One 4-oz wide mouth jar -- Analysis: Alkylated PAH and PAH (Method 8270C SIM; CIN 50641)	Fill from bulk sample composite. Use a Kimwipe to remove any particles from threads and lip, tightly seal cap. Double bag, chill to 4°C.	CHILL at 4°C. Wrap jar in bubble wrap, place into double-bagged ziplock bags and seal. Ship overnight.			√√

*All containers are filled for routine environmental and triplicate samples. One triplicate sample set per water science center may be collected at an oiled site. One equipment blank for sediment will be processed by each water science center. One duplicate sample for each site type (beach or marsh) is to be collected by each water science center. **Refer to Section 7 of the protocol for details on sample collection and processing; for detailed QA/QC sampling information, refer specifically to sections 7.5 and 9.**

Appendix E. Health and Safety

Appendix E–1. Health and Safety Plan Package

Appendix E–2. Job Hazard Analysis

Appendix E–3. USGS Safety Bulletin (7/21/2010): Personal Flotation Device Selection and Use

Appendix E–4. Contacts for Deepwater Horizon Incident Response (current as of 8/6/2010)

Appendix E–5. Instructions for British Petroleum (BP) Site-Specific Training

Appendix E-1. Health and Safety Plan Package

USGS personnel working under the direction of the Incident Command or other Federal Agency are to follow that organization's HASP. USGS HASP requirements for response to the Gulf of Mexico Deepwater Horizon oil spill are fulfilled by assembling a USGS DWH GOM HASP package, which should be kept on hand when deploying to the field site. This package includes the following documents (the following HASP elements also can be accessed through a www.my.usgs.gov wiki[12]):

1. **Agency HASPs.** A HASP provided by the Incident Command (IC) or Agency under whose jurisdiction the work will be conducted is required. In this case, the HASP provided by the U.S. Fish and Wildlife Service (FWS) will suffice, unless directed otherwise.
    a. U.S. Coast Guard (*http://www.uscg.mil/forms/ics/ICS_208_CG.pdf*),
    b. U.S. Fish and Wildlife Service (*http://internal.usgs.gov/ops/safetynet/FWS%20WIldlife%20Branch%20HASP%20(MC%20252%20Oil%20Spill).pdf*)
2. **The Daily Operational and Safety Situational Report (the "shift" or operations plan).** The Shift Plan – which usually covers a 48-hour time period – is obtained from the designated IC safety or Industrial Hygiene staff on or for the day(s) of field deployment. Arrangements can be made to receive the Shift Plan via e-mail for the time period of planned field deployment to avoid delay of field work by contacting the USGS Bureau Industrial Hygienist (Anthony Zepeda, 703-648-7551), or by contacting:
    a. **Houma LA Incident Command** - 1697 Highway 311, Houma LA 70395, Main 985-493-7600; Operations 985-493-3343; mc252decon@gmail.com.
    b. **Mobile AL Incident Command** - One South Water Street Mobile AL 36602, 251-442-1938.
3. **Evacuation Plan.** The Evacuation Plan generally is separate from the Shift Plan. Evacuation plans are specific to and provided either by the Huoma, La., or Mobile, Ala., Incident Command Sectors, as appropriate. The field team should request the latest Evacuation Plan when requesting the Shift Plan and include it in their HASP package. Eamples are linked to the HASP Package of the my.usgs.gov wiki (see footnote #12).
4. **Job Hazard Analysis (JHA).** A draft JHA for Houma GOM-DWH is included in Appendix E-2 and is linked on the HASP Package section of the wiki (footnote #12).
5. **Section 3.0 of this Sampling Protocol**. A copy of this section is linked on the HASP Package section of the my.usgs.wiki (see footnote #12).

[12] These wiki files are readily accessible by USGS personnel; non-USGS personnel should contact the Office of Water Quality (703-648-6862 or 703-648-6866 or 703-648-6902 for access privileges): https://my.usgs.gov/josso/signon/login.do?josso_back_to=https://my.usgs.gov/OWQ_Deep_OilWiki/josso_security_check

Consideration should be given to supplementing the HASP with additional topical information to cover health, safety, and hazards conditions that may be unique to USGS sampling sites. For this purpose, *the USGS Template HASP for Oil Impacted Areas* was developed for use by USGS personnel:
http://internal.usgs.gov/ops/safetynet/HASP%20for%20Oil%20Spill%20Impacted%20Areas.doc
Supplemental information can be found *at http://1stop.usgs.gov/safety/topic/jha/index.html* .

Appendix E-2. Job Hazard Analysis

Job Hazard Analysis

- Check or highlight the numbered box(s) for all significant safety concerns this project should address. Significant safety concerns are commonly those that require training, purchase of safety equipment, or specialized preparation to address potentially hazardous conditions.
- Identify any unlisted safety concerns at bottom of the page.
- Provide details on the back of this page.

Project Title (Short)____

Field Team / Supervisor____

Site ID and Date____

√	Safety Concerns
1.	Wading, bridge, boat, or cableway measurements or sampling
2.	Working on ice covered rivers or lakes
3.	Measuring or sampling during floods
4.	Well drilling; borehole logging
5.	Electrical hazards in the work area
6.	Construction
7.	Working in remote areas, communication, office call in procedures
8.	Ergonomics, carpal tunnel syndrome
9.	Field Vehicles appropriate for task?- Safety screens, equipment restraints.
10.	All terrain vehicles, snowmobiles
11.	Helicopter or fixed wing aircraft usage
12.	Site access
13.	Hypothermia or heat stroke
14.	Hantavirus, Lyme Disease, Histoplasmosis, Pfiesteria, Others?
15.	Contaminated water with sanitary, biological, or chemical concerns
16.	Immunizations
17.	Laboratory or mobile laboratory. Chemical hygiene plan.
18.	Hazardous waste disposal
19.	Hazardous waste site operations
20.	Confined space
21.	Radioactivity
22.	Respiratory protection
23.	Scuba Diving
24.	Electrofishing
25.	Use and disposal of chemical reagents

(Job Hazard Analysis continued on next page.)

Box no.	**For each numbered box checked on the previous page, briefly:** A. Describe the safety concern as it relates to this project. B. Describe how this safety concern will be addressed. Include training, safety equipment and other actions that will be required. C. Estimate costs.
1.	Wading in Gulf of Mexico surf zone to 3 feet of water. 2 to 3-person team working at sampling location, each with USGS-approved PFD, waders, and PPE, as described in the USGS Gulf of Mexico Deepwater Horizon (GOM DWH) Sampling Protocol.
7.	Remote sites may not have 911 access; precautions are taken to have on hand cell phones or radios and emergency contact numbers.
9.	Field vehicles, including motorcraft, comply with DOI/USGS regulations and standards, include proper http://1stop.usgs.gov/safety/topic/jha/index.htmlsafety equipment, chemical spill kits, and MSDS sheets.
12.	Access to hot zones is verified daily with the Coast Guard Incident Command.
13.	Summer conditions and PPE requirements could aggravate potential for hypothermia or heat stroke; HASP is on hand that details personnel behavior and work constraints when working under these conditions, including rest periods, liquid intake, and emergency procedures.
15.	Potential exposure to crude oil products. HASP and GOM DWH Sampling Protocol dictate the PPE and safe sample-handling procedures. Minimum of 24 hours of HazWOper training is current and completed.
17.	Mobile laboratory contains and conforms to the WSC chemical hygiene plan.
18.	Oil-soiled disposable equipment and garments and cleaning solutions will be disposed in accordance with the OSHE and USGS protocols, as described in the USGS GOM DWH Sampling Protocol and in accordance with State and local regulations.
19.	Training has been completed for setting up and working in Hot (Exclusion) zones, Contamination Reduction Zones, Support Zones, and a Contaminant Corridor and is detailed in the USGS GOM DWH Sampling Protocol. Sampling and decontamination activities will be carried out using these procedures.
22.	Potential exists for volatile hydrocarbon exposure to the respiratory system. The field team will follow the exposure-detection protocol, monitoring exposure levels using a PID while on site as directed in the USGS GOM DWH Sampling Protocol, evacuating the site at a PID measurement of 20 ppmv and 5 ppm for Benzene, and executing the evacuation procedures provided by Incident Command and informing the Industrial Hygienist (IH) on duty of the evacuation. Field personnel will not return to the site until it is cleared by the IH and will not be working under conditions that require use of a respirator.
25.	Potential contact with chemical sample preservatives: Formalin, sulfuric acid, nitric acid, and hydrochloric acid. The specific JHAs for these substances are included in this HASP and field personnel have been briefed regarding the hazards and proper use and handling of these chemical substances.

Discussed job hazard analysis (JHA) with Water Science Center's

- Collateral Duty Safety Officer Yes____ No____
- Copy of JHA given to Collateral Duty Safety Officer Yes____ No____

Water Science Center Director/Supervisor ____________________ Date ____________

Regional Program Officer _______________________________________ Date ____________

(Job Hazard Analysis continued on next page.)

Appendix E-2. Job Hazard Analysis.—**Continued**

Job Hazard Analysis Plan for (Project Title):

Instructions for Employees:

Each employee shall comply with occupational safety and health standards and all rules, regulations, and orders issued pursuant to this project, which are applicable to his or her own actions and conduct. Management is responsible to ensure that all safety policies are implemented and monitored at the field level. Supervisors must ensure that employees are informed of safety policies; that the policies are integrated into field operations; and that they are carried out in a proper and consistent manner. However, once you have received training and have been assigned an activity, most of the responsibility for personal safety and that of others is yours. Your first responsibility is to think for yourself. Both supervisors and employees will be held accountable if safety policies are not followed.

Preparing for the Field

In preparing yourself, consider the following elements. Many of the tasks assigned to USGS employees require strenuous exercise, sometimes under adverse weather conditions.

Adequate planning for field assignments includes: Discussing the assignment thoroughly with your supervisor to ensure that you understand what is expected, why it needs to be done, and how it should be accomplished. Know where the nearest emergency medical facilities are located; make plans on how to contact these facilities if you are alone and severely injured (cellular phone). Reviewing maps, property descriptions, and notes made by yourself and others on previous visits to ensure that you are aware of site conditions and potential hazards that may exist. Contacting landowners and public officials to inform them of your plans and receive permission for access. Appropriate personal gear may include: Adequate clothing for weather conditions. Proper footgear that you will need for fieldwork, including hiking boots, steel-toed safety shoes, hip boots, hardhats, and waders. A PFD is required when working on boats and or while wading into the surf zone and wetland or marsh areas (see PFD Safety Bulletin dated 7/21/2010).

A list of required tools, instruments, and supplies should be made when planning your trip and these items should be checked to ensure they are in good operating condition before you start your trip (these are listed in Appendix B of the USGS GOM-DWH Sampling Protocol (https://my.usgs.gov/OWQ_Deep_OilWiki/). An office Call-in policy will be in effect for all field activities. **Field personnel engaged in response to the Deepwater Horizon oil spill must obtain the daily or 48-hour Operational Plan (Shift Plan) before deploying to the field site, either from the USGS Bureau or Eastern Region Industrial Hygienist (A. Zepeda, 703-648-7551; B. Demith, 703-648-4636) or from the Houma Sector Unified Command FWS Safety Officer (Jack Morrow, 404-408-7226, john_morrow@fws.gov).**

We cannot eliminate all the hazards associated with our jobs. We can, however, reduce these hazards to reasonable risks. The intent of Job Hazard Analyses (JHAs) is to identify the hazards associated with our jobs and then develop realistic actions that can be used to reduce these hazards to reasonable workplace risks.

Additional JHA information for task-specific work is available on the WRD Safety Homepage *http://1stop.usgs.gov/safety/topic/jha/index.html*.

Sampling in the Gulf of Mexico

Detailed instructions are provided in the USGS *Sampling Protocol for Post-Landfall Deepwater Horizon Oil Release, Gulf of Mexico, 2010: Addendum to Standard USGS Methods for the Collection of Water, Sediment, Benthic Invertebrates, and Microorganisms* (Sampling Protocol) and in the updated information posted in the OWQ_Deep_Oil Wiki, previously referenced. Field personnel must become familiar with the contents of the Sampling Protocol and abide by all the health and safety requires described, including the mandatory HazWOper and other training, PPE, and air-monitoring requirements, and are to check the wiki for bulletins and updates that affect personnel health, safety, and ability to perform their duties.

Sampling and Measurements by Wading

Personal Flotation Devices (PFD's) are required in all operations near, in, or over water except in those cases where an approved site-specific Job Hazard Analysis (JHA) defines the conditions for an exemption (refer to the *U.S. GEOLOGICAL SURVEY (USGS)* ***SAFETY BULLETIN:*** *Personal Flotation Device (PFD) Selection/Use,* issued 7/21/2010*)*. In areas of potential contamination appropriate PPE must be worn, as described in the Sampling Protocol referenced above. Prevent water from contacting your skin.

Floods

Rain can fall at a rate of several inches per hour and rapidly create dangerous conditions in the area where you are working. Weather forecasts, evacuation plans, and the daily briefing provided by the local Incident Command are necessary in planning activities to ensure your safety. Maintain an updated copy of your floodplan. Maintain regular office and IC contact during emergency conditions. Have the proper rescue equipment on hand and use it according to your plan. Make sure you have emergency communication capability in case of an accident. Raingear must meet color requirements of the state and reflective requirements of ANSI Class III garments.

Remote Areas, Communications

Mobile telephones provide a minimum precaution. Satellite communication services might be available for remote areas where cellular service is not available. Make an itinerary for every field trip and leave a copy at the office and with the IC in addition to family or colleagues. Schedule times to check in at work and with family or colleagues when field trips require overnight stays. Follow the established schedule. Notify all concerned parties if your schedule changes. Obtain or reserve communication equipment, such as a cellular phone or two-way radio. It’s a good idea for all field crews to be aware of any potential medical conditions or treatments for existing medical conditions of the field-team members. Examples of these conditions would include severe allergic reactions, Diabetes, coronary problems, heat stress, etc.

Ergonomics

Work-related musculoskeletal disorders (MSD) result when there is a mismatch between the physical capacity of workers and the demands of the job. Many of these are caused or aggravated by work related stressors such as such as lifting, reaching, pulling, pushing, and bending. Get assistance in moving heavy or large items to reduce back injuries.

Field Vehicles

It is required that the installation of barriers behind the front seats of all vehicles that are used to carry heavy equipment is enforced. Defensive driver training will be given to all employees who are expected to operate motor vehicles on the job. All weights, compressed gas cylinders, and all other heavy or large items shall be appropriately secured in the vehicle. Gasoline, methanol, and other hazardous materials should be transported in leak proof containers (safety can) and secured to prevent movement and transported to prevent release of fumes. For all vehicles used in field situations, an appropriate fire extinguisher shall be securely mounted and easily accessible. Vehicle maintenance and condition are the responsibility of the users.

Field Vehicles Must Have The Following Safety Equipment:

Fire extinguisher, First Aid kit, PFD’s, PID, ANSI Traffic vests, Hardhat, Safety Glasses, Gloves (leather, cloth, chemical resistant), Traffic control lights, cones, emergency signs.

Site Access

Working in and around the surf zone and wetlands or marshes will subject you to conditions that can cause slips, falls, contact with contaminated water and sediments, impede mobility, and that could result in serious injury to you and your coworkers. You can't avoid all potential dangers, but you can minimize the risk of accidents by considering the following guidelines.

1. Avoid steep slopes and navigate slippery conditions with care, using the buddy system.
2. Do not enter the surf zone under rough surf conditions.
3. When navigating through deep marsh muds, keep moving to avoid sinking into the muck and becoming immobilized.
4. Adhere to PFD, PPE, and all other safety requirements.
5. Be alert to significant wildlife threats, such as the potential to encounter alligators, snakes, or other domestic and wild animals and be prepared to take appropriate preventive and defensive action (*National Field Manual for the Collection of Water-Quality Data*, Chapter 9). Biting insects, such as mosquitoes, chiggers, ticks, and various flies, are generally of less immediate hazard than stinging insects, but they may be carriers of disease.

Dealing With Hostile Persons

Be aware of radical or strong political groups operating in the area. Familiarize yourself with any controversial issues or illegal activities in the area you will be working. Be able to briefly explain the necessity for the data collection you are charged with. Formulate a plan for dealing with hostile people that includes avoidance or calm, deliberate departure from their presence.

Hyperthermia

Hyperthermia is a condition of increased body temperature caused by exposure to excessive heat. Contributing factors are physical exertion, clothing, humidity, lack of air movement, and temperature, but the most important factor is body hydration. The normal body requirement for fluids in temperate regions is 2 1/2 quarts per day; GOM conditions will require more fluid. Early warning symptoms of Hyperthermia are chilling, a throbbing pressure in the head, unsteadiness, dizziness, nausea, dry skin (either hot and red or cool and pale), rapid pulse, and muscle pains and spasms.

Viral and Bacterial Issues

USGS policy on respiratory protection and provides generic guidelines to assist centers in development of a safety program for employees who work in an environment with potential exposure to respiratory hazards. Respirators may not be used without appropriate medical surveillance and clearance.

USGS personnel should assume that any water they sample, measure or gage may be contaminated with pathogenic organisms. It should be a regular practice after sampling to thoroughly disinfect with a biocidal agent (for example, germicidal soap or alcohol based cleaners) any exposed skin that has come in contact with the water.

Contaminated Water and Soil - Sampling Wastewater Disposal

Wear appropriate gloves and eye protection. Prevent water from contacting your skin. Appropriate immunizations are made available on a voluntary basis. Carry appropriate disinfecting solutions for cleaning of hands, equipment and materials. Calibration standards, decontamination and other cleaning solutions, and chemical preservatives must be handled and disposed of with respect to local environmental policies. Process samples with care. Always use appropriate gloves and safety glasses when handling samples and preservatives. Biohazards must be appropriately labeled, stored and disposed according to local regulations.

Labs and Mobile Labs

Each USGS vehicle performing water quality work is considered a mobile lab. Mobile labs must meet the requirements of chemical transportation regulations of the DOT. Each vehicle will be supplied with a copy of the district chemical hygiene plan, Material Data Safety Sheets (MSDS) for any chemical carried and supplied with appropriate personal protective equipment. Any USGS personnel using chemicals shall be appropriately trained through lab safety, hazard communications training. Normally it is not necessary for USGS vehicles to be placarded. Mobile labs, including water-quality vehicles will meet the same standards of facility labs. Each vehicle will be supplied with chemical hygiene plans, MSDS's, PPE, emergency eye wash, JHA's appropriate to job tasks.

Formalin and Formaldehyde

Formalin is a teratogen, which can cause adverse birth and reproductive effects. It is also a mutagen, which can cause DNA damage. If exposure exceeds 0.75 ppm for 8 hours (TWA) and greater than 2.0 ppm for and 15 minute period; all provisions listed in 29 CFR 1910.1048 shall apply. Wear appropriate gloves or clothing to prevent exposure. Wear safety goggles. Keep formalin from contact with alkalis, acids, and phenols. Formalin or formalin-preserved samples will not be transported in the passenger compartments of vehicles. Wash thoroughly after handling formalin. *http://1stop.usgs.gov/safety/topic/jha/formalin.html*

Dry Ice

Dry ice will be used to preserve specific samples for the GOM-DWH project and must be handled in accordance with the dry-ice JHA: *http://1stop.usgs.gov/safety/topic/jha/DryIce.pdf*

Acid Sample Preservatives

Some samples will be preserved with nitric (HNO_3), hydrochloric (HCl), or sulfuric (H_2SO_4) acid, which must be handled as stipulated in the following JHAs:

- HNO_3 and HCL: *http://1stop.usgs.gov/safety/topic/jha/acid_hcl_hno3.html*
- H_2SO_4: *http://1stop.usgs.gov/safety/topic/jha/acid_h2s04_amps.html*

Decontamination Agents

Chemical substances used for equipment cleaning and decontamination may include methanol (MeOH) and nitric or hydrochloric acids. The ASR referenced above for nitric and hydrochloric acid applies to the use of these chemicals as cleaning agents.

- MeOH: *http://1stop.usgs.gov/safety/topic/jha/methanol.htm*

Sampling in Weather Extremes

Fieldwork often is necessary under adverse atmospheric and other environmental conditions. Prepare for extreme conditions that might be experienced in your area of the country. Before leaving for the field, check the weather forecast using one or more of these options: the local television station, the national weather channel, the local land/marine weather band channel that constantly repeats current and future weather conditions, or computer networks. Extremes of air temperature occur in all parts of the country. The ideal comfort range for humans is between 16 to 32ºC (60 to 90ºF). Hypothermia and Hyperthermia normally occur in temperatures outside this range.

Do nothing that will endanger the public. Use vehicle light bar (flashing lights), consult traffic control plan, and wear PFD or reflective vest. Do not park on bridge unless known to be safe. Do not attempt a wading measurement if there is any doubt that you will be able to safely cross the stream.

Personal Protective Equipment (PPE) as Required and Applicable

Field Work

- Personal Flotation Device (PFD)
- Hard Hat
- Safety Glasses
- Gloves (Work and Chemical Resistant)
- Hip Or Chest Waders With or Without Steeltoes & Shanks
- Steel Toed Boots
- Cell Phone
- Reflective Clothing
- Bridge And Traffic Safety Plan and Equipment
- Trip Plan

Boating

- PFD
- USCG Required Equipment
- Trip/Float Plan

Water Quality

- PFD
- Antibacterial Cleaners
- Safety Glasses
- Gloves (Chemical)
- Ground Fault Interuptors (GFI) for Use With AC Pumps
- Immunizations

Construction

- PFD
- Hard Hat
- Steel-Toed Shoes or Boots
- Safety Glasses
- Gloves
- Hearing Protection
- Climbing Harness
- Ground Fault Interuptors (GFIi) for Use With Power Tools

Appendix E-3. USGS Safety Bulletin (7/21/2010): Personal Flotation Device Selection and Use

U.S. GEOLOGICAL SURVEY (USGS) **SAFETY BULLETIN:** *Personal Flotation Device (PFD) Selection/Use*	**DATE ISSUED:** ***07/21/10***	**PAGE:** ***1 of 3***
AREA AFFECTED: ***Gulf of Mexico (GOM)*** ***Deepwater Horizon Oil Spill*** ***Response/Cleanup Areas***	**OPERATIONAL PERIOD:** ***Remains in effect for the duration of USGS GOM Deepwater Horizon Oil Spill Activities or until superseded by supplemental guidance issued after 7/21/2010.***	

This Safety Bulletin provides clarifying information regarding Personal Floatation Device (PFD) use by U. S. Geological Survey personnel working within the Gulf of Mexico (GOM) Deepwater Horizon Oil Spill affected areas. This message is provided to answer specific questions raised by USGS employees regarding Agency requirements for PFD's. It does not address aviation related PFD use requirements.

Agency personnel must comply with USGS PFD policy requirements [e.g. 445-2-H, Chapter 31, 31.4 (A) (6)] and adhere to any supplemental Agency requirements established in response to GOM Deepwater Oil Spill watercraft related activities. USGS employees responding to any affected GOM area involving watercraft will provide their own PFD according to USGS Policy and supplemental information contained herein. If you are responding to any GOM affected area and do not have a PFD, contact your immediate supervisor and make arrangements to acquire one PRIOR to assignment or mobilization. If USGS employees are assigned to a Vessel of Opportunity (VOO), you are required to wear your own PFD, meeting Agency PFD requirements unless the VOO Operator mandates otherwise. (An example of this would be during extreme weather conditions or working on open decks of larger vessels where the VOO Operator provides a higher level of PFD safety.)

Question 1: Are personnel required to wear a PFD while on-board USGS, Partner, Agency, BP VOO, or any other GOM spill assigned watercraft?

Yes. Although there are some exceptions provided in USCG, DOI and USGS policies, all personnel working aboard GOM Oil Spill assigned watercraft are required to wear a PFD. Such exceptions are typically based on vessel size/class and/or location of personnel on vessel (e.g., on the deck, in enclosed cabin areas, and at the discretion of the watercraft operator at other locations on the vessel. In regards to these exceptions, personnel must follow USGS Watercraft/PFD Policy requirements. USGS employees assigned to VOO Vessels are directed to provide and wear USGS approved PFD's while on-board. In the event of extenuating circumstances, (such as severe weather or working on open decks of larger vessels), VOO Operators may provide crew with higher levels of safety such as a Type I PFD. In that case, USGS employees are directed to adhere to the VOO Operator mandates.

Question 2: Are there any other specific times or activities when I need to wear a PFD?

Yes. Numerous water based activities may be conducted during our work on the GOM Oil Spill and USGS employees must mitigate the hazard of drowning by wearing a PFD while working AROUND THE WATER (e.g., conducting work along shorelines), ABOVE THE WATER (e.g., on watercraft, structures or bridges), and NEAR THE WATER (e.g., wading). You and your Spill Supervisor must evaluate the hazards of any proposed work to ensure that adequate hazard mitigation measures have been implemented. Assistance in evaluating hazards can be gained by contacting your respective spill safety officer, local collateral duty safety coordinator or Bureau Watercraft Safety Program Manager.

CAUTION: NO PFD SHALL BE WORN UNDER ANY TYPE OF OUTER CLOTHING. Wearing any PFD under a Tyvek suit or under other layers of clothing may compromise the floatation of the PFD as well as increase the element of heat stress.

Question 3: Is there a requirement for vessels to have a throwable device on-board a USGS watercraft?

Yes. Any vessel 16 feet and greater (except canoes and kayaks) working the GOM Oil Spill, must carry one throwable Type IV device, (e.g., throw rings, cushions) (* throw-rope bags alone are not a Type IV) ready for immediate deployment. USGS Watercraft Operators and VOO Operators must indicate the throwable device location during a safety briefing before initial vessel departure.

Question 4: Must a PFD be U. S. Coast Guard approved?

Yes. Approved PFD's have an USCG approval number typically provided on the inside shell fabric or material. ALL PFD's used on watercraft for the GOM Oil Spill must have the USCG approval.

Question 5: What does "in good, serviceable condition" really mean?

According to USGS Policy, PFD's must be regularly inspected by the wearer to ensure the unit is in good, serviceable condition. All DOI-USGS PFD's shall be International Orange (or ANSI Hi-Vis Lime-Green) in color). All adjustment straps, buckles and/or zippers should be in good working order. All outer shell and inner shell fabric should be intact without compromise. Approved, retro reflective tape should be intact and securely attached. PFD's that are UV Damaged and faded in color should be immediately replaced. PFD's with frayed or broken straps, broken zippers or buckles should be immediately replaced. PFD's with cracked, faded or torn retro reflective tape should be immediately replaced. Any torn fabric (inner or outer shell) indicates a need for immediate replacement. All of the above inconsistent findings reference a PFD that is NOT in good, serviceable condition.

Question 6: Are there different types of PFD's?

Yes. There are five (5) types of PFD's which provide one of three forms of floatation. The five types include (1) Type I Off-Shore Life Jacket; (2) Type II Near-shore Buoyant Vest; (3) Type III Floatation Aid; (4) Type IV Throwable Device; and (6) Type V Special Use Device. BP requires VOO operators to furnish Type III PFD's to VOO passengers that do not have a PFD. In all cases, each USGS employee will provide their own individual PFD before embarking upon a VOO vessel. VOO Operators have the final authority to mandate wearing a VOO supplied PFD.

Question 7: Are there different sizes of PFD's and is it important to match the size to the wearer?

Yes. Many PFD types come in ranges of sizes from small to XXXL. Depending upon the manufacturer, (e.g., Stearns, Revere, Mustang Survival, etc.) the PFD may have side adjustments for dual sizing. Personnel who wear undersized PFD's tend not to wear the unit correctly (unzipped and/or unlatched) which could lead to displacement from the wearer when water entry is made. A PFD that is too large for the wearer may come off upon water entry. USGS employees required to wear Tyvek style suits should ensure that their PFD fits properly over this outerwear.

Question 8: Where and how do I get a PFD when I've been assigned GOM Oil Spill related tasks involving watercraft operation or water hazards?

If you are mobilized to a known area where there is NO OIL or NO OIL RESIDUE reported, you can use the standard USGS approved PFD that you have been supplied with. *note sizing requirements referenced in Question 7.

If you are mobilized to an area where OIL and/or OIL RESIDUE has been reported or is suspected, USGS employees should consider the following guidelines:

1. Oil and/or Oil residue, once attached to the fabric material of any standard PFD, likely cannot be removed from the fabric by conventional cleaning methods, thus rendering the PFD contaminated. Once the fabric is contaminated, the PFD will be deemed in "unserviceable condition" and must be disposed of properly. <u>OIL and/or OIL residue contaminated PFD's shall not reused, if contamination takes place.</u>
2. USGS employees shall consider the following options for USGS Approved PFD's in areas of GOM OIL and/OIL Residue response:

   a. <u>West Marine/Port Supply</u> is a common USGS vendor that offers a Type V PFD designed for the Oil Worker Profession. The floatation foam panels are dipped in a rubberized coating allowing it to be cleaned easily. This is a <u>Revere Model 280 RT Work Vest</u> with nylon straps and nylon buckles. Oil and/or Oil residue can easily be cleaned with mild soap and water or alcohol swabs.

   b. West Marine/Port Supply Product number is Model # 10967776. Special USGS pricing for this Work Vest (single or multiple vest purchase) is $30.00 each.

   c. The Revere Model 280 RT is manufactured with SOLAS Retro-Reflective Tape that <u>DOES NOT</u> meet the DOI Standards for necessary square inches of tape and MUST be modified in order to meet our Standards.

      - Pre-Cut patches of SOLAS (adhesive backed) Reflective Tape will be available from the Bureau Watercraft Safety Program Manager along with a detailed drawing of where the wearer shall attach the tape in order for the PFD to meet compliance standards.

- It shall be the responsibility of the USGS employee to immediately notify the USGS Spill Supervisor upon modification of this PFD and the USGS Spill Supervisor will maintain records indicating the employee's name and date of modification and Spill Supervisor's name.
- Revere Work Vest Model 280 RT PFD's that are <u>not</u> modified accordingly <u>SHALL NOT</u> be used at any time for any water related USGS activities inside the GOM Oil Spill Area or during any watercraft activities outside the GOM Oil Spill area.
- Revere Work Vest PFD's, <u>once modified</u>, may be used in other watercraft activities outside the GOM Oil Spill areas.

INFLATABLE PFD's:

NOTE: According to USGS Policy, with any inflatable PFD, the wearer MUST conduct minimal semi-annual oral inflation tests, allowing the unit to stand, inflated, for a 24 hour period. Traditional, automatic inflatable PFD's (wafer style) must be annually inflated by submerging in water, leak testing, drying and re-arming. Newer MUSTANG HAMMER (hydrostatic) INFLATOR MECHANISMS are allowed to go 4 years before automatic inflation is required (new USGS Policy). IN ALL CASES, the periodic testing of inflatable PFD's are to be recorded in a "maintenance log" maintained by the wearer and a copy sent to the local CDSPC of the Cost Center. During any Center Safety Audit/Inspection, these maintenance records are to be made readily available to the person(s) conducting the audit/inspection. Failure to comply with this USGS maintenance requirement may result in the wearer forfeiting the continued use of the inflatable PFD.

USGS Policy further states that employees opting to wear any inflatable PFD must undergo documented training exercises before wearing this PFD as a primary device.

Prepared by: Gary L. Hill, USGS Watercraft Safety Program Manager, (727) 803-8747 ext 3004

Appendix E-4. Contacts for Deepwater Horizon Incident Response (current as of 8.06.2010)

Unified and/or Incident Command Specific to Deepwater Horizon Response

- **Houma LA Incident Command** - 1697 Highway 311, Houma LA 70395, Main 985-493-7600; Operations 985-493-3343; mc252decon@gmail.com
- **Mobile AL Incident Command** - One South Water Street Mobile AL 36602, 251-442-1938.
- **Houma Sector, Wildlife Branch Safety Officer -- BP persistent cell phone (985-665-7093)**
- **BP-provided persistent phone for Houma Safety Officer (Glen Stapleton) 985-709 5957**
- **St. Petersburg FL Incident Command –** Fish and Wildlife Research Institute, 100 8th Avenue SE, St. Petersburg FL 33701, 904-755-8008
- **Fish and Wildlife Service (FWS) Safety Officer, Mobile, AL** - Gary Wilson, Gary_Wilson@fws.gov, 503-803-0888; or Brian_Hardison@fws.gov 404-376-3035
- **Fish and Wildlife Service Safety Officer, Houma, LA -** Jack Morrow 985-665-7093 (Unified Command) or 404-408-7226, John_Morrow@fws.gov
- **DOI Occupational Safety and Health Manager -** Barry Noll, barry_noll@ios.doi.gov, Cell: 202-288-6843

Safety Contacts Specific to Deepwater Horizon Response

USGS personnel should contact the Safety point of contacts to obtain current guidance on safety and health issues such as known hazardous conditions. Your local and Regional USGS Safety and Health staff should be able to provide assistance if primary points of contact are not available. Jack Marrow, Fish and Wildlife Service (FWS) Safety Officer, Houma Sector, at 985-665-7093.

- Gary Wilson, Fish and Wildlife Service (FWS) Safety Officer, Mobile Sector, at 503-803-0888.
- Tim Radtke, DOI Industrial Hygienist, 303-638-2623
- Regional Safety Office, if the above are not available

PFD and other Watercraft Safety Issues Specific to Deepwater Horizon Response

- Gary L. Hill, Bureau Watercraft Safety Program Manager, USGS Center for Coastal and Wetland Studies, St. Petersburg FL: 727-803-8747 (land)/ 727-365-0070 (cell); garylhill@usgs.gov.

Online safety and health resources/information Specific to Deepwater Horizon Response

- Joint Incident Command: *http://www.deepwaterhorizonresponse.com/go/doctype/2931/53023*
- DOI: *http://www.doi.gov/deepwaterhorizon/,* and *https://www.smis.doi.gov/smisaux/OilSpillInfo.htm*
- USGS: *http://www.usgs.gov/deepwater_horizon/*, and *http://internalgov/ops/safetynet/oilspillworkers.html*

Waste Disposal and Other Environmental Issues Specific to Deepwater Horizon Response

Waste disposal and other environmental issues should be referred to the following DOI IC staff:

- Doug Mutter, PMB/OEPC - Douglas_Mutter@ios.doi.gov
- Stephen Spencer, PMB/OEPC - Stephen_Spencer@ios.doi.gov Cell: 505-249-2462

Watercraft Decontamination Specific to Deepwater Horizon Response

USGS personnel should notify the IC regarding decontamination services for WSC vessels.

- Mobile IC Decon Center: 985-493-3343, or mc252decon@gmail.com, or Mobile Decon Center 251-455-3010 (for locations of Mobile IC Regon Decon Centers, see *http://www.bpdecon.com*).

Use of Vessels of Opportunity (VOO) Specific to Deepwater Horizon Response

- VOO coordination hotline: 866-279-7983 or 877-847-7470
- Vince Mitchell, VOO Program Coordinator for Houma, LA, 427-773-9983.

Air Monitoring Specific to Deepwater Horizon Response

- Bob Garbe (DOI Occupational Health Program Manager): Robert_Garbe@ios.doi.gov, 303-810-9934 (cell)
- Tim Radtke (DI Industrial Hygienist: Tim_Radtke@ios.doi.gov, 303-638-2623 (cell)
- Houma, LA Incident Command Center (Main Office): 985-493-7600
- Anthony Zepeda USGS Bureau Industrial Hygienist: – azepeda@usgs.gov, 703-648-7551. E-mail or fax (703-648-7592) copies of field form with PID readings.
- Beth Demith, USGS Eastern Region Industrial Hygienist: bdemith@usgs.gov, 703-648-4636

Air–monitoring results specific to the Deepwater Horizon response can be found under the following URLs:

- USEPA - http://www.epa.gov/bpspill/air.html
- Current Air Quality along the Gulf Coast - *http://gulfcoast.airnowtech.org/*

Accident Reporting

All USGS accidents shall be reported within the DOI Safety Management Information System (SMIS) accessible at https://www.smis.doi.gov/ and clicking on "Accident Reporting" tab. Note that under the "Special (Disaster Response Related) Accident Report" selection, the department has added the following category "During the Response to the Gulf Oil Spill." Please mark this category when reporting accidents involving individuals who become ill or are injured during natural disaster relief efforts. On the injury selection page there is an entry button that allows the reporting supervisor to categorize an injury due to the Department's response. This specialized entry page has specific questions on PPE and training. Questions related to SMIS may be directed to the DOI Occupational Safety and Health Manager, 202-288-5549/202-904-0008 or USGS HQ Safety and Health Specialist 703-648-7553.

Appendix. E-5. Instructions for British Petroleum (BP) Site-Specific Training

Directions to complete the BP Site Specific HAZWOPER Training (Post Emergency Spilled Oil Cleanup – HSEREH004) course for the Mississippi Canyon 252 Deepwater Horizon Oil Spill May 20, 2010 edition

Step 1	Log in to: https://www2.virtualtrainingassistant.com/BPPublic/wc.dll?learner~cmenu
Note: Before beginning this course, you may have to remove the Pop-up Blocker from your computer. If so, A. Go to "Tools" B. Select "Pop-up Blocker" C. At Pop-up Blocker Settings," select "Allow Pop-ups"	
Step 2	To Log In, click on: [I'm a New Student] (located to the right of the block for "User ID")
Step 3	You are now on the Edit Profile Screen. A. Enter your name into the "Name" section. B. At "I am a ____ [V]" click on the pull-down menu and select "Gov't Agency Representative." C. At "Wildlife Organization [V]," select/click on the pull-down menu and select the appropriate agency (e.g., **U.S. Fish and Wildlife Service**, USDA Wildlife Services, etc.). D. At "Rehab Location _____," skip this block – leave it blank. E. At "Phone," enter your phone number. F. At "Email Address," provide your email address. G. At" Learner User ID," enter a "**4-8 character unique ID**." Write down your "User ID." H. At "Password," enter a "**4-8 character unique password**" and "Please re-enter password, enter your "**4-8 character unique password.**" Write down your "Password." I. NOTE: If you have not done so: write down both your ID and your password. You may need to use them again. J. Select the [Submit Changes] button.

Step 4	You are on the "My Learner For: [your name] Learning Plan" screen. There is a green bar across the middle of the screen, titled "Course Title." Below that, the yellow bar contains the course title for "Post Emergency Spilled Oil Cleanup..[Start]." A. Select/click on the [Start] option.
Step 5	The next screen is the "My Learner For: [your name] Course Description" and contains a "Start" button located in the upper left side of the screen (under text: "Course Description"). A. Select/click on [Start].
Step 6	The next screen is the "My Learner For: [your name] Lessons for Class" and green and yellow bars are located across the middle of the screen. The yellow bar presents a selection for "Health & Safety CBT...[run]," under the "Action" column, A. Select/click on [Run].

Step 7	The next screen that appears will be: Training Launched" A. From this screen, the program will download a 10.55 MB file for course content
Step 8	A. Wait a few moments to allow the download. B. Maximize the screen to full page. C. Proceed through the 107 slides/pages. D. Upon completion, page/screen #107 will indicate that you should "Please continue to the next lesson, press run, and print completion certificate…"
	Note: In order to complete this action, you will have to close out of the 107 page presentation by selecting/clicking on the red boxed [X] in the upper right corner of the screen

Step 9	At this point, sometimes, the "Sign In" screen will re-appear. A. If it does not appear, proceed to step 10. B. If it does appear: i. Enter your "User ID" ii. Enter your "Password" iii. Select/click on [Enter]

Appendix F. Examples of a Field Form and Analytical Services Request and Chain of Custody Forms Specific to USGS Sampling in Response to the Deepwater Horizon Oil Spill

Appendix F-1. Field Form for DWH Oil-Release Sampling (4 pages)

Appendix F-2 Examples of Analytical Services Request (ASR) and Chain-of-Custody (CoC) Record Forms

F-2A ASR-CoC for Sediment Analyses by TestAmerica Laboratory

F-2B ASR-CoC for Water Analyses by TestAmerica Laboratory

F-2C ASR-CoC for Replicate Sediment Analyses by TestAmerica Laboratory

F-2D ASR-CoC for Blank Water Analyses by TestAmerica Laboratory

Appendix. F-1. Field Form for DWH Oil-Release Sampling

USGS

U. S. GEOLOGICAL SURVEY INCIDENT RESPONSE
WATER QUALITY and SEDIMENT COLLECTION FIELD NOTES NWIS Record No. ______

Station No. ______ Station Name ______ Field ID ______

Sample Date ______ Sample Start Time ______ End Time ______ Mean Time ______ Time Datum ______ (eg. EST, EDT, UTC)

Water Sample Medium: WS WSQ OAQ Sample Type: 9 (regular) 7 (replicate) 2 (blank) 1 (spike)

Sediment Sample Medium: SB SBQ Sample Purpose (71999): (200) Oil Spill Response Site Visit Purpose (50280): (1007) Oil Spill Response

QC Sample Associated with this Environmental Sample (99111) 1) None 10) Blank 30) Replicate 40) Spike 100) More than one type of QA 200)Other

Project No. ______ Project Name DEEPWATER HORIZON OIL SPILL RESPONSE

Photo Ionization Detector						
Time						

FIELD MEASUREMENTS

Property	Parm Code	Method Code	Result	Units	Remark Code	Value Qualifier	Null Value Qualifier	NWIS Result-Level Comments
Temperature, Air	00020	THM04 (thermistor) THM05 (thermometer)		°C				
Temperature, Water	00010	THM01 (thermistor)		°C				
Specific Conductance	00095	SC001 (contacting sensor)		µS/cm				
Dissolved Oxygen	00300	LUMIN (luminescent)		mg/L				
Barometric Pressure	00025			mm Hg				
pH	00400	PROBE (electrode)		units				
Turbidity [see page 4 for codes]								
Other								

WATER SAMPLING INFORMATION

Parameter	Pcode	Value	Information
Sampler Type	84164	3070 Grab Sample (Dip) 4080 peristaltic pump; 8010 Other ______	Depth of water (72199) ______ ft.
Sampling Method	82398	3070 Grab Sample (Dip) 4033 peristaltic 8010 Other ______	Sampling Depth (00003) ______ ft.
Wave Height (feet)	70224		**Oil Products Present:**
Latitude (ddmmss)	91110	N: ______	Pancake(s) Mousse
Longitude (dddmmss)	91111	W: ______	Other
Oil Slick on Water	84176	1 Light Sheen 2 Heavy Sheen 3 Light Slick 4 Heavy Slick	
Observations [Severity Codes: 0=none; 1=mild; 2=moderate; 3=serious; 4=extreme]		Oil-Grease (01300) ___ Detergent Suds (01305) ___ Floating Garbage(01320) ___ Floating Algae Mats (01325) ___ Atm. Odor (01330) ___ Fish Kill (01340) ___ Floating Debris (01345) ___ Turbidity (01350) ___ Oil Slick Coverage on Shore within 25 Feet of Bed Sediment Sample Collection (84177) ___ Floating Vegetation (84178) ___	

SEDIMENT SAMPLING INFORMATION

Latitude (91110): N (ddmmss):

Longitude (91111): W (dddmmss):

SAMPLE ANALYSIS	Collection Apparatus:	Composite Vessel:
	STERILE SPOON SCOOP SPATULA CORER TEFLON METAL PLASTIC BAG	STERILE GLASS METAL PLASTIC TEFLON BOWL BAG LINER

COMPILED BY: ______ CHECKED BY: ______ LOGGED INTO NWIS BY: ______

Date ______ Date ______ Date ______

Station Number ______ Station Name ______ Date ______ Time ______

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SAMPLING CONDITIONS

Bottom: sand marl (shell bed) mud other ___________

Weather: ***sky-*** clear partly cloudy cloudy ***precipitation-*** none light medium heavy rain mist ___________

wind- calm light breeze gusty windy est. wind speed_____ mph ***temperature-*** very cold cool warm hot ___________

Observations and Digital Photograph Records:

North File/image name_____________________ East File/Image name_____________________

South File /Image name_____________________ West File/Image name_____________________

Other File/Image name _____________________ Other File/Image name_____________________

Sample Comments (for NWIS; 300 characters max. note presence absence, oil or tarballs in/on water and sediment):Tarballs, size and approximate coverage in sample collection area, COLLECT ADDITIONAL IMAGES.

WATER QUALITY FIELD PARAMETERS

MAKE_________________________ MODEL_________________________ Barometric pressure = _______ mm Hg

Depth	Time	Temp °C (00010) (Method code THM01)	SC µS/cm (00095) (Method Code SC0001)	DO mg/L (00300) (Method Code LUMIN)	DO sat % (00301)	pH units (00400) (Method Code Probe)	Turbidity _______ (______) _____ (Method Code)	NWIS Record No.

QUALITY-CONTROL INFORMATION

Filter Lot Number

NWIS LOT NUMBERS available at http://wwwnwql.cr.usgs.gov/qas.shtml?filters_home#Q460FLD

Filter Type	Filter Type Fixed-value Parameter Code (50276)	Pore Size (microns)	Manufacturer's Lot Number	NWIS Lot Number (Parameter Code 99206)
Aqua-Prep Disc	10	0.45		

NWIS PRESERVATIVE LOT NUMBERS

7.5N — 7.7N HNO_3 ____________ Exp. Date: ____________ (METALS&CATIONS)

6N HCl ____________ Exp. Date ____________ (Hg)

4.5N H_2SO_4 ______________ Exp. Date: ______________ (NUTRIENTS&DOC)

Conc. H_2SO_4 ____________ Exp. Date: ____________ (COD, PHENOL, O&G)

1:1 HCl______________ Exp. Date: ______________ (VOC)

BLANK WATER LOT NUMBERS

Inorganic (99200) ______________________ 2nd Inorganic (99201) ______________________

Pesticide (99202) ______________________ 2nd Pesticide (99203) ______________________

QC SAMPLES

Sample Type	NWIS Record No.	Sample Type	NWIS Record No.	Sample Type	NWIS Record No.
Equip Blank _____	_____________	Sequential _____	_____________	Trip Blank ________	_____________
Field Blank _____	_____________	Spike _____	_____________	Other ___________	_____________

COMMENTS:____

____

____

REFERENCE LIST FOR CODES USED ON THIS FORM

A complete set of fixed-value codes can be found online at: http://wwwnwis.er.usgs.gov/currentdocs/index.html

Sample Medium Codes
- WS Surface water
- WSQ Surface Water Quality-control sample (Replicate, Spike)
- OAQ Blank Water
- SO Sediment (beach sand or soil)
- SOQ Sediment Replicate

71999 Sample Purpose
- 10 Routine
- XX Spill

Sample Type Code
- 9 Regular
- 7 Replicate
- 2 Blank
- 1 Spike

Time Datum Codes

Time Zone	Std Time Code	UTC Offset (hours)	Daylight Time Code	UTC Offset (hours)
Central	CST	-6	CDT	-5
Eastern	EST	-5	EDT	-4

84164 Sampler Type
- 3070 Grab Sample (Dip)
- 4030 Peristaltic pump
- 8010 Other

Value Qualifiers
- e see field comment
- f sample field preparation problem
- k counts outside the acceptable range

50280 Purpose of Site Visit
- 1001 Fixed frequency, surface-water
- 1099 Other, surface-water

82398 Sampling Method
- 70 Grab Sample (Dip)
- 8010 Other
- 4033 Peristaltic pump

Null-value Qualifiers
- e required equipment not functional or available
- f sample discarded; improper filter used
- o insufficient amount of water
- p sample discarded; improper preservation
- q sample discarded; holding time exceeded
- r sample ruined in preparation

Parameter and method codes for field measurements and turbidity can be found in separate attachments at http://water.usgs.gov/usgs/owq/Forms.html

(Circle appropriate selections)

99100 Blank-solution type
- 10 Inorganic grade (distilled/deionized)
- 40 Pesticide grade (OK for organics and organic carbon)
- 50 Volatile-organic grade (OK for VOCs, organics, and organic carbon)
- 200 Other

99102 Blank-sample type
- 1 Source Solution
- 30 Trip
- 40 Sampler
- 50 Splitter
- 60 Filter
- 70 Preservation
- 80 Equipment (done in non-field environment)
- 90 Ambient
- 100 Field
- 200 Other

99106 Spike-sample type
- 10 Field
- 20 Lab

99107 Spike-solution source
- 10 NWQL

99108 Spike-solution volume, mL _______________

99112 Purpose, Topical QC data
- 1 Routine QC (non-topical)

99101 Source of blank water
- 10 NWQL
- 40 NIST
- 55 Wisconsin Mercury Lab
- 140 EMD Chemicals
- 150 Ricca Chemical Company
- 200 Other

99111 QC sample associated with this environmental sample
- 1 No associated QA data
- 10 Blank
- 30 Replicate Sample
- 40 Spike sample
- 100 More than one type of QA sample
- 200 Other

99105 Replicate-sample type
- 10 Concurrent
- 20 Sequential
- 30 Split
- 40 Split-Concurrent
- 50 Split-Sequential
- 200 Other

A complete set of fixed-value codes can be found online at:
http://wwwnwis.er.usgs.gov/currentdocs/index.html

Appendix. F-2. Examples of Analytical Services Request and Chain of Custody Forms

Appendix. F-2A. ASR-CoC for Sediment Anlayses by TestAmerica Laboratory

U.S. GEOLOGICAL SURVEY – ANALYTICAL SERVICES REQUEST (ASR)
For USGS Contract No. 07CRCN0028 with TestAmerica Laboratories (TAL)

SAMPLE IDENTIFICATION

TAL RECORD NUMBER / SAMPLE TRACKING ID	User Code	Project Account Number	LAB USE ONLY / LABORATORY ID
		G X 1 0 0 0 0 0 E 7 P 8 0 0 0	

STATION ID*	Begin Date (YYYYMMDD)*	Begin Time*	Medium code*	Sample Type
	2 0 1		SO	9

USGS Project Contact Name	End Date (YYYYMMDD)	End Time	USGS Project Contact Email
	2 0 1		@usgs.gov

SITE / SAMPLE / PROJECT INFORMATION (Optional)

State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required
							30 days (USGS contract)

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

TAL Name & Ph.no.	TAL Contact Email	USGS Project Name
Marty Edwards 850-471-6227	Marty.edwards@ testamericainc.com	GOM BP Oil Spill

Station Name or Field ID:

Sample conditions or hazards: Potential Gulf Oil Contamination

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)
Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

Analysis schedule(s)

Note: Analysis schedules must be established and set up in advance with Contract Laboratory

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50137	Solid	O&G HEM, One 8 ounce clear glass for O&G, SVOC, & % Moisture	X						
50228	Solid	% moisture,	X						
50117	Solid	SVOC TCL	X						
50641	Solid	8270 SIM, Alkylated PAHs, 4 ounce clear glass	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:		Date:		Time:	
ASR: Received by:		Date:		Time:	
ASR: Relinquished by:		Date:		Time:	
ASR: Received by:		Date:		Time:	
ASR: Relinquished by:		Date:		Time:	
ASR: Received by:		Date:		Time:	

Appendix F-2B. ASR-CoC for Water Analyses by TestAmerica Laboratory

U.S. GEOLOGICAL SURVEY – ANALYTICAL SERVICES REQUEST (ASR)
For USGS Contract No. 07CRCN0028 with TestAmerica Laboratories (TAL)

SAMPLE IDENTIFICATION

TAL RECORD NUMBER / SAMPLE TRACKING ID	User Code	Project Account	LAB USE ONLY / LABORATORY ID
		G X 1 0 D D 0 0 E 7 P 6 0 0 0	

STATION ID*	Begin Date (YYYYMMDD)*	Begin Time*	Medium code*	Sample Type
	2 0 1		WS	9

USGS Project Contact Name	End Date (YYYYMMDD)	End Time	USGS Project Contact Email
	2 0 1		@usgs.gov

SITE / SAMPLE / PROJECT INFORMATION (Optional)

State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required
							30 days (USGS contract)

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

TAL Name & Ph.no.	TAL Contact Email	**USGS Project Name**
Marty Edwards 850-471-6227	Marty.edwards@ testamericainc.com	GOM BP Oil Spill

Station Name or Field ID:

Sample conditions or hazards: Potential Gulf Oil Contamination

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

Analysis schedule(s)

Note: Analysis schedules must be established and set up in advance with Contract Laboratory

CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50130	U	DRO/ORO extended scan C10-C36, 1 1-L amber	X						
50114	U	GRO, 2x40ml VOA unpreserved	X						
50117	U	SVOC TCL, 2 1-L amber	X						
50109	U	VOC TCL, incl. BTEX; 2x40ml VOA unpreserved	X						
50136	U	HEM, 32 ounce wide mouth clear glass				X			
50068, 50066, 50092	U	TKN, Ammonia (350.1), & TP, 250 ml wide mouth plastic w/H2SO4		X					
50017	U	Metals Scan, 250 ml wide mouth plastic w/HNO3			X				

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:		Date:		Time:	
ASR: Received by:		Date:		Time:	
ASR: Relinquished by:		Date:		Time:	
ASR: Received by:		Date:		Time:	
ASR: Relinquished by:		Date:		Time:	
ASR: Received by:		Date:		Time:	

USGS DODESP Contract ASR, revision 03Oct.10

Appendix F-2C ASR-CoC for Replicate Sediment Analyses by TestAmerica Laboratory

U.S. GEOLOGICAL SURVEY – ANALYTICAL SERVICES REQUEST (ASR)
For USGS Contract No. 07CRCN0028 with TestAmerica Laboratories (TAL)

SAMPLE IDENTIFICATION

TAL RECORD NUMBER / SAMPLE TRACKING ID	User Code	Project Account Number	LAB USE ONLY / LABORATORY ID
		G X 1 0 0 0 0 0 E 7 P 8 0 0 0	

STATION ID*	Begin Date (YYYYMMDD)*	Begin Time*	Medium code*	Sample Type
	2 0 1		SOQ	7

USGS Project Contact Name	End Date (YYYYMMDD)	End Time	USGS Project Contact Email
	2 0 1		@usgs.gov

SITE / SAMPLE / PROJECT INFORMATION (Optional)

State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required
			I	G	A	2	30 days (USGS contract)

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

TAL Name & Ph.no.	TAL Contact Email	USGS Project Name
Marty Edwards 850-471-6227	Marty.edwards@ testamericainc.com	GOM BP Oil Spill

Station Name: **Field ID:**

Sample conditions or hazards: Potential Gulf Oil Contamination

Duplicate or triplicate. **Offset end time by 2 minutes.**

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)
Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

Analysis schedule(s)

Note: Analysis schedules must be established and set up in advance with Contract Laboratory

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50137	Solid	O&G HEM, One 8 ounce clear glass for O&G, SVOC, & % Moisture	X						
50228	Solid	% moisture,	X						
50117	Solid	SVOC TCL	X						
50641	Solid	8270 SIM, Alkylated PAHs, 4 ounce clear glass	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:		Date:		Time:	
ASR: Received by:		Date:		Time:	
ASR: Relinquished by:		Date:		Time:	
ASR: Received by:		Date:		Time:	
ASR: Relinquished by:		Date:		Time:	
ASR: Received by:		Date:		Time:	

Appendix F-2D ASR-CoC for Blank Water Analyses by TestAmerica Laboratory

U.S. GEOLOGICAL SURVEY – ANALYTICAL SERVICES REQUEST (ASR)
For USGS Contract No. 07CRCN0028 with TestAmerica Laboratories (TAL)

SAMPLE IDENTIFICATION

TAL RECORD NUMBER / SAMPLE TRACKING ID	User Code	Project Account	LAB USE ONLY / LABORATORY ID
		G X 1 0 D D 0 0 E 7 P 6 0 0 0	

STATION ID*	Begin Date (YYYYMMDD)*	Begin Time*	Medium code*	Sample Type
	2 0 1		OAQ	2

USGS Project Contact Name	End Date (YYYYMMDD)	End Time	USGS Project Contact Email
	2 0 1		@usgs.gov

SITE / SAMPLE / PROJECT INFORMATION (Optional)

State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required
							30 days (USGS contract)

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

TAL Name & Ph.no.	TAL Contact Email	USGS Project Name
Marty Edwards 850-471-6227	Marty.edwards@ testamericainc.com	GOM BP Oil Spill

Station Name or Field ID:

Sample conditions or hazards: ***Indicate blank type:*** Equipment (Rinsate) Blank ( ); Ambient Blank ( )

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)
Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

Analysis schedule(s)

Note: Analysis schedules must be established and set up in advance with Contract Laboratory

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50130	U	DRO/ORO extended scan C10-C36, 1 1-L amber	X						
50114	U	GRO, 2x40ml VOA unpreserved	X						
50117	U	SVOC TCL, 2 1-L amber	X						
50109	U	VOC TCL, incl. BTEX; 2x40ml VOA unpreserved	X						
50136	U	HEM, 32 ounce wide mouth clear glass				X			
50068, 50066, 50092	U	TKN, Ammonia (350.1), & TP, 250 ml wide mouth plastic w/H2SO4		X					
50017	U	Metals Scan, 250 ml wide mouth plastic w/HNO3			X				

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:		Date:		Time:	
ASR: Received by:		Date:		Time:	
ASR: Relinquished by:		Date:		Time:	
ASR: Received by:		Date:		Time:	
ASR: Relinquished by:		Date:		Time:	
ASR: Received by:		Date:		Time:	

Appendix G. Manufacturer Guidance for Use of Multiparameter Sondes in Oil-Contaminated Waters

Attachment 1. YSI, Inc.: Cleaning, Care, and Deployment of Multiparameter Sondes and Sensors" (Published with permission.)

Recommended Procedures for Use of YSI Water Quality Monitoring Instruments during Oil Spills

Overview: This is a guidance document that is intended for users of YSI 6-Series sondes and handheld instruments in environments impacted by an oil spill. The specific form and impacts of oil in water on YSI's equipment can vary. These guidelines are our best practices for decontaminating and deploying equipment; however, they do not guarantee that sensors or equipment will not be impacted by the oil.

YSI encourages customers to continue to collect data during an oil spill. We ask all users who are working in oil-impacted areas to provide us with feedback on sensor performance and oil conditions, so that we can improve this document. Please send any information to environmental@ysi.com.

For the 2010 Gulf of Mexico oil spill, we will guarantee expedited (3-5 working days) repairs on equipment affected by the oil at our Ohio and Baton Rouge (USA) repair facilities.

Instrument Decontamination

If you have YSI instruments that are contaminated with crude oil, follow this decontamination procedure.

You will need:

- Gloves
- Eye protection (safety glasses with side shields; or goggles)
- Cloths or lint free paper towels
- Replacement brushes and wipers and hex wrench
- Dawn dishwashing liquid and Simple Green (degreasing formula)
- Buckets
- Soft brushes for cleaning

- Pipe cleaners and Q-Tips
- Waste collection container

Procedure:

1. Wear gloves and eye protection when handling items contaminated with crude oil.
2. Spray all contaminated areas with Simple Green to remove as much contaminant as possible.
3. Use soft cloth or paper towels to wipe off excess oil from instruments and sensors.

✓ Be careful when wiping around sensor optics or membranes.

✓ Dispose of oil-saturated cloths according to local regulations *(see note below).*

4. Remove oil-coated wipers and brushes from sensors.
5. Submerge instrument in warm, soapy water.
6. Use soft brush to wipe away remaining oil.
7. Use small brush to clean inside the conductivity cell of the temperature-conductivity probe.
8. Rinse in soapy water.
9. Repeat steps 4-7, several times if necessary. Dispose of oily water according to local regulations for hazardous materials *(see note below).*
10. Do a final rinse in a fresh container of warm soapy water followed by a rinse in clean water.
11. Dry and install new wipers and brushes.

Oil Effects on Specific Water Quality Sensors

The most common problems with sensors will be related to sensors having been in contact with oil. Special attention should be paid to the following sensors in the decontamination and calibration steps.

1. **pH**: The performance of the pH and pH/ORP sensors due to the sensitivity of the glass bulb and reference junction. The pH sensor may require additional cleaning steps and may benefit from elevating the soapy water temperature to (35°C) and adding rapid stirring while soaking.
2. **Depth:** Spray Simple Green into depth port openings and use pipe cleaners to remove any contaminant.
3. **ROX DO Membranes:** The optical probe DO membrane would also benefit from a warmer soapy water temperature. Stirring or gentle sweeps with a soft paint brush across the membrane should aid in cleaning.
4. **Wipers:** Replace all wiper pads on a contaminated unit. Cleaning of EDS or V2-4 bristle type brushes may not be possible. If the bristles remain sticky after cleaning the brush must be replaced.

Instrument Deployment

If you need to prepare YSI instruments to deploy into water contaminated with crude oil, YSI suggests the following procedure. Crude oil is can be thick and sticky, and we cannot guarantee the same performance intervals of our sensor membranes and wipers as under normal conditions.

You will need:

- YSIC-Spray nanopolymer coating
- Disposable plastic bags (Grocery store type)
- Rubber bands
- Light weight line or cord
- Dawn dishwashing liquid
- Buckets
- Soft brushes for cleaning
- Replacement brushes and wipers and hex wrench

Procedure:

1. Apply C-Spray protective coating to exterior of instrument, sensors, and cable, according to the C-Spray instruction sheet.

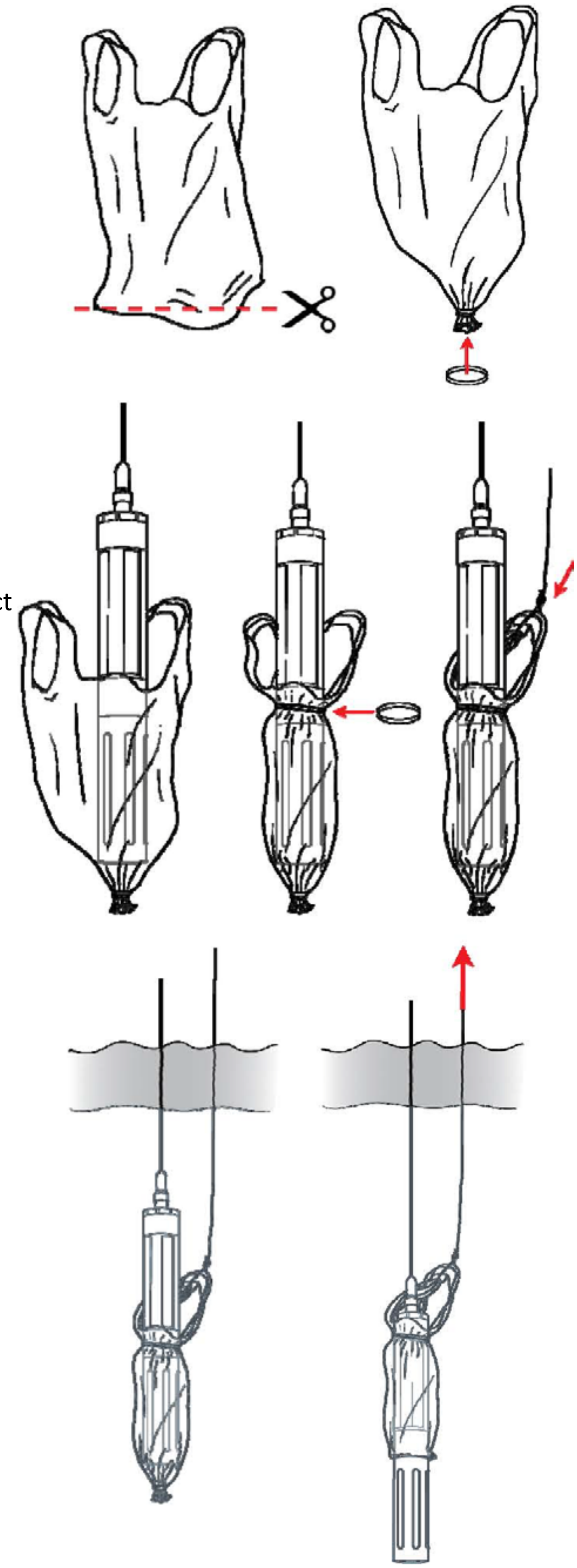
- Recent testing has demonstrated that C-Spray has no negative impacts on YSI optical sensors, ROX membranes or YSI pH probes.
- ROX: Spray on and disperse over membrane and probe face. Allow to sit 5 minutes and wipe off excess with a Kimwipe
- YSI pH: Spray probe body including bulb and junction area. Allow to sit 5 minutes, and shake off excess.
- All other optical sensors: Remove wiper, spray onto probe face and allow tosit for 5 minutes. Remove excess with Kimwipe and polish probe face with dry Kimwipe to remove and streaking. Reinstall wipers.

2. Calibrate the sonde after application like you normally would.
3. For sampling applications, try one of the three following methods in order to deploy a sonde below a surface oil slick without impacting the sensors (see illustrations):

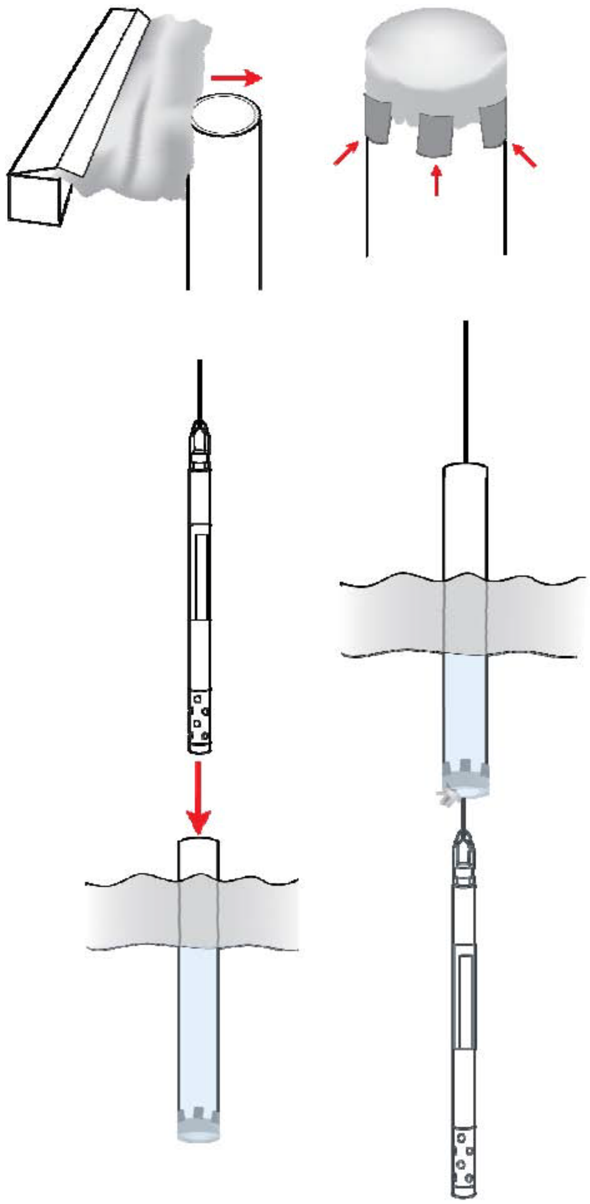
Deployment Methods:

1. Dispersants
    - If the oil film is light you can spray a dispersant onto the water surface before you lower the sonde. Mix “Dawn Dishwashing Soap” 50/50 with tap water in a squirt bottle.

2. Plastic Bag—This method works best with heavier instruments such as YSI 6600, 6920, 6820 sondes
    i. Place sonde in disposable plastic bag.
    ii. Cut off bottom of bag.
    iii. Gather bottom of bag around bottom of sonde/sensor and use a rubber band to close the bag.
    iv. Place second rubber band around the bag and body of sonde, below the bag handles.
    v. Attach a thin, sturdy line to bag handles.
    vi. Deploy sonde vertically and lower it through and below oil layer
    vii. Pull up on the line attached to the bag to pull up the bag and reveal the sensors to the water. You may need to "bounce" the line in order to push it through the opening.
    viii. When finished sampling, use an oar or other object to break apart the oil on the water surface before pulling instrument out of the water
    ix. Rinse instrument in bucket of soapy water. Brush clean.
    x. Remove bag and dispose properly
    xi. If necessary, replace wipers and brushes on instrument
    xii. Repeat process with bag for next deployment



3. PC Tube
    i. Tape one layer of plastic or foil to the bottom a PVC tube long enough to penetrate into water below the surface oil.
    ii. Place sonde or handheld sensor inside PVC tube.
    iii. Deploy sonde and tube vertically and lower it through and below oil layer.
    iv. Drop or push down on sonde or sensor while holding tube steady. The sonde will break through the foil, exposing the sensors to the water.
    v. When finished sampling, pull instrument up through the tube.
    vi. Rinse instrument and tube in bucket of soapy water. Brush clean.
    vii. If necessary, replace wipers and brushes on instrument.



Disposing of Oil-Contaminated Water or Materials

If you generate waste liquids and/or waste materials while cleaning, consult your local waste disposal contractors and waste water treatment authorities, or local regulatory agencies, for requirements associated with proper handling and disposal of these materials.

YSI Oil Decontamination & Deployment Procedures 5-18-2010

1700/1725 Brannum Lane
Yellow Springs, OH
45387 USA
800 765 4974
937 767 7241
937 767 9353 fax
www.ysi.com
employee-owned

Attachment 2. IN SITU, Inc.: Cleaning and Care of Multiparameter Sondes and Sensors

General Cleaning

Rinse the instrument body well, especially if it has been in contact with contaminated media. Level of cleaning for sensors/sonde/cable should be determined based on the level of contaminant exposure that has occurred.

For minor exposure follow general care instructions found in the following documents. Rinsing with warm soapy water and a soft bristle brush should remove moderate amounts of oily contaminants. Use commercial dish detergent for standard cleaning. Simple Green can also be used if more significant exposure occurs. If pH, DO and RDO sensors are removed, OxiClean can be used for sonde body and cable.

Air-dry or wipe with a lint-free tissue. Ultrasonic cleaning is not recommended. Follow all manufacturer recommended calibration procedures after cleaning has been performed.

O-ring Replacement

O-rings should be replaced if the sensors have been exposed to oily contaminants and sensors have to be removed from the ports for cleaning. In all other situations, the o-rings should only be replaced for annual maintenance on the instrument (replace battery compartment o-rings as well).

If the o-rings become damaged to the extent that they no longer provide an effective seal, they should be replaced. If there is any doubt whether the o-rings should be replaced, it is best to err on the side of safety and replace them.

Before replacing o-rings, clean all mating surfaces, including the o-ring grooves. O-rings and lubricant are included in the MP TROLL 9000 Maintenance kit available from In-Situ Inc. or your distributor.

Conductivity Sensor

Check the sensor for decline in sensitivity of the electrodes. If necessary, flush the sensor with water, or swish in a mild detergent solution and rinse with tap water. A swab or soft-bristle brush may be gently used to clean the electrodes. Remember that the electrodes are made of graphite, which is soft and easily damaged.

pH, pH/ORP

If the platinum ORP sensor appears dull or oil-coated, it may be cleaned with a cotton swab dipped in alcohol. Rub gently until the platinum appears shiny. Rinse in clean water.

If a film develops on the glass electrode, or if the sensing glass or junction becomes dehydrated, the response may be sluggish or erratic, or the sensor may fail to calibrate. In these cases, rinse the sensor in 90% isopropyl alcohol and soak in a storage solution (Catalog No. 0065370) for at least an hour or overnight if needed. If this does not restore the response, try soaking in 0.1 M HCl solution for 5-10 minutes, followed by a thorough rinse in clean water. Replace junction and reference filling solution after cleaning.

Typical cleaning: First, rinse the sensor tip under a running cold water faucet or use a gentle jet of clean water from a rinse bottle. If this is not sufficient select the specific method (or combination of methods) from the list below. After any of these methods have been applied, prepare the sensor for subsequent use by rinsing the sensor tip with water followed by an overnight soak in pH 4 buffer. Replacing junction and reference filling solution should be done if contaminant exposure occurs.

Oily or greasy residue: Use warm water with mild soap. Follow with a generous water rinse. Isopropyl alcohol can be used for short soaking periods of up to an hour. Strong solvents (chlorinated solvents, ethers, or any ketones including acetone) must be avoided.

Protein-like material, or slimy films: First clean the sensor in mild soap and warm water. Then soak in a 0.1M HCl solution for 10 minutes and rinse with DI water.

RDO

Cleaning the Sensor

1. Leave the cap on the sensor!
2. Rinse the sensor with warm soapy water and a soft bristle brush.
3. Replace sensing cap as needed.

Note: If any damage to the black layer of the sensor has occurred due to contamination, the sensing cap should be replaced to ensure accurate readings.

Do not use organic solvents—they will damage the foil. Do not remove the cap from the sensor prior to brushing. After cleaning the sensor, perform a 2-point user calibration.

If extensive mineral build-up is present, soak the cap end in vinegar for 15 minutes, then soak in deionized water for 15 minutes.

Cleaning the Optical Window (Perform only if changing the cap)

Remove the cap and gently wipe the window with the supplied lens wipe.

Caution: Do not wet the lens area with water or any solution.

Clark Cell DO

Inspect the sensor and membrane if readings begin to drift.

• Check for discoloration of the electrodes due to silver chloride (AgCl) deposition.

• Inspect the membrane for integrity of the surface, for the presence of algal growth or other contaminants, for crystallization that may indicate a leak in the membrane, and to ensure no air bubbles are trapped under the membrane.

Remove the membrane module and clean the electrodes as follows:

Cathode. Use a polishing strip to buff the platinum cathode until it is shiny. This removes any deposits, increasing the chemically active surface of the electrode for a stronger D.O. signal. **Anode.** If the sensor appears to be excessively discolored from its original matte grey color, clean the anode with ammonia and a soft brush. Extreme discoloration may be removed by soaking for a half-hour in ammonia before cleaning with a brush.

The surface of the anode should appear uniform, but not necessarily mirror-like.

Regular cleaning will prevent pitting of the anode surface, caused by accumulated silver chloride deposition. Severe pitting cannot be removed; the sole remedy is to replace the sensor.

After cleaning, rinse thoroughly and shake to dry. Then fill and attach a new membrane module as follows.

Replacing the Membrane Module

The D.O. sensor performs best in clean water. In environments with high organic content, the membrane performance can be affected ed. Rips, tears and other damage will also affect membrane performance. For best results, replace the membrane when the slope and offset calculated during calibration change dramatically.

The current applied is so small that the electrolyte solution can be expected to last longer than the membrane in most applications

To replace a membrane module:

1. Make sure the area around port 2 is free of dirt and moisture, then remove the sensor. Remove and discard the used membrane module.
2. Inspect and clean the sensor as needed (see above).
3. Fill a new membrane cap with electrolyte and attach it to the sensor.

Refer to “Fill the Membrane Module” in the instrument manual.

4. Install and condition the sensor. Refer to "Condition a Newly Installed Sensor" in the instrument manual.

Remember to condition the sensor for at least 2 hours, preferably 10 hours, before recalibrating with a new membrane. Even with all visible air bubbles removed, a certain amount of gas will be trapped under the membrane. The conditioning period will remove this excess oxygen.

Turbidity

The optical windows of the sensor are made of scratch-resistant sapphire. The optical components are not user-serviceable. Serious mechanical and temperature shock are about the only things that can damage the LED. Follow general cleaning instructions for cleaning oily contaminants from the sonde. If you feel the instrument has suffered such damage, contact In-Situ Technical Support.