

**Assessment Plan for Marsh Edges and Sandy Shorelines**

Prepared by  
the Fish Technical Working Group of the  
Mississippi Canyon 252 Trustees

Version 5.0  
Date August 17, 2011

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DRAFT Marsh Edge/Sandy Shoreline Biota Plan

Mississippi Canyon 252 (MC252)

**Assessment Plan for Marsh Edges and Sandy Shorelines**


Approval of this work plan is for the purposes of obtaining data for the Natural Resource Damage Assessment (NRDA). Parties reserve the right to produce their own independent interpretation and analysis of any data collected pursuant to this work plan.

This plan will be implemented consistent with existing trustee regulations and policies. All applicable state and federal permits must be obtained prior to conducting work.

The trustees have developed a preliminary conceptual model of the Deepwater Horizon (DWH) release, potential pathways and routes of exposure, and potential receptors. This preliminary model has informed the trustees' decision to pursue the studies outlined in the work plan. By signing this work plan and agreeing to fund the work outlined, BP is not endorsing the model articulated in the work plan.

**APPROVED:**


  
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NOAA Trustee Representative:

  
\_\_\_\_\_  
Date

  
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Louisiana Trustee Representative:

  
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Date

  
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BP Representative:

  
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## **Summary**

This document presents a study plan for habitats within the 1-m depth contour adjacent to sandy shorelines and marshes in the north-central Gulf of Mexico (Plan). Investigations under this Plan will be undertaken in the spring and summer, with the potential for additional monitoring if appropriate. The Plan is intended for use in areas near shorelines that were documented to have been impacted by the Mississippi Canyon 252 (MC 252) oil spill and may potentially be exposed to re-suspension of oil. For the purposes of this work plan, “Mississippi Canyon 252 oil” or “MC 252 oil” means oil, dispersant, or oil and dispersant mixtures. The plan specifically addresses the following topics:

- I. Approach and Rationale.** This section describes the overall purpose of and need for a marsh edge and sandy shoreline sampling plan.
- II. Objectives.** This section defines the objectives of the Plan and provides an overview of the sampling approach.
- III. Integration with Other Proposed, Approved, or Pending Work Plans.**
- IV. Iterative Site-selection for Submerged Oil and Marsh Edge Sandy Shoreline Biota Plans.** This section describes the approach to identifying sites for evaluation.
- V. Description of Methods.** This section contains a brief synopsis of the parameters to be measured for the various collection metrics.
- VI. Analyses**
- VII. Data Handling and Coordination among Trustees and RP**
- VIII. References**
- IX. Detailed Standard Operating Protocols (SOPs).** This section sets forth the standard operating procedures (SOPs) for use during site evaluation.
  - A. Benthic cores for collections of infauna and small crustaceans**
  - B. Epibenthic sled for collections of penaeid shrimp**
  - C. Quadrat excavation for sandy shoreline bivalves**
- X. Estimated Cost**
- XI. Appendix 1.** Maps of proposed sampling sites
- XII. Appendix 2.** This section describes the decon procedures for this sampling plan.

### I. Approach and Rationale

Within marine and estuarine landscapes, transition areas between habitat types (“edges”) are known to have extremely high biological production, and serve as key nursery habitats for juvenile fish and mobile invertebrates. Such areas also serve as important foraging habitats for larger species. Shallow water (< 1m depth) habitats adjacent to sandy shorelines and salt marshes (Fig. 1) are the most common habitat edges in estuaries of the northern Gulf of Mexico. Sandy shoreline and marsh edge habitats have been and may continue to be exposed to the release and re-suspension of MC 252 oil. Based on surveys of past oil spills (Ixtoc , Tunnel et al. 1981; Exxon Valdez , Peterson et al. 2003; Persian Gulf-Kuwait Conflict, Gundlach et al. 1993, see



Figure 1. Marsh edge communities are important nursery habitats for fish and mobile invertebrates

also NRC 2003) as well as observations from the MC 252 event (Fig. 2), sandy shores and marsh edge habitats often receive and accumulate oil transported by surface waters. Further exposure may occur when oil that has accumulated in bottom sediments is re-suspended by currents and transported to nearshore areas via tide and wind induced changes in water elevation. Oil deposited higher in the marsh or sandy shorelines may be re-suspended when water floods these areas and transports oil back into nearshore benthic habitats. In addition, these shallow subtidal areas are also the site of intense Response activities, which may result in additional habitat degradation.

Marsh edge habitats are known to be important for numerous economically and ecologically important species of finfish and shellfish. Much of the high production of penaeid shrimp (brown and white) in the Gulf of Mexico can be attributed to marsh edge communities (Minello 1999; Rozas and Minello 2010). The vegetation in this zone provides refuge for penaeid shrimps, crabs and finfishes. Benthic invertebrates living within the sediments (infauna) are key prey items for predators in these habitats (McTigue and Feller 1989; McTigue and Zimmerman 1998). Consequently, contamination or degradation of benthic



Figure 2. Marsh edge habitats oiled in Louisiana, source LDWF, Bay Jimmy - January 7, 2011.

infauna represents a potential pathway for injury to shrimp, crabs and fishes. Previous studies of marsh edge communities in Maryland and Massachusetts have demonstrated both significant and persistent impacts (+ 7 yrs) from heavy oiling (Reddy et al. 2002; Michel et al. 2009) as well as slight adverse effects from low levels of degraded oil in Galveston Bay, Texas (Rozas et al. 2000). Given the importance of this habitat to the northern Gulf of Mexico and indications that exposure may persist for some time, a work plan focused on this habitat is warranted.

Sandy shoreline habitats are also essential for several species of economically and ecologically important species. For example, Florida pompano (*Trachinotus carolinus*) spend the vast majority of their life cycle within the sandy shore zone (Moude and Ross 1981; Wheeler et al. 2002). Numerous species of flounders and sciaenids (red drum, *Sciaenops ocellatus*, spotted seatrout, *Cynoscion nebulosus*) as well as Spanish mackerel (*Scomberomorus maculatus*) utilize these areas for foraging or reproduction. Many of the benthic species that occur within this nearshore zone, including haustoriid amphipods and *Donax* clams, provide a rich food base for these predators and have demonstrated sensitivity to contaminants (Gomez Gesteira and Dauvin 2000).

This workplan focuses specifically on the very shallow water habitats ( $\leq 1$  m depth) adjacent to marsh edges and sandy shorelines. The Plan is designed to document bioavailability of MC252 oil. Sites will be sampled in the summer 2011.

### **II. Objectives**

Determine contaminant levels in benthic infauna and small, epibenthic crustaceans along a continuum of exposure levels to MC252 oil.

### **III. Integration with Other Proposed, Approved or Pending Work Plans.**

The plan is designed as a parallel effort with the 2011 “Submerged Oil Characterization Across Multiple Habitats for Assessment of Persistent Exposures in Nearshore Sediments Deepwater Horizon Oil Spill” (Submerged Oil) sampling plan. The two plans use a coordinated site selection approach. The Submerged Oil plan will sample sediment contaminants at sites selected for inclusion in this plan. Analytical results from the submerged oil plan will dictate the sites at which biological sampling described in this plan will occur.

### **IV. Iterative Site-selection for Submerged Oil and Marsh Edge Sandy Shoreline Biota Plans**

Biota sampling under this workplan will take place at a subset of sites selected for sampling under the concurrently developed Submerged Oil sampling plan. For the Submerged Oil plan, a large group of potential sampling locations was narrowed down to a set of approximately 371 sample sites (Appendix 1, Figures A - G). During summer 2010 the Shoreline TWG surveyed 2789 shoreline points in Louisiana, Mississippi, Alabama and Florida while executing the Shoreline Pre-assessment Plan. These points were designated the “shoreline pre-assessment sites”. In the fall of 2010, they resampled 150 of the LA shoreline pre-assessment sites in marsh which were designated “shoreline assessment sites”. The Submerged Oil plan selects marsh edge and sandy shoreline sites from the Shoreline Pre-assessment and Shoreline Assessment sites. All 150 shoreline assessment sites in marsh habitats were selected as the sample frame from which to select LA marsh edge sites. Marsh edge site selections in MS, AL and FL are outlined below. All 748 shoreline pre-assessment sites with a primary habitat designation of ‘beach’ were selected as the sample frame from which to select sandy shore sites in all four states as outlined below.

The Submerged Oil plan assumes that the level of benthic oil is likely correlated to the level of oiling seen on the shoreline. The potential sampling locations were stratified using shoreline oiling observations. This plan uses 3 data sets to stratify and select most of the 371 sample sites. Marsh sites in LA were stratified using an intersection of assessment data gathered in the Sampling and Monitoring Plan for the Assessment of MC252 Oil Impacts to Coastal Wetland Vegetation in the Gulf of Mexico (Shoreline TWG) and surface oiling observations from Shoreline Cleanup Assessment Technique teams (SCAT data) collected by Response teams. Sandy shoreline sites were stratified using an intersection of subsurface oiling data collected by Response teams and SCAT.

### **A. Location Stratification and Site Selection for the Submerged Oil Sampling Plan**

#### *Marsh Edge*

The pool of sample locations for the marsh edge are comprised of the 150 Shoreline TWG assessment sites sampled in LA in the fall of 2010. These locations were stratified by oiling category by integrating NRDA and Response data.

Shoreline TWG sites were first assigned an oiling category based on both the summer pre-assessment and fall assessment site visits (Tables 1 and 2). Sites with dominant vegetation classifications of “Back Barrier Herbaceous Salt Marsh” or “Mainland Herbaceous Salt Marsh” with height of oil on vegetation greater than 50% during either the summer pre-assessment or the fall assessment visit were assigned an oiling category of H (heavily oiled). Sites with dominant vegetation classifications of “Coastal Mangrove Marsh” or “Delta *Phragmites* Marsh” with height of oil on vegetation greater than 10% during either the summer pre-assessment or the fall assessment site visit were assigned an oiling category of H (heavily oiled). Sites with no oil

observed on the vegetation in either visit were assigned an oiling category of N (no oil observed). All other sites were assigned an oiling category of ML (moderately or lightly oiled).

Locations were assigned a second oiling category by selecting the maximum of all SCAT oiling observations found within a 100 meter radius of the location center point. (Appendix 1 Figures H). The maximum SCAT oiling layer was dated 24 April 2011 and 11 November 2010 for the Houma and Mobile sectors respectively. Oiling categories were H (heavy), M (moderate), L(light), VL (very light) or N (no oil observed). The 100m buffer was used because the width of the sampling sites extends 100m on each side of the site center points.

The final oiling category for the locations was calculated as the maximum of either the category determined using NRDA pre-assessment/assessment data or the SCAT data (Table 3). Final oiling categories were H (heavily oiled), ML (moderately, lightly, or very lightly oiled) and N (no oil observed).

The final sampling sites were derived by removing all locations with a center point within 100m of an SAV bed to avoid redundancy. This habitat is being assessed by another TWG. The SAV map layers for this analysis were provided by the Water Resources Division of the National Park Service. The final number of sites in the marsh edge sample frame for LA was 130 sites.

Site selection for marsh edge sites in Mississippi and Alabama is outlined in Addendum to Sampling and Monitoring Plan for the Assessment of MC252 Oil Impacts to Coastal Wetland Vegetation in the Gulf of Mexico put together by Mississippi Department of Environmental Quality and Alabama Department of Conservation and Natural Resources. In Florida, marsh edge sites will be selected from within each of the Florida Department of Environmental Protection's proposed salt marsh evaluation areas. There are 11 proposed salt marsh evaluation areas and 2 - 3 sites will be selected from each. All marsh edge sites in Mississippi, Alabama and Florida will be sampled. The total number of sites to be sampled for each oiling category is presented in Table 5.

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Table 1. Oiling categories applied to Shoreline TWG “Back Barrier Herbaceous Salt Marsh” and “Mainland Herbaceous Salt Marsh” assessment sites in Louisiana for use as marsh edge sites in proposed plan where the cell number is the number of sites and the cell color is the oiling category (red = heavy, orange = moderate/light/very light, and blue = no oil observed).

|  |          | Pre-Assessment Oil Height on Vegetation |        |         |         |          | Row Sums |
|--|----------|---|--------|---------|---------|----------|----------|
|  |          | 0                                       | >0-10% | 10%-50% | 50%-90% | 90%-100% |          |
| Assessment<br>Oil Height<br>on<br>Vegetation | 0        | 18                                      | 12     | 10      | 9       | 10       | 59       |
|  | >0-10%   | 0                                       | 0      | 0       | 0       | 0        | 0        |
|  | 10%-50%  | 0                                       | 2      | 9       | 4       | 2        | 17       |
|  | 50%-90%  | 0                                       | 0      | 1       | 2       | 3        | 6        |
|  | 90%-100% | 0                                       | 0      | 5       | 4       | 2        | 11       |
| Column Sums                                  |          | 18                                      | 14     | 25      | 19      | 17       | 93       |

Table 2. Oiling categories applied to Shoreline TWG “Coastal Mangrove Marsh” and “Delta *Phragmites* Marsh” assessment sites in Louisiana for use as marsh edge sites in proposed plan where the cell number is the number of sites and the cell color is the oiling category (red = heavy, orange = moderate/light/very light, and blue = no oil observed).

|  |          | Pre-Assessment Oil Height on Vegetation |        |         |         |          | Totals |
|--|----------|---|--------|---------|---------|----------|--------|
|  |          | 0                                       | >0-10% | 10%-50% | 50%-90% | 90%-100% |        |
| Assessment<br>Oil Height<br>on<br>Vegetation | 0        | 12                                      | 12     | 12      | 3       | 0        | 39     |
|  | >0-10%   | 0                                       | 0      | 0       | 0       | 0        | 0      |
|  | 10%-50%  | 1                                       | 2      | 1       | 1       | 2        | 7      |
|  | 50%-90%  | 1                                       | 0      | 3       | 2       | 2        | 8      |
|  | 90%-100% | 0                                       | 0      | 1       | 1       | 1        | 3      |
| Totals                                       |          | 14                                      | 14     | 17      | 7       | 5        | 57     |



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Table 3. Final oiling categories applied to Shoreline TWG marsh assessment sites in Louisiana for use as marsh edge sites in proposed plan where the cell number is the number of sites and the cell color is the oiling category (red = heavy, orange = moderate/light/very light, and blue = no oil observed).

|   |        | Maximum Oiling of All Maximum Oiling<br>SCAT Segments within 100 meter buffer |    |    |    |    |     | Totals |
|---|--------|---|----|----|----|----|-----|--------|
|   |        | H   | M  | L  | VL | N  | NA* |        |
| Pre-Assessment & Assessment Oil<br>Height on Vegetation | H      | 21  | 20 | 13 | 2  | 11 | 8   | 75     |
|   | ML     | 8   | 9  | 7  | 3  | 10 | 8   | 45     |
|   | N      | 1   | 3  | 5  | 4  | 13 | 4   | 30     |
|   | Totals | 30  | 32 | 25 | 9  | 34 | 20  | 150    |

\* NA = not available

### Sandy Shoreline

The pool of sample locations for the sandy shoreline sites are comprised of the 748 Shoreline TWG pre-assessment sites sampled in LA, MS, AL and FL in the fall of 2010 with a primary habitat designation of 'beach'. These locations were stratified by oiling category by integrating NRDA and response data.

Locations were first assigned an oiling category based on SCAT *surface* oiling observations by selecting the maximum of all SCAT oiling observations found within a 100 meter radius of the location center point. (Appendix 1 Figure H). The maximum SCAT oiling layer was dated 24 April 2011 and 11 November 2010 for the Houma and Mobile sectors respectively. Oiling categories were H (heavy), M (moderate), L(light), VL (very light) or N (no oil observed).

Locations were assigned a second oiling category by selecting the maximum *subsurface* shoreline oiling category found within a 100m radius of the location center point (Appendix 1 Figure I). This subsurface data was generated by the Response effort. The pit/trench oiling layer was dated 24 April 2011 and 19 April 2011 for the Houma and Mobile sectors respectively. Oiling categories were H (heavy), M (moderate), L(light), VL (very light) or N (no oil observed).

The final oiling category was calculated as the maximum of either surface or the subsurface category for each location (Table 4). Final oiling categories were H (heavily oiled), ML (moderately, lightly, or very lightly oiled) and N (no oil observed).

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Sandy shoreline sampling sites for all states (Louisiana, Mississippi, Alabama, and Florida) were probabilistically selected from these 748 locations using the generalized random tessellation stratified (GRTS) spatially balanced sampling procedure stratified by oiling category.

All 748 locations were assigned a GRTS value. Sampling sites were selected for each strata/state combination in the GRTS value order. The number of sites selected is presented in Table 5. Proposed initial sample locations are presented in Appendix 1 Figures A - I. In all strata, if a site is not accessible or cannot be sampled safely, the next site from the GRTS list will be sampled instead. The skipped site will be labeled as inaccessible with missing data.

Trustees, in consultation with BP, may also select other sites for additional sampling outside the scope described above.

Table 4. Final oiling categories applied to Shoreline TWG Beach pre-assessment sites in Louisiana for use as sandy shoreline sites in proposed plan where the cell number is the number of sites and the cell color is the oiling category (red = heavy, orange = moderate/light/very light, and blue = no oil observed).

|  |        | Maximum Oiling of All Pit/Trenches within 100 meter buffer |    |     |    |     |     | Totals |
|--|--------|--|----|-----|----|-----|-----|--------|
|  |        | H  | M  | L   | VL | N   | NA* |        |
| Maximum Oiling of All Maximum Oiling SCAT Segments within 100 meter buffer | H      | 5  | 33 | 104 | 31 | 50  | 0   | 223    |
|  | M      | 0  | 4  | 7   | 4  | 15  | 0   | 30     |
|  | L      | 2  | 12 | 72  | 21 | 137 | 4   | 248    |
|  | VL     | 0  | 1  | 3   | 1  | 20  | 0   | 25     |
|  | N      | 1  | 1  | 50  | 11 | 54  | 0   | 117    |
|  | NA     | 0  | 5  | 49  | 5  | 46  | 0   | 105    |
|  | Totals | 8  | 56 | 285 | 73 | 322 | 4   | 748    |

\* NA = not available

Table 5. Number of sites actually sampled for Submerged Oil work plan in 2011.

| <b>State</b> | <b>Oiling Category</b> | <b># Marsh Edge Sites</b> | <b># Sandy Shoreline Sites</b> |
|--------------|------------------------|---------------------------|--------------------------------|
| LA           | H                      | 66                        | 19                             |
|              | ML                     | 42                        | 10                             |
|              | N                      | 15                        | 6                              |
|              | <b>Total</b>           | <b>123</b>                | <b>35</b>                      |
| MS           | H                      | 5                         | 6                              |
|              | ML                     | 4                         | 7                              |
|              | N                      | 8                         | 2                              |
|              | <b>Total</b>           | <b>17</b>                 | <b>15</b>                      |
| AL           | H                      | 1                         | 16                             |
|              | ML                     | 7                         | 12                             |
|              | N                      | 9                         | 16                             |
|              | <b>Total</b>           | <b>17</b>                 | <b>44</b>                      |
| FL           | H                      | not categorized           | 7                              |
|              | ML                     | not categorized           | 23                             |
|              | N                      | not categorized           | 27                             |
|              | <b>Total</b>           | <b>23</b>                 | <b>57</b>                      |
| All          | H                      | 72                        | 48                             |
|              | ML                     | 53                        | 52                             |
|              | N                      | 32                        | 51                             |
|              | NA                     | 23                        | 0                              |
|              | <b>Total</b>           | <b>180</b>                | <b>151</b>                     |

**B. Site Selection for Marsh Edge Sandy Shoreline Biota Sampling**

This plan is tightly linked to the 2011 Submerged Oil sampling plan (“Nearshore Ephemeral Data Collections: Submerged Oil Characterization Across Multiple Habitats”) and relies on TPH screening data generated by that effort as one criteria for triggering biota sampling, covered under this plan. As TPH results are made available, sites will be categorized as A, B, C or D.

- A – oil is present in excess of naturally-occurring organic matter (NOM)
- B – oil is present in comparable abundance to NOM
- C – trace oil is present but is exceeded by NOM

- D – no obvious oil, overwhelmingly comprised of NOM

In addition to TPH data, other criteria may be used, including distance from shore, sample horizon within the core, and habitat to select sites for biota sampling. While selection is an iterative process and must consider the data as it becomes available, Table 6 lays out the initial plan for triggering sites for biota sampling.

Table 6. Submerged Oil sample types to trigger biota sampling.

|                     | Habitat | Distance from shore (m) |        |
|---------------------|---------|-------------------------|--------|
| Sample horizon (cm) |         | 0-20                    | 20-500 |
| 0-2                 | Marsh   | Yes                     | Yes    |
|                     | Beach   | Yes                     | Yes    |
| 2-4                 | Marsh   | Yes                     | No     |
|                     | Beach   | No                      | No     |

Sample sites where the sediment chemistry results are categorized as A, B or C and the table above indicates that the sample type is initially identified as a trigger for biological sampling of the site. This initial plan takes into account the specific species of biota targeted with regard to the depth of the Submerged Oil sample, and how far from shore the sediment sample was collected.

In addition to sampling all triggered A/B/C sites, a number of sites categorized as D will also be sampled. The number of D sites to be sampled will be either 25% of the total number sites characterized as A/B/C or a minimum of 30 beach and 30 marsh sites, whichever is greater.

#### *Selection of Sites with a TPH screening value of D*

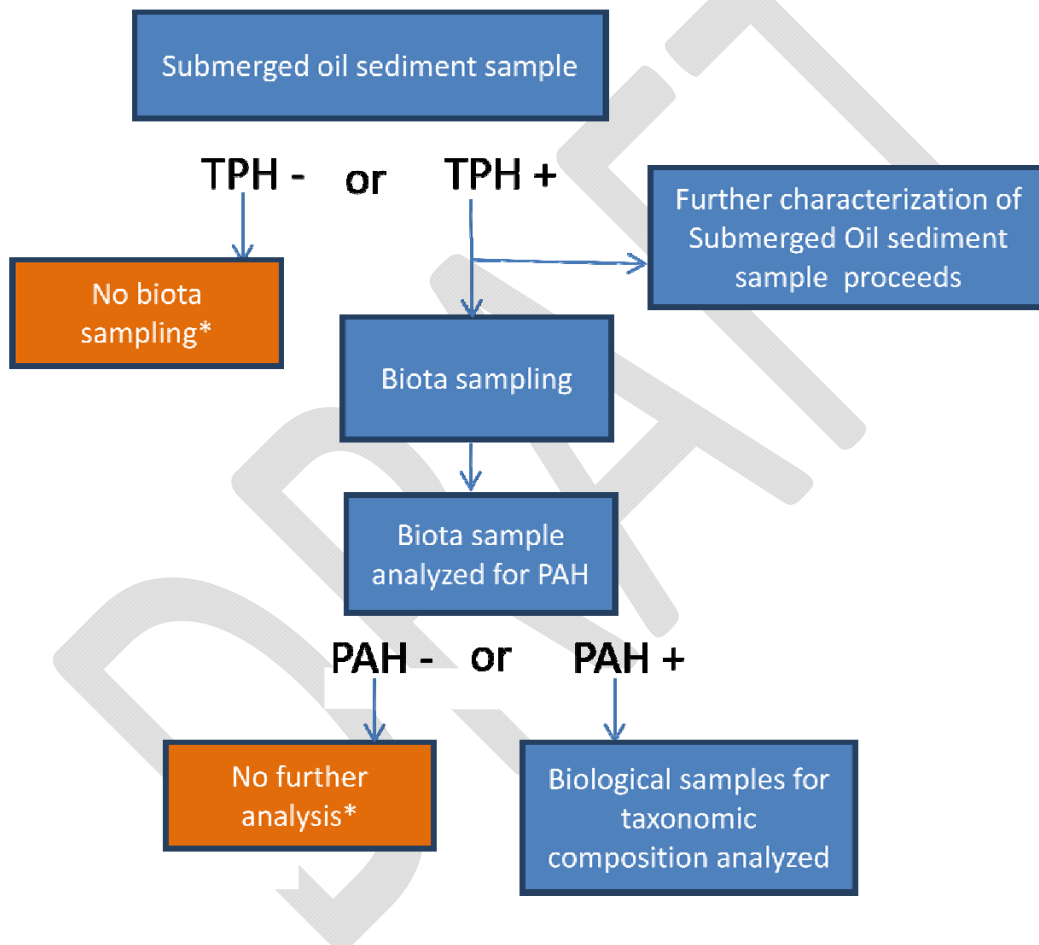
TPH data are delivered from the lab in batches which affects how D sites will be selected. If the total number of D sites to sample from a batch is equal to the number of D sites available for the given batch, then all D sites will be selected. If the total number of D sites to sample is greater than the number of D sites available for the given batch, then all D sites will be selected and the number of D sites left to select will be carried over to the next batch. If the total number of D sites available divided by the total number of D sites to sample is less than 2, then a simple random sample of the D sites will be drawn and these sites selected. Otherwise, the D sites will be ranked by longitude and a systematic sample will be drawn with a random starting point. The selection of D sites will be completed every other time a batch of TPH screening results are delivered (anticipated as once weekly) and will result in a sample of D sites equal to 25% of the A, B, C sites sampled. For example, if a group of results are available for 100 sites and 40 sites

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are identified as A, B or C and 60 sites are identified as D, the 40 A, B or C sites would be selected for sampling and 10 D sites would need to be selected. Sixty D sites divided by 10 D sites to sample equals 6, so the sites would be ranked by longitude; the first site selected would be a random number between 1 and 6, and every 6<sup>th</sup> site thereafter would be selected (e.g. if random start is 3, then sample 3, 9, 15,...). This selection as sample results come in and the ranking by longitude will ensure that the sampling of D sites have adequate temporal and spatial distribution. If 30 marsh and 30 beach sites have not been selected when all batches have been completed then the additional sites to total 60 will be selected randomly from the remaining unselected D sites.

Figure 3. Summary diagram of the major elements in the decision process for Submerged Oil samples and biota sampling and analyses. TPH + means that the Submerged Oil sediment sample is placed in category A (oil is present in excess of naturally-occurring organic matter [NOM]), B (oil is present in comparable abundance to NOM), or C (trace oil is present but is exceeded by NOM), whereas TPH – indicates the sample is reported in category D. PAH + means that the biota tissue sample is placed in category 1 (MC-252 clearly present; oil consistent with MC-252), 2 (MC-252 likely present), or 3 (MC-252 possibly present), whereas PAH – indicates the sample is reported in category 4 (no obvious presence of MC-252).



\* Unless the site is selected for sampling and/or analysis by the Trustees.

### **V. Description of Methods**

Detailed descriptions of field collection procedures as well as overviews of the lab methodologies for each metric are provided in section IX (SOPs). Here, a brief overview of each metric to be assessed is given.

The Plan will focus on sampling benthic invertebrates and epibenthic crustaceans for tissue exposure. Specifically, the marsh edge component of the study will target penaeid shrimp, infaunal polychaetes, and amphipods. Once a marsh-edge sampling site is chosen, up to 28, 10-cm-diameter cores will be collected. The first three cores collected will be preserved for taxonomic identification to provide data about the communities sampled. The remaining cores, no more than 25, will be used to obtain a composite tissue sample of soft-bodied macrofauna, i.e., polychaetes, as the primary taxon and an additional composite tissue sample of amphipods as the secondary taxon for contaminant analysis. Composite tissue samples are to be comprised of only one taxon, either the primary or the secondary. It is likely that not all sites will produce sufficient biomass for tissue analysis for the primary taxonomic group. In these cases, the secondary taxonomic group may be analyzed. The samples may be rinsed of any debris using clean de-ionized water (as sorting will be conducted in the lab).

In addition to benthic infauna, epibenthic (living or feeding on the sediment surface) crustaceans will be collected for contaminant analysis and for taxonomic identification. A small stainless steel or aluminum epibenthic sled trawl, fitted with a 0.5 mm mesh plankton net should be pulled by hand for 100 m parallel to the marsh edge. Starting locations for the sled tows should be chosen so that no tows will overlap and all tows will be contained within the 200m site. One trawl pull sample will be preserved for taxonomic identification. At a minimum, one additional trawl pull will be performed and up to five additional replicate tows will be performed until the target amount of 10 g wet weight is collected. The samples may be rinsed with clean site water to remove any debris or sediment. Trawl samples will be placed in separate sample containers in the field and transported to the lab for further processing. In the lab, penaeid shrimp will be placed into their own group and identified to species. Identification of small crustaceans captured in the trawl, and separation into major taxonomic groups, specifically amphipods and isopods, will occur in the lab, as well as Blue crabs (*Callinectes sapidus*), which will be separated for potential analysis under other work plans. Penaeid shrimp will be the target crustacean for marsh edge samples. All other organisms will be archived frozen.

Cores will be collected from the sandy shoreline sites using the same approach described above for marsh edge sites. Up to 28 cores will be collected for small epibenthic crustaceans.

The primary taxonomic group targeted will be haustorid amphipods. The secondary taxonomic group for the sandy shoreline component of this plan (collected at all sites but analyzed only if the primary taxonomic group is not collected in sufficient quantity) will be bivalves, primarily the Coquina clam, *Donax variabilis*. Bivalves will be collected by inserting a 0.25 m<sup>2</sup> metal quadrat to a depth of 10 cm in the shallow-water, sandy shoreline environment and excavating the top 5 – 10 cm of the sediment with a shovel. Material from within the quadrat will be sieved through a 2.0 mm sieve in the field. The process will be repeated up to 8 times or until 10 g wet weight (approximately 10 unshucked *Donax*) is collected from the composited samples from multiple quadrats (SOP C). The samples may be rinsed with clean site water to remove any debris or sediment.

Cores should be collected along the marsh edge or sandy shoreline within 5m of shore and contained within the 200m wide site. Salinity, temperature, dissolved oxygen, and depth should be measured at each site. All benthic invertebrate cores will be individually capped, labeled and packaged for transit in the field. Samples will be sent to a lab for processing. In the lab, each core should be sieved using a 0.5 mm sieve. After sieving, the first three cores should be preserved in 10% buffered Formalin/rose Bengal solution and within 48 hrs transferred to 70% ethanol to archive for possible taxonomic identification. At a minimum the next nine remaining cores will be sieved and sorted into primary and secondary taxa, either floated and decanted, or picked. Blue crabs will also be separated for potential analysis under other work plans. The samples may be rinsed of any debris using clean de-ionized water (as sorting will be conducted in the lab). All samples will be frozen either for chemical analysis or for archive. Any remaining non-target organisms will be frozen in a separate container and archived. To achieve sufficient biomass for analysis (10g), the cores should be processed in the order collected and pooled into a single, well mixed, composited sample until the target biomass is reached in well mixed composited samples from multiple cores (SOP A). Cores that remain after the target tissue biomass is obtained from both marsh edge and sandy shoreline sites will undergo a minimal processing procedure of sieving to reduce the sample volume and the resulting sieved material (organic and inorganic) will be composited into one sample from each site and archived frozen.

All samples collected pursuant to this Plan will be submitted to laboratories that are operated in a manner that is consistent with the guidelines of the Analytical Quality Assurance Plan for the Mississippi Canyon (Deepwater Horizon) Natural Resource Damage Assessment (version 2.2) for chemical analysis. For Taxonomic processing and archiving, samples will go to labs approved by the trustees and BP.



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Table 7. Summary of metrics

| <b>Parameter</b>       | <b>Metric</b>  | <b>SOP</b> | <b>Sampling device</b>         | <b>Frequency</b> | <b>Analyses</b>   | <b>Goal</b>     |
|------------------------|----------------|------------|--------------------------------|------------------|-------------------|-----------------|
| Benthic Macro-infauna  | Tissue samples | A          | Core tube samples at each site | Once in summer   | According to AQAP | Assess Exposure |
| Epibenthic crustaceans | Tissue samples | B          | Epibenthic sled trawl          | Once in summer   | According to AQAP | Assess Exposure |

Table 8. Primary and secondary taxa targeted for tissue analyses.

| <b>Habitat</b>  | <b>Functional Group</b> | <b>Primary Taxon</b> | <b>Collection Method</b> | <b>SOP</b> | <b>Secondary taxa</b>      | <b>Collection Method</b> | <b>SOP</b> |
|-----------------|-------------------------|----------------------|--------------------------|------------|----------------------------|--------------------------|------------|
| Marsh edge      | Epibenthic crustaceans  | Penaeid shrimp       | Epibenthic sled          | B          | Amphipods, Isopods, mysids | Epibenthic sled          | B          |
|                 | Infauna                 | Polychaetes          | Cores                    | A          | Amphipods                  | Cores                    | A          |
| Sandy shoreline | Epifaunal Invertebrates | Haustorid amphipods  | Cores                    | A          | Bivalves                   | Quadrat excavation       | C          |

## **VI. Analyses**

After collection and processing, the biological samples collected for tissue analysis, either the primary taxa or the secondary taxa from each site sampled, will be analyzed using the GCMS methods for PAH analyses (Figure 12). PAH results for select tissue samples may trigger analysis of the corresponding taxonomy samples. Tissue samples categorized as a 1, 2, or 3 will trigger taxonomic analysis. A percentage of Category 4 samples will also be analyzed.

## **VII. Data Handling, Sharing and Coordination among Trustees and RP**

### **A. Data Handling and Sharing**

MC 252 NRDA chain-of-custody procedures will be observed at all times for all NRDA samples. All samples will be transferred with appropriate chain-of-custody forms.

All field and laboratory data will be collected, managed and stored in accordance with US EPA Good Laboratory Practice regulations (GLPs) to the extent practicable. In accordance with GLPs, all field and laboratory work, and the calibration and use of field and laboratory equipment (scales, hand held GPS devices, etc.) shall be conducted using written Standard Operating Procedures (SOPs). The appropriate training on particular equipment or in the conduct of specific field studies for all personnel involved with the project shall be documented, and those records kept on file by the implementing entity for the duration of this project. All data (including electronically archived data), and original data sheets or electronic files, must be promptly transferred to USFWS, with copies to BP or their representative, and the Louisiana Oil Spill Coordinator's Office (LOSCO). All samples will be sent to NRDA approved laboratories.

Each laboratory shall simultaneously deliver raw data, including all necessary metadata, generated as part of this work plan as a Laboratory Analytical Data Package (LADP) to the trustee Data Management Team (DMT), the Louisiana Oil Spill Coordinator's Office (LOSCO) on behalf of the State of Louisiana, and to BP (or Cardno ENTRIX on behalf of BP). The electronic data deliverable (EDD) spreadsheet with pre-validated analytical results, which is a component of the complete LADP, will also be delivered to the secure [REDACTED] site maintained by the trustees' Data Management Team (DMT). Any preliminary data distributed to the DMT shall also be distributed to LOSCO and to BP (or Cardno ENTRIX on behalf of BP). Thereafter, the DMT will validate and perform quality assurance/quality control (QA/QC) procedures on the LADP consistent with the authorized Analytical Quality Assurance Plan, after which time the validated/QA/QC'd data shall be made available simultaneously to all trustees

and BP (or Cardno ENTRIX on behalf of BP). Any questions raised on the validated/QA/QC results shall be handled per the procedures in the Analytical Quality Assurance Plan and the issue and results shall be distributed to all parties. In the interest of maintaining one consistent data set for use by all parties, only the validated/QA/QC'd data set released by the DMT shall be considered the consensus data set. In order to ensure reliability of the consensus data and full review by the parties, no party shall publish consensus data until 7 days after such data have been made available to the parties. Also, the LADP shall not be released by the DMT, LOSCO, BP or Cardno ENTRIX prior to validation/QA/QC absent a showing of critical operational need. Should any party show a critical operational need for data prior to validation/QA/QC, any released data will be clearly marked "preliminary/unvalidated" and will be made available equally to all trustees and to BP (or Cardno ENTRIX on behalf of BP).

## **B. Scheduling Field Efforts**

A good faith effort will be made to conduct all study elements that fall within the BP safety policy with cooperative, integrated teams of observers and field technicians. Where study elements fall outside of BP safety policy, teams will be integrated to the extent possible. A weekly schedule describing the number of teams and their general area of operation will be prepared by the Trustees' project coordinator and provided to BP or its designated contractor, and for sampling within Louisiana, to a Louisiana representative, two weeks in advance. The Louisiana representative and BP or its designated representative will provide the Trustees' project coordinator and other responsible Trustee agencies a list of the field efforts in which it will participate at least 10 days prior to the beginning of the designated week. If these agreed-upon notification and communication procedures are followed, yet circumstances prevent Louisiana or BP or its designated representative from participating in a field effort, the field effort may be carried out without Louisiana or BP or its designated representative's participation.

*Field data transfer:* Prior to concluding each field day, integrated teams will share (1) all data sheets (2) all official photographs, and (3) the official GPS track log using methods developed as part of the Beached Bird Survey (Study #1) effort. Louisiana representatives will be invited to participate in any field work conducted within that state.

In the event that the data is collected without a BP representative or the Louisiana representative present, those data (data sheets, track logs, photos, any and all data collected as part of the field effort) will be e-mailed to a designated BP representative, or Louisiana representative as needed, within 3 days of its being collected. In the event that transfer of such data is delayed due to equipment malfunction or other reasons, it will be emailed to the missing representative(s) as soon as practicable.

**C. Durable Equipment** - All durable equipment (such as cameras, GPS, etc.) purchased by BP for this study will be returned to BP or their designated representatives at the conclusion of their use for this study, unless otherwise agreed.

**D. Health & Safety:**

Field teams will comply with existing training and safety protocols as applicable to operations. Prior to commencement of field activities, BP and the Trustees will agree upon a person or persons to whom study participants may report any safety concerns. Such person(s) will take action to address and resolve reported concerns.

- The team leader and field crew parties should have completed all applicable health and safety training as directed by NOAA or state agency oil spill policy.
- All field team members must complete the NOAA safety training and documentation requirements as set forth in “Safety Requirements for All Personnel Working on NOAA-led NRDA teams for MS Canyon 252 Incident” (NOAA Safety Documentation Requirements.doc).
- All field team members should read all of the documents in the Safety directory on the case’s [REDACTED] site. Exception: if field activities do not include use of or helicopter, then familiarity with the safety documents for these vehicles is not required.
- Each field team must submit a plan, not later than the night prior to going into the field. This plan must specify:
  - The team leader;
  - Names of all team members;
  - The sampling location(s)-- please use the NOAA NRDA grid coordinates;
  - What kind of sampling they are doing;
  - Expected arrival time at sampling area (daily);
  - Expected departure from sampling area (daily);
  - Team deployment date;
  - Team return date.

This information may be reported in one of two ways:

1. Fill out the Excel spreadsheet “Team Member Information Form – Excel.xls” and send it to [REDACTED]. Please use one tab for each team.
  2. If you cannot submit this spreadsheet electronically, you can call in and report the information using this number: [REDACTED]
- Field teams must adhere to all procedures set forth in the MC 252 Site Safety Plan (“NRDA MC 252 Site Safety Plan\_5.13.10.pdf”).
  - Any field team member operating an all-terrain vehicle (ATV) for land-based site access will be required to complete a 4-hour ATV driver safety course.

- Any encounters with protected species are to be reported to the appropriate authorities. Field crews are also to follow any guidance or Best Management Practices (BMPs) provided by federal, state, or tribal historic preservation officers to avoid potential impacts to protected species or to historic or cultural resources. Any affected historic or cultural resources are to be reported to the appropriate authorities as described in such guidance or BMPs.

### **Vessel requirements:**

Agency-owned and operated vessels, vessels chartered by Trustee agencies or their representatives, or vessels provided through BP's transitional support vessel (TSV) program or chartered directly by BP or its representatives, will be utilized for field work associated with this plan. The vessels will be outfitted with the necessary equipment for deploying core sampling equipment. Vessels will be selected on a case-by-case basis considering site access logistical requirements.

### **E. Adaptive Management of Field Efforts**

BPs continued participation in, and funding of this cooperative Plan, or any of its specific tasks, is contingent upon the results of adaptive management meetings which will occur at approximately 30 day intervals. During these meetings adherence to SOPs will be reviewed and discussed.

## **VIII. References**

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## IX. SOPs

*All materials associated with the collection or analysis of samples under these protocols or pursuant to any approved work plan, except those consumed as a consequence of the applicable sampling or analytical process, must be retained unless and until approval is given for their disposal in accordance with the retention requirements set forth in paragraph 14 of Pretrial Order # 1 (issued August 10, 2010) and any other applicable Court Orders governing tangible items that are or may be issued in MDL No. 2179 IN RE: Oil Spill by the Oil Rig "DEEPWATER HORIZON" (E.D. LA 2010). Such approval to dispose must be given in writing and by a person authorized to direct such action on behalf of the state or federal agency whose employees or contractors are in possession or control of such materials.*

### A. SOP: Benthic cores for collections for infauna and small crustaceans

A unique sample code or number should be given to each sample and prominently marked in the upper right corner. The sample code should be constructed of the location ID, date, matrix, sample team number, and sample number (for details, see **NOAA Field Sampling Workbooks**, "Guide for FieldForms\_COC\_v.16.1.pdf" available on the case [REDACTED]). Sample codes should be recorded on the **Sample Form** datasheet (to be done if plan is adopted) and also in the **NRDA Sample Collection Form – Tissue/Wrack** (available on the case [REDACTED] site).

#### 1. Site Description

The site name along with the lat and long for the Site Center Point and Endpoints 1 and 2 via a GPS should be noted. Coordinates should be recorded in Decimal Degrees with WGS84 as the datum. The time of day, date, general weather, and general site description should be noted next.

#### 2. Physical/Chemical Parameters

To accurately characterize the site a range of physical/chemical parameters, several variables, such as salinity, water temperature, and dissolved oxygen should be measured from the subsurface and at depth at three locations across each site. These parameters should be measured using a YSI sonde, which will be verified daily to ensure proper chronologic and quantitative bracketing. Calibration will be required, per manufacturer specifications, if parameters fail to verify within the following acceptance criteria:



Figure SOP 1. Picture of a core.



- DO  $\pm$  0.3 mg/L of theoretical saturation;
- Salinity (calibrated as specific conductance)  $\pm$  5% of a standard 50,000  $\mu$ mhos/cm KCL solution.

A general description of the bottom type should also be given. The tidal state should be recorded using the GPS tide function, including the notation of the closest tidal station used. Several descriptors are given for the collector to note the relative amount of oil present within the area sampled. The list should be a range of oiled conditions from none to the most saturated.

### **3. Sampling Collection**

Up to twenty-eight benthic cores will be collected from each selected site using a pre-fabricated core head with check valve and using 10-cm diameter, 30-cm long, clear core tubes (Figure SOP 1). Figure SOP 2 gives an idealized layout of random sampling locations. The first three cores should be collected on a line perpendicular from the Site Center Point to 5m offshore. These samples will be processed and archived for taxonomic analysis. The 25 additional cores should be collected in a zone from the edge to 5 m distance parallel to the shoreline and within the bounds of Endpoints 1 and 2. These samples will be collected for analysis of tissue contaminants. For these samples, appropriate decon procedures must be followed (see Appendix 2).

Cores should be collected at random locations in random order within the site. This is important because cores are processed in the lab in the order in which they were collected until the necessary tissue mass is achieved. At this point remaining cores are sieved to reduce volume archived. Random locations and random order are necessary so that the composite sample is well mixed and representative of the site.

An acceptable core sample consists of at least the top 10 cm with an intact surface layer. Minimally disturbed samples should be collected from over the side of the vessel. If the depth, sediment density, or other physical conditions preclude the potential to sample from the vessel, samples may be collected by exiting the vessel and proceeding on foot to the sampling location, taking care not to disturb the area from which a sample will be taken.

### **4. Field Sample Processing**

Intact cores should be capped and taped, labeled according to NRDA procedures, placed in a heavy duty plastic sieve, taped and returned to sample intake. The intact cores will be delivered to a processing lab chosen by the trustees.

### **5. Lab Processing**

While in transit to the lab, samples should be kept in a cooler with ice and immediately transferred to a refrigerated cooler upon receipt. Samples should be processed within 10 days.

Core contents should be placed in a 0.5 mm sieve and gently washed with water. Sediments should pass through the sieve while the benthic invertebrates and detritus material are retained on the sieve. Polychaetes from the marsh edge cores and haustoriid amphipods from the sandy shoreline cores should be separated from the detrital material and placed in a glass vial. These are the primary taxa for the marsh edge and sandy shoreline sites respectively. The secondary taxa in the marsh edge core samples, amphipods, should be separated and placed in a separate glass vial. Blue crabs will also be separated and placed in a separate sample container, labeled, and frozen. Other animals collected by the coring should be placed in a separate sample container, labeled and frozen for archiving.

The first three taxonomy-purposed cores collected should be processed, composited, and archived for taxonomic composition. For these three cores only, the material retained on the sieve should be composited and initially preserved in a 5% buffered Formalin/rose Bengal stain solution and within 48 hours the content transferred to 70% Ethanol for archiving. These composite samples may be used to enumerate and identify the benthic invertebrate species present in the corresponding sample for tissue chemistry if the tissue analyzed for contaminants results in a positive PAH screening result.

The remaining 25 cores should be processed and composited to collect a sufficient quantity of tissue for PAH analyses. No vital staining or fixatives should be used. Because these samples are collected for chemical analysis, appropriate practices must be taken to avoid cross-contamination from other oil hydrocarbon sources. Separating out the animals without introducing potential contaminants is the key. Handling and storage procedures will minimize any chance for cross-contamination (see General sample guidance below).

Tissue contaminant cores should be processed in the order they were collected and will be composited from one site. At a minimum, the first 9 cores will be processed to make a composite sample. The target sample size is a minimum of 10 g of tissue per site. If after processing the first 9 cores, the 10 g target for the primary taxa has not been met, additional cores should be processed until the target is reached. The remaining cores should be sieved, composited, and the unprocessed material archived (i.e. not separated from detritus but sample volume reduced) as a separate composite sample. The final samples should be labeled according to NRDA procedures and stored frozen.

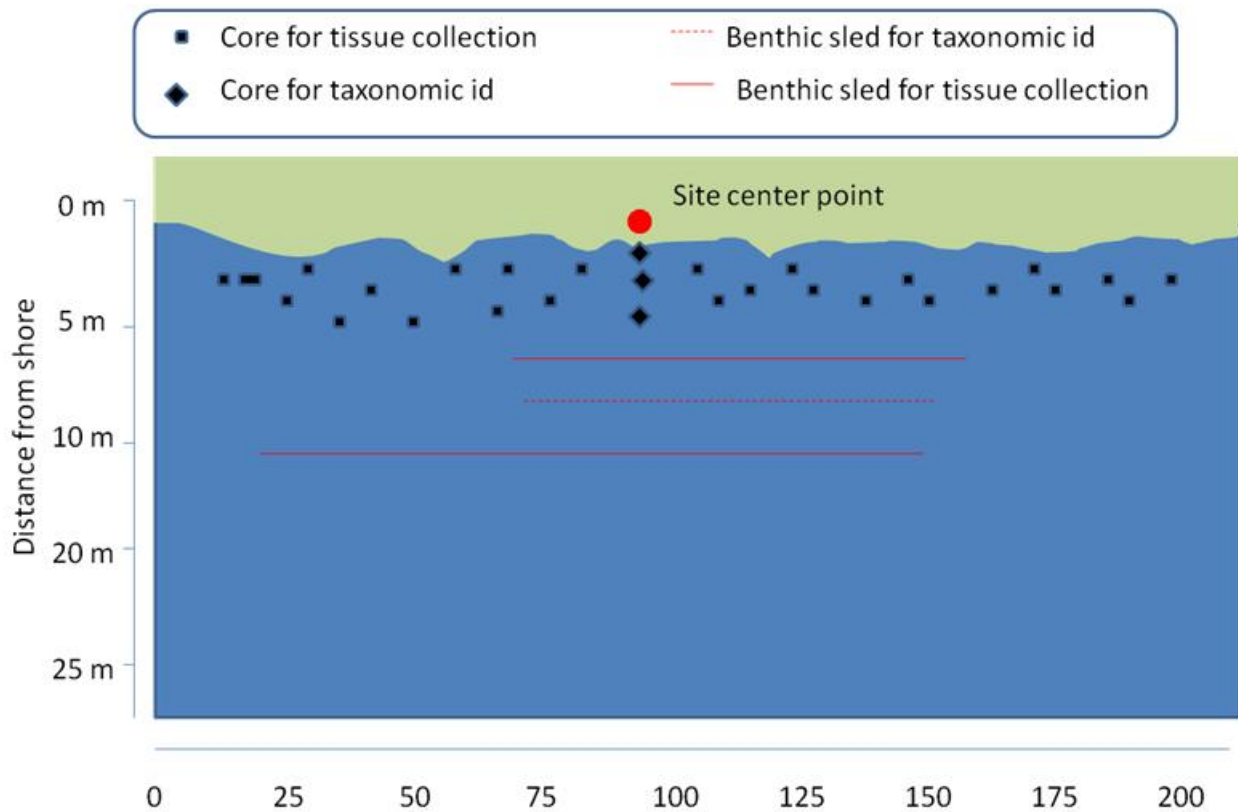


Figure SOP 2. Idealized layout of coring and trawl activities within a Marsh Edge site.

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6. General Guidance for NRDA Infauna Tissue Collection

*a. Container and Sample Size*

PAH - 10 g wet weight tissue; in a certified-clean glass jar.

% Lipid and % Moisture - from same sample as above

*b. Sampling Equipment Decontamination*

- Cores, shovels, dredges, or gloved hands are used to collect infauna from intertidal and subtidal areas; a sieve or screen is used for removing sediments.
- All non-disposable sampling gear must be decontaminated before using and between sampling stations. If taking multiple samples at an oiled station, decontaminate visibly oiled sampling equipment between samples and between any attempts to sample.
- See Appendix 2 for further detail on decontamination procedures.

*c. Sample Collection Methods*

## **DRAFT Marsh Edge/Sandy Shoreline Biota Plan**

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- Get location data and take relevant photos at all sites before sampling (see GPS and photography bullet below).
- Wear nitrile or other non-contaminating gloves and change gloves after each sample to avoid cross-contamination.
- Record observations of any external evidence of contamination, for example oiled layers in sediment or burrows, sheens from sieving, etc.
- Following sieving, attached organisms are pried away from the substrate. Infaunal samples should be rinsed with clean water to remove excess sediment. Collect live animals (shells intact and tightly closed) if possible. Note the condition of recently dead animals.
- Refer to workgroup sampling plan for approximate number (volume) of individuals needed to obtain the estimated 10 g tissue wet weight for the target species. Do not shuck bivalves.
- Group all individuals for a sample into a certified-clean glass jar. Jars are labeled using an adhesive label and directly on the lid. Use clear tape to protect the paper label.
- Avoid sources of contamination such as exhaust fumes and engine cooling systems on vessels or near vehicles. Work up-wind of any exhausts. Segregate dirty/clean areas. If needed, lay out clean substrates to work on and replace frequently. Take precautions so as not to cross-contaminate site with oil from boots and shovels.
- If possible, sample least-oiled areas first, followed by the more contaminated areas to minimize risk of cross-contamination. Avoid sampling near creosoted pilings.
- Immediately place all samples in coolers on ice. Ship samples to the chemistry laboratory as soon as possible; samples should be received by the processing lab and processed within 10 days of collection. Consult with [REDACTED] for specific instructions; special shipping will be required to maintain samples until received by the lab.

### *d. Labeling / Documentation / Other Considerations*

- On [REDACTED], the NRDA Field Sampling Checklist generically summarizes pre- and post-field sampling tasks.
- Prepare sample labels as presented in NRDA Data Management Protocol for Field Sampling. If using jars, record the sample number on both the label and lid. IDs on sample labels must be complete and identical to IDs on the chain of custody. Jar labels receive a protective layer of clear tape wrapped around the entire circumference of the container to secure the label and protect the writing.
- See the event-specific protocol documents for shipping to designated labs (NRDA Sample Shipping Instructions) and for chain of custody and sampling documentation instructions

## **DRAFT Marsh Edge/Sandy Shoreline Biota Plan**

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(NRDA Data Management Protocol for Field Sampling). Tissue sampling log sheets typically record sample number; date/time, location, GPS coordinates, species and tissue type.

- Documentation is critical; all field notebooks should be dated, signed and preserved. If crossing out or correcting any entries, date and initial when making the changes. Original records should be gathered and archived.
- Record the presence of oil, weather conditions, etc. in field notes. Record GPS coordinates for each sample.
- Take relevant photographs of the sampling locations and sample collection itself if possible. Make sure each photograph or series can be later associated with the corresponding sampling location GPS (see NRDA Field Photography Guidance). Do not delete, open or alter any photos.
- All sampling, COC, shipping, GPS and photo files are submitted to [REDACTED]. Sampling hotline: [REDACTED]
- The labs have received instructions specifying sample processing and analytic methods.

*All materials associated with the collection or analysis of samples under these protocols or pursuant to any approved work plan, except those consumed as a consequence of the applicable sampling or analytical process, must be retained unless and until approval is given for their disposal in accordance with the retention requirements set forth in paragraph 14 of Pretrial Order # 1 (issued August 10, 2010) and any other applicable Court Orders governing tangible items that are or may be issued in MDL No. 2179 IN RE: Oil Spill by the Oil Rig "DEEPWATER HORIZON" (E.D. LA 2010). Such approval to dispose must be given in writing and by a person authorized to direct such action on behalf of the state or federal agency whose employees or contractors are in possession or control of such materials.*

## **B. SOP: Epibenthic Sled Collections**

A unique sample code or number should be given to each sample and prominently marked in the upper right corner. The sample code should be constructed of the location ID, date, matrix, sample team number, and sample number (for details, see **NOAA Field Sampling Workbooks**, "Guide for FieldForms\_COC\_v.16.1.pdf" available on the case [REDACTED] site). Sample codes should be recorded on the **Sample Form** datasheet (to be done if plan is adopted) and also in the **NRDA Sample Collection Form – Tissue/Wrack** (available on the case [REDACTED] site).

### 1. Site Description

The site name along with the lat and long for the Site Center Point and Endpoints 1 and 2 via a GPS should be noted. Coordinates should be recorded in Decimal Degrees with WGS84 as the datum. The time of day, date, general weather, and general site description should be noted next.

### 2. Physical/Chemical Parameters

To accurately characterize the site a range of physical/chemical parameters, several variables, such as salinity, water temperature, dissolved oxygen should be measured from the subsurface and at depth at three locations across each site. These parameters should be measured using a YSI sonde, which is verified daily to ensure proper chronologic and quantitative bracketing. Calibration will be required, per manufacturer specifications, if parameters fail to verify within the following acceptance criteria:

- DO  $\pm$  0.3 mg/L of theoretical saturation;
- Salinity (calibrated as specific conductance)  $\pm$  5% of a standard 50,000  $\mu$ mhos/cm KCL solution.

The tidal state should be recorded using the GPS tide function, including the notation of the closest tidal station used. Several descriptors are given for the collector to note the relative amount of oil present within the area sampled. The list should be a range of oiled conditions from none to the most saturated.

### **3. Sampling device**

The benthic sled trawl consists of a 2 m long, 505 um plankton net and 0.5 mm cod end affixed to a stainless steel or aluminum frame with 0.25 m<sup>2</sup> opening mounted onto a pair of skis (Figure SOP 3).



Figure SOP 3. Picture of an epibenthic sled.

### **4. Sampling procedures**

All trawls (archiving taxonomy and tissue collection) should be pulled by hand for 100 m parallel to the marsh edge. The trawl should be placed at a starting location and the collector should then walk on the shore, wade or boat in an arc to a point 100 m directly in front of the trawl and parallel to shore. The trawl is then pulled for the 100 m (pre-marked tow line should be used; Figure SOP 4).

For each trawl pull, record the time the trawl is deployed, the time trawling commences and is complete, the GPS waypoints for start and end points and the coordinates, the depths at start and end point, and the trawl sample weight.

#### **(a) Tissue collection**

With the net freshly decontaminated, the first trawl sample should be devoted to collecting tissue for chemistry analysis. The entire sample should be sieved on a 0.5 mm sieve. The sample should be weighed to determine total wet weight of each component. The target tissue amounts are 10 g of penaeid or other large shrimp or 10 g of amphipods and small crustacean. Up to 5 additional trawls, or 6 total, will be performed if the target amount is not collected by the first trawl pull. These will be performed after the second trawl pull for taxonomic identification.

#### **(b) Sample for possible taxonomic identification**

At each site, the second trawl collected should be saved for archiving. This sample may be used to enumerate and identify the benthic invertebrate species present in the corresponding sample

for tissue chemistry if the tissue analyzed for contaminants results in a positive PAH screening result.

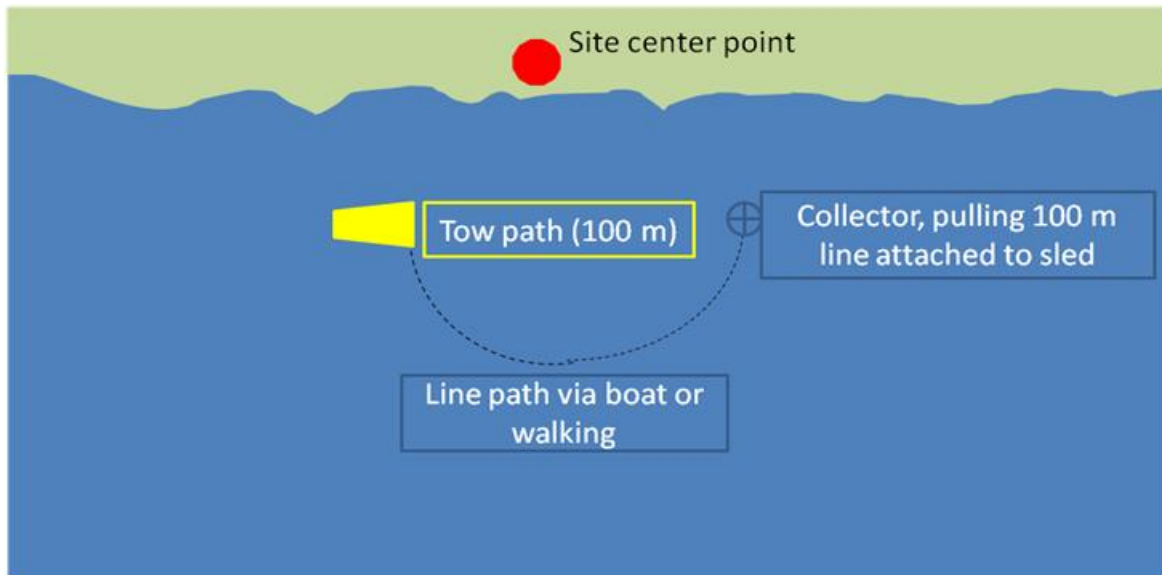


Figure SOP 4. Schematic illustration of trawl placement and tow path.

### 5. Lab Processing

While in transit to the lab, samples should be kept in a cooler with ice and immediately transferred to a refrigerated cooler upon receipt. Samples should be processed within 10 days.

Trawl sample contents may be sieved through two stacked sieves, a 0.5 mm sieve and a 2.0 mm sieve. The 2.0 mm sieve sample and 0.5 mm sieve sample can be sorted into higher resolution taxonomic categories. Because the samples are being collected for chemical analysis, appropriate practices must be taken to avoid cross-contamination from other oil hydrocarbon sources (see General NRDA guidance below).

Penaeid shrimp will be placed into their own group and identified to species. Penaeid shrimp will be the primary target. The secondary taxa will include small crustaceans (amphipods, isopods, mysids), which will be archived for potential later analysis. All other organisms should be archived separately. Blue crabs will also be separated and placed in a separate sample container, labeled, and frozen for archiving. All other organisms should be archived for later analysis if deemed appropriate by the Trustees.



For the taxonomy sample only, the material collected by the trawl should be initially preserved in a 5% buffered Formalin solution and within 48 hours the content transferred to 70% Ethanol for archiving.

Guidance on the identification of juvenile penaeid shrimp can be found in and references within:

James G. Ditty and Jaime R. Alvarado Bremer (2011) Species Discrimination of Postlarvae and Early Juvenile Brown Shrimp (*Farfantepenaeus aztecus*) and Pink Shrimp (*F. duorarum*) (Decapoda: Penaeidae): Coupling Molecular Genetics and Comparative Morphology to Identify Early Life Stages. *Journal of Crustacean Biology*: February 2011, Vol. 31, No. 1, pp. 126-137.

### **6. General Guidance for NRDA: Epibenthic Sled Trawl Sampling**

#### ***a. Container and Sample Size***

PAH - 10 g wet weight tissue; in a certified-clean glass jar.

% Lipid and % Moisture - from same sample as above

#### ***b. Sampling Equipment Decontamination***

- Various trawl nets or traps are used to collect mobile epifauna such as shrimp, crabs and finfish.
- Equipment used in collecting specimens for oil contamination should itself be free of gross contamination. Soaking and agitating the collection bag (cod end) in a detergent solution is a suitable remediation or prophylactic measure.
- Landing a net or trap atop a clean or scrubbed surface (plywood or tarp) or emptying the cod end into a detergent-scrubbed bucket or collection table can also help deter cross-contamination from vessel lube oils, fuel and exhaust sources.
- Consider that most vessels are covered in a residue of oils from everyday operations and that the non-gloved, collectors' hands are the most efficient way of transferring that oil to the specimens. Fresh, clean, nitrile gloves must be worn when handling samples.
- In general, all non-disposable sampling gear must be decontaminated before using and between sampling stations. If taking multiple samples at an oiled station, decontaminate visibly oiled sampling equipment between samples and between any attempts to sample.
- See Appendix 2 for further detail on decontamination procedures.

### *c. Sample Collection Methods*

- Get location data and take relevant photos at all sites before sampling (see GPS and photography bullet below).
- Wear nitrile or other non-contaminating gloves and change gloves after each sample to avoid cross-contamination.
- Record observations of any external evidence of contamination, for example odors, sheens from the net or oiled debris in the catch.

### *d. Labeling / Documentation / Other Considerations*

- On [REDACTED], the NRDA Field Sampling Checklist generically summarizes pre- and post-field sampling tasks.
- Prepare sample labels as presented in NRDA Data Management Protocol for Field Sampling. If using jars, record the sample number on both the label and lid. IDs on sample labels must be complete and identical to IDs on the chain of custody. Jar labels receive a protective layer of clear tape wrapped around the entire circumference of the container to secure the label and protect the writing.
- See the event-specific protocol documents for shipping to designated labs (NRDA Sample Shipping Instructions) and for chain of custody and sampling documentation instructions (NRDA Data Management Protocol for Field Sampling). Tissue sampling log sheets typically record sample number; date/time, location, GPS coordinates, species and tissue type.
- Documentation is critical; all field notebooks should be dated, signed and preserved. If crossing out or correcting any entries, date and initial when making the changes. Original records should be gathered and archived.
- Record the presence of oil, weather conditions, etc. in field notes. Record GPS coordinates for each sample.
- Take relevant photographs of the sampling locations and sample collection itself if possible. Make sure each photograph or series can be later associated with the corresponding sampling location GPS (see NRDA Field Photography Guidance). Do not delete, open or alter any photos.
- All sampling, COC, shipping, GPS and photo files are submitted to [REDACTED] Sampling hotline: [REDACTED]
- The labs have received instructions specifying sample processing and analytic methods.

*All materials associated with the collection or analysis of samples under these protocols or pursuant to any approved work plan, except those consumed as a consequence of the applicable sampling or analytical process, must be retained unless and until approval is given for their disposal in accordance with the retention requirements set forth in paragraph 14 of Pretrial Order # 1 (issued August 10, 2010) and any other applicable Court Orders governing tangible items that are or may be issued in MDL No. 2179 IN RE: Oil Spill by the Oil Rig "DEEPWATER HORIZON" (E.D. LA 2010). Such approval to dispose must be given in writing and by a person authorized to direct such action on behalf of the state or federal agency whose employees or contractors are in possession or control of such materials.*

### **C. SOP: Quadrat excavation for sandy shoreline bivalves**

A unique sample code or number should be given to each sample and prominently marked in the upper right corner. The sample code should be constructed of the location ID, date, matrix, sample team number, and sample number (for details, see **NOAA Field Sampling Workbooks**, "Guide for FieldForms\_COC\_v.16.1.pdf" available on the case [REDACTED]). Sample codes should be recorded on the **Sample Form** datasheet (to be done if plan is adopted) and also in the **NRDA Sample Collection Form – Tissue/Wrack** (available on the case [REDACTED]).

#### 1. Site Description

The site name along with the lat and long for the Site Center Point and Endpoints 1 and 2 via a GPS should be noted. Coordinates should be recorded in Decimal Degrees with WGS84 as the datum. The time of day, date, general weather, and general site description should be noted next.

#### 2. Physical/Chemical Parameters

To accurately characterize the site a range of physical/chemical parameters, several variables, such as salinity, water temperature, dissolved oxygen should be measured from the subsurface and at depth at three locations across each site. These parameters should be measured using a YSI sonde, which will be verified daily to ensure proper chronologic and quantitative bracketing. Calibration will be required, per manufacturer specifications, if parameters fail to verify within the following acceptance criteria:

- DO  $\pm$  0.3 mg/L of theoretical saturation;
- Salinity (calibrated as specific conductance)  $\pm$  5% of a standard 50,000  $\mu$ mhos/cm KCL solution.

A general description of the bottom type should also be given (sand, clay, etc.). The tidal state should be recorded using the GPS tide function, including the notation of the closest tidal station

used. Several descriptors are given for the collector to note the relative amount of oil present within the area sampled. The list should be a range of oiled conditions from none to the most saturated.

### **3. Sampling Collection and Processing**

In the sandy shoreline sites, bivalves should be collected from a 0.25 m<sup>2</sup> quadrat by digging up the top 5-10 cm of sand with a shovel and sieving through a 2.0 mm sieve tray. Quadrats should be placed randomly in the swash zone between Endpoints 1 and 2. The target tissue sample is 10 g not including the shell. A minimum of one quadrat will be sampled per site and replicated up to 8 times to reach the target tissue weight. All bivalves retained on the sieve should be transferred to a glass sample jar.

Decontamination of quadrats and related gear (e.g., shovels) will occur in accordance with methods specified for coring devices, as specified within Appendix 2.

For each quadrat, the GPS location should be saved and the waypoint number recorded, the weight of the bivalve sample, the species present, and the depth of collection recorded. The final sample is labeled according to NRDA procedures and stored frozen.

### **4. Lab Processing**

While in transit to the lab for chemical analysis, samples should be kept in a cooler with ice. Upon receipt at the lab, samples should be processed within 10 days of collection or frozen to arrest the holding time for processing at a later date. No vital staining or fixatives should be used.

Bivalve samples should be shucked at the chemistry laboratory and the tissue homogenized and composited then archived frozen for potential PAH analysis. Since these samples are being processed for chemical analysis, appropriate practices must be taken to avoid cross-contamination from other oil hydrocarbon sources (see General NRDA guidance under SOP B).

### **5. General Guidance for NRDA Infauna Tissue Collection**

#### **a. Container and Sample Size**

PAH - 10 g wet weight tissue; in a certified-clean glass jar.

% Lipid and % Moisture - from same sample as above

#### **b. Sampling Equipment**

- Cores, shovels, dredges, or gloved hands are used to collect infauna from intertidal and subtidal areas; a sieve or screen is used for removing sediments.

## **DRAFT Marsh Edge/Sandy Shoreline Biota Plan**

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- All non-disposable sampling gear must be decontaminated before using and between sampling stations. If taking multiple samples at an oiled station, decontaminate visibly oiled sampling equipment between samples and between any attempts to sample.
- See Appendix 2 for further detail on decontamination procedures.

### *c. Sample Collection Methods*

- Get location data and take relevant photos at all sites before sampling (see GPS and photography bullet below).
- Wear nitrile or other non-contaminating gloves and change gloves after each sample to avoid cross-contamination.
- Record observations of any external evidence of contamination, for example, oiled layers in sediment or burrows, sheens from sieving.
- Following sieving, attached organisms are pried away from the substrate. Infaunal samples should be rinsed with clean water to remove excess sediment. Collect live animals (shells intact and tightly closed) if possible. Note the condition of recently dead animals.
- Refer to workgroup sampling plan for approximate number (volume) of individuals needed to obtain the estimated 10 g tissue wet weight for the target species. Do not shuck bivalves.
- Group all individuals for a sample into a certified-clean glass jar. Jars are labeled using an adhesive label and directly on the lid. Use clear tape to protect the paper label.
- Avoid sources of contamination such as exhaust fumes and engine cooling systems on vessels or near vehicles. Work up-wind of any exhausts. Segregate dirty/clean areas. If needed, lay out clean substrates to work on and replace frequently. Take precautions so as not to cross-contaminate site with oil from boots and shovels.
- If possible, sample least-oiled areas first, followed by the more contaminated areas to minimize risk of cross-contamination. Avoid sampling near creosoted pilings.
- Immediately place all samples in coolers on ice. Ship samples to the laboratory as soon as possible; samples should be received by the lab and processed within 10 days of collection. Consult with [REDACTED] for specific instructions; special shipping will be required to maintain samples until received by the lab.

### *d. Labeling / Documentation / Other Considerations*

- On [REDACTED], the NRDA Field Sampling Checklist generically summarizes pre- and post-field sampling tasks.

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- Prepare sample labels as presented in NRDA Data Management Protocol for Field Sampling. If using jars, record the sample number on both the label and lid. IDs on sample labels must be complete and identical to IDs on the chain of custody. Jar labels receive a protective layer of clear tape wrapped around the entire circumference of the container to secure the label and protect the writing.
- See the event-specific protocol documents for shipping to designated labs (NRDA Sample Shipping Instructions) and for chain of custody and sampling documentation instructions (NRDA Data Management Protocol for Field Sampling). Tissue sampling log sheets typically record sample number; date/time, location, GPS coordinates, species and tissue type.
- Documentation is critical; all field notebooks should be dated, signed and preserved. If crossing out or correcting any entries, date and initial when making the changes. Original records should be gathered and archived.
- Record the presence of oil, weather conditions, etc. in field notes. Record GPS coordinates for each sample.
- Take relevant photographs of the sampling locations and sample collection itself if possible. Make sure each photograph or series can be later associated with the corresponding sampling location GPS (see NRDA Field Photography Guidance). Do not delete, open or alter any photos.
- All sampling, COC, shipping, GPS and photo files are submitted to [REDACTED] Sampling hotline: [REDACTED]
- The labs have received instructions specifying sample processing and analytic methods.

**X. Estimated Cost**

Supplies

- Sea-Gear Corp. plankton nets @ \$600 each x 4 = \$2400
- Sea-Gear Corp. plankton net cod end buckets @ \$200 each x 6 = \$1200
- Trawl frame components and fabrication @ \$500 each x 3 = \$1500
- Metal quadrats @ \$200 x 3 = \$600
- Additional sample collection and sorting supplies (sieves, trays, forceps) = \$2,000
- Core sample collection supplies (3 core heads, 5600 core tubes, other miscellaneous supplies) @ \$14.50 per sample = \$81,200.00
- 6 YSI multi-probes
- Sampling equipment decontamination supplies – lab grade detergent, scrub brushes, buckets
- Personnel and vessel decontamination supplies (detergent, garbage bags, pressure washer, wash water collection containers)
- Lodging, food/water for remote deployment of personnel @ \$200 per personnel per day = \$93,600
- 6 sets of field gear (GPS, camera, radio, satellite tracker, batteries)
- Observation data recording/sample labeling supplies

Personnel

- (18) trained personnel (two federal trustee representative & one state trustee representative per field team X 6 teams) for biota sampling
- (26) 10 hr days for sampling per boat X 6 boats = 156 boat days
- 18 personnel \* 26 days/person = 468 personnel days

## **DRAFT Marsh Edge/Sandy Shoreline Biota Plan**

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Costs are estimated for the anticipated sampling effort associated with this work plan.

| <b>Category</b>  | <b>Unit Cost</b> | <b>Units</b> | <b>Total Cost</b> |
|--|------------------|--------------|-------------------|
|  |                  | <b>Type</b>  | <b>Number</b>     |
| Vessel costs – biota sampling                            | \$1,500          | Days         | 156               |
|  |                  |              | \$234,000         |
| Safety supplies, sample sorting supplies, and containers |                  |              | \$15,000          |
| Core sampling supplies                                   |                  |              | \$85,000          |
| Trawl & bivalve sampling supplies                        |                  |              | \$15,000          |
| Personnel for Sample Collection                          | \$800            | Days         | 468               |
|  |                  |              | \$374,400         |
| Lodging and meal per diem for personnel                  | \$200            | Days         | 468               |
|  |                  |              | \$93,600          |
| <b>Estimated Total</b>                                   |                  |              | <b>\$817,000</b>  |

The Parties acknowledge that this budget is an estimate, and that actual costs may prove to be higher. BP's commitment to fund the costs of this work includes any additional reasonable costs



## **DRAFT Marsh Edge/Sandy Shoreline Biota Plan**

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within the scope of this work plan that may arise. The trustees will make a good faith effort to notify BP in advance of any such increased costs.

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**XI. Appendix 1. Maps of proposed sampling sites**

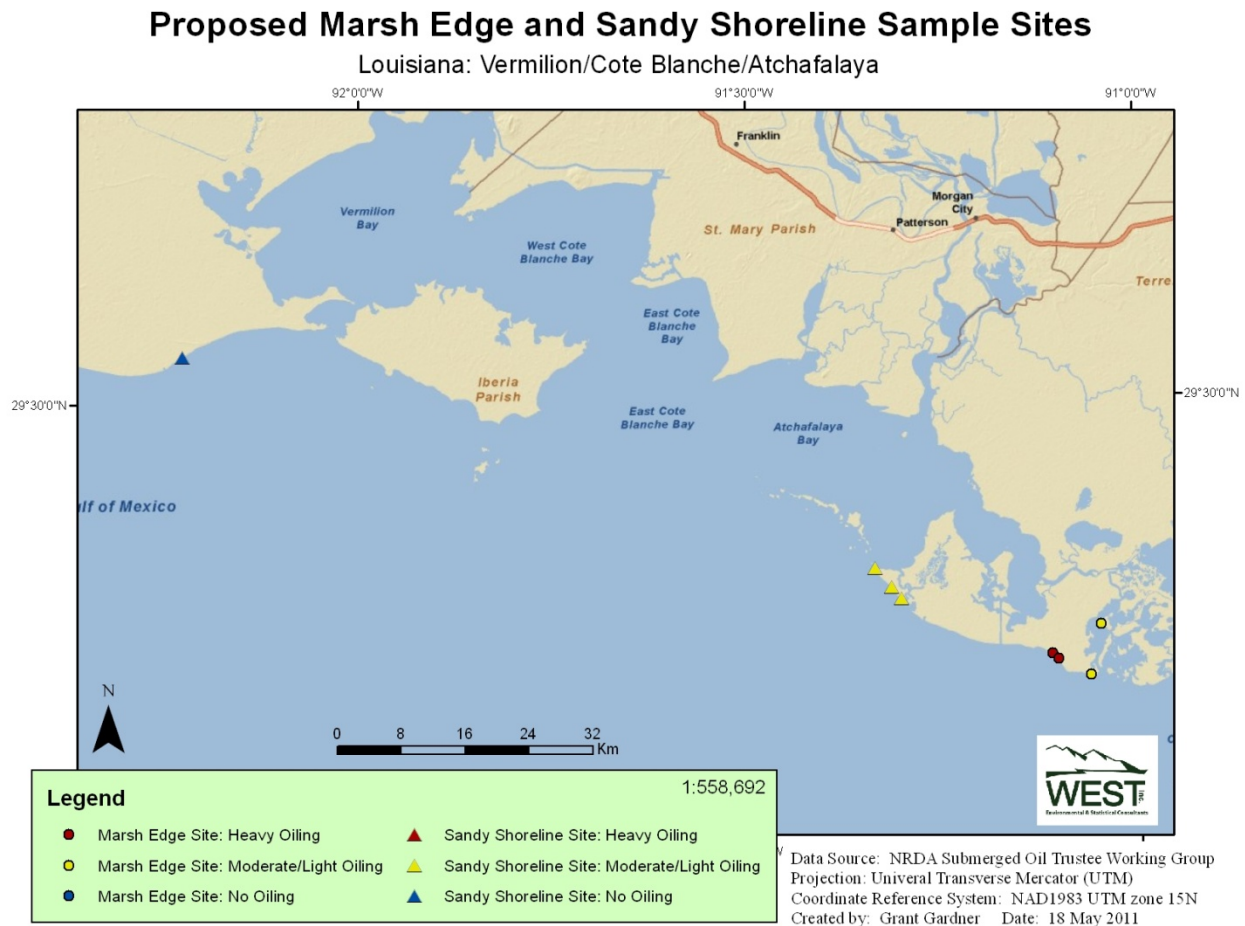


Figure A. Proposed marsh edge and sandy shoreline sample sites for western Louisiana.

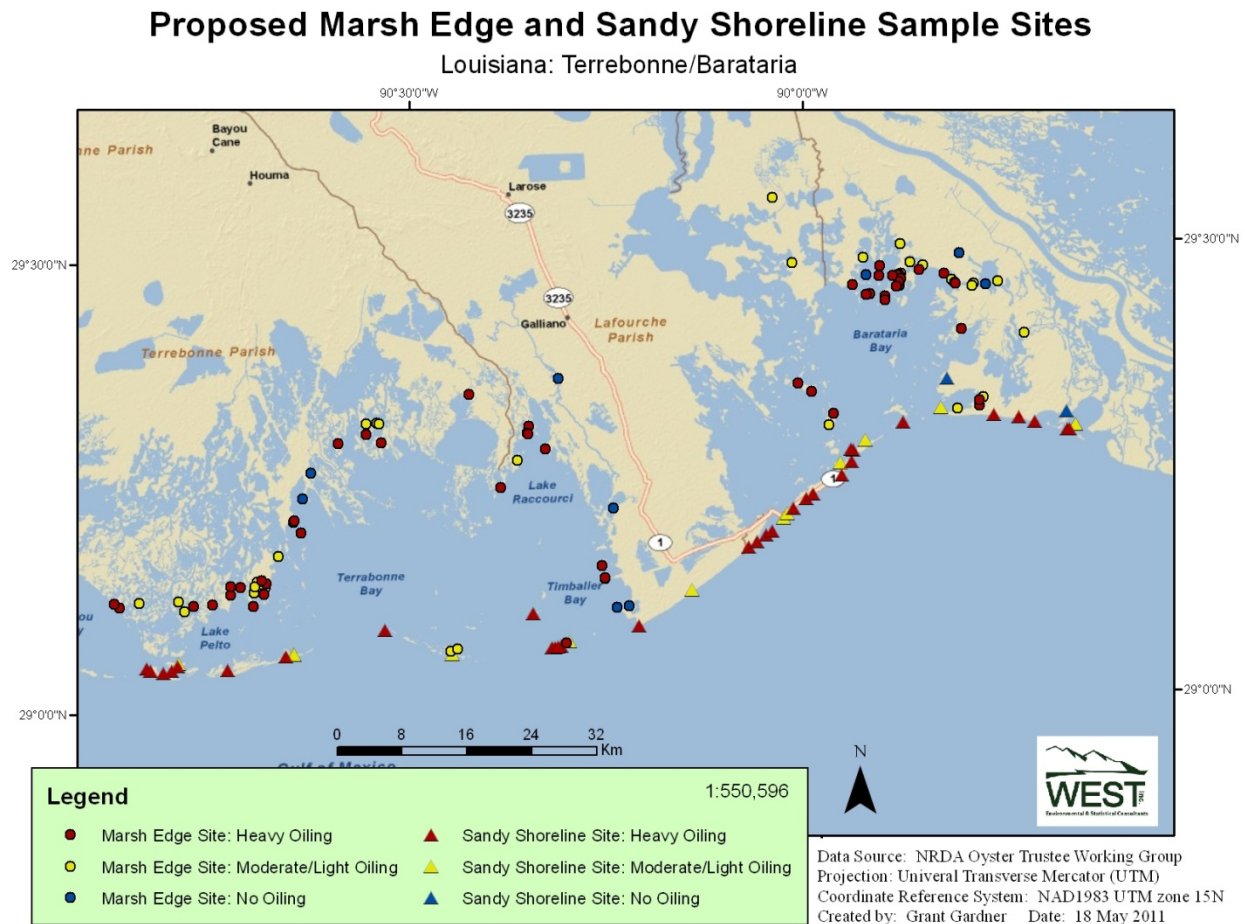


Figure B. Proposed marsh edge and sandy shoreline sample sites for central Louisiana.

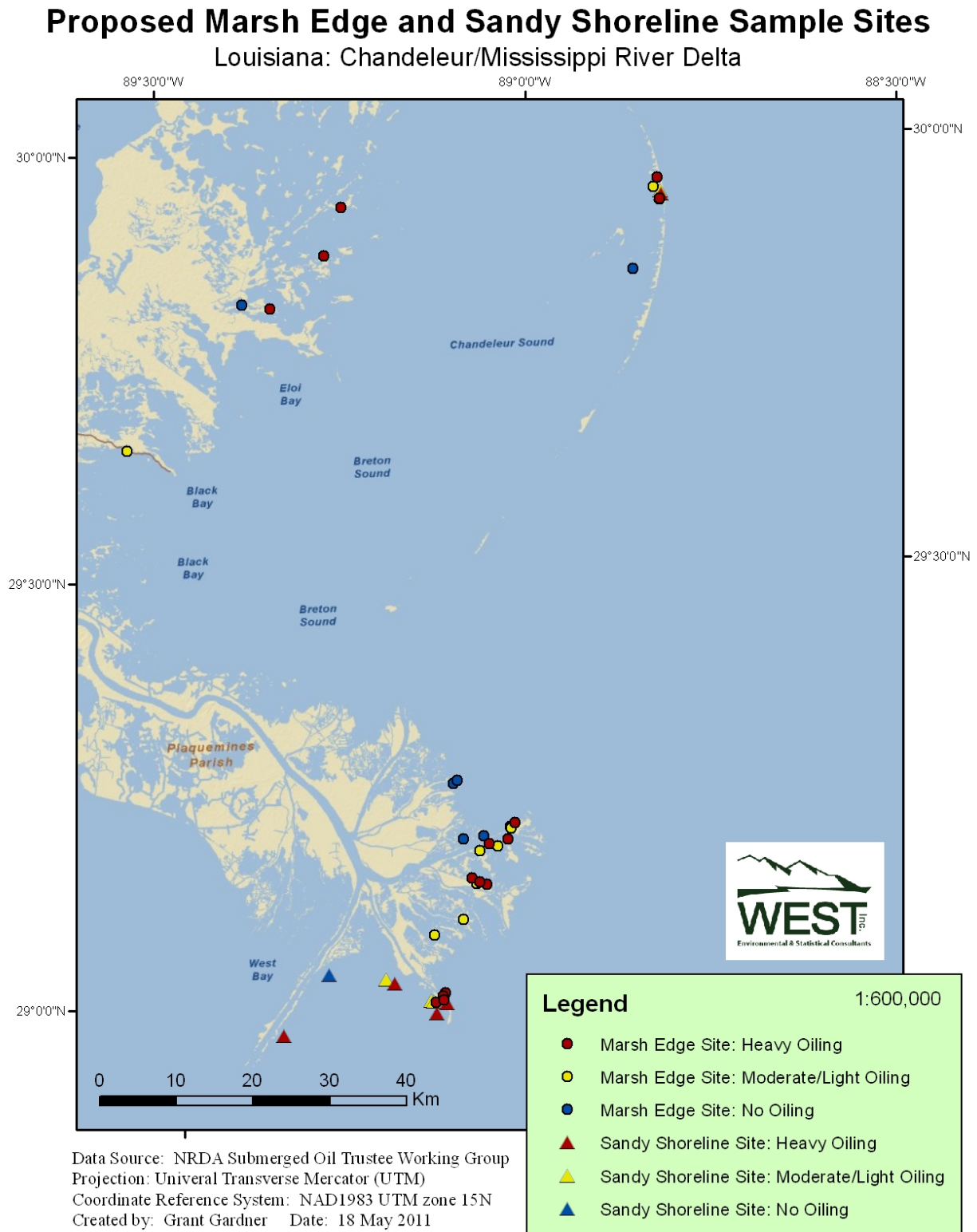


Figure C. Proposed marsh edge and sandy shoreline sample sites for eastern Louisiana.

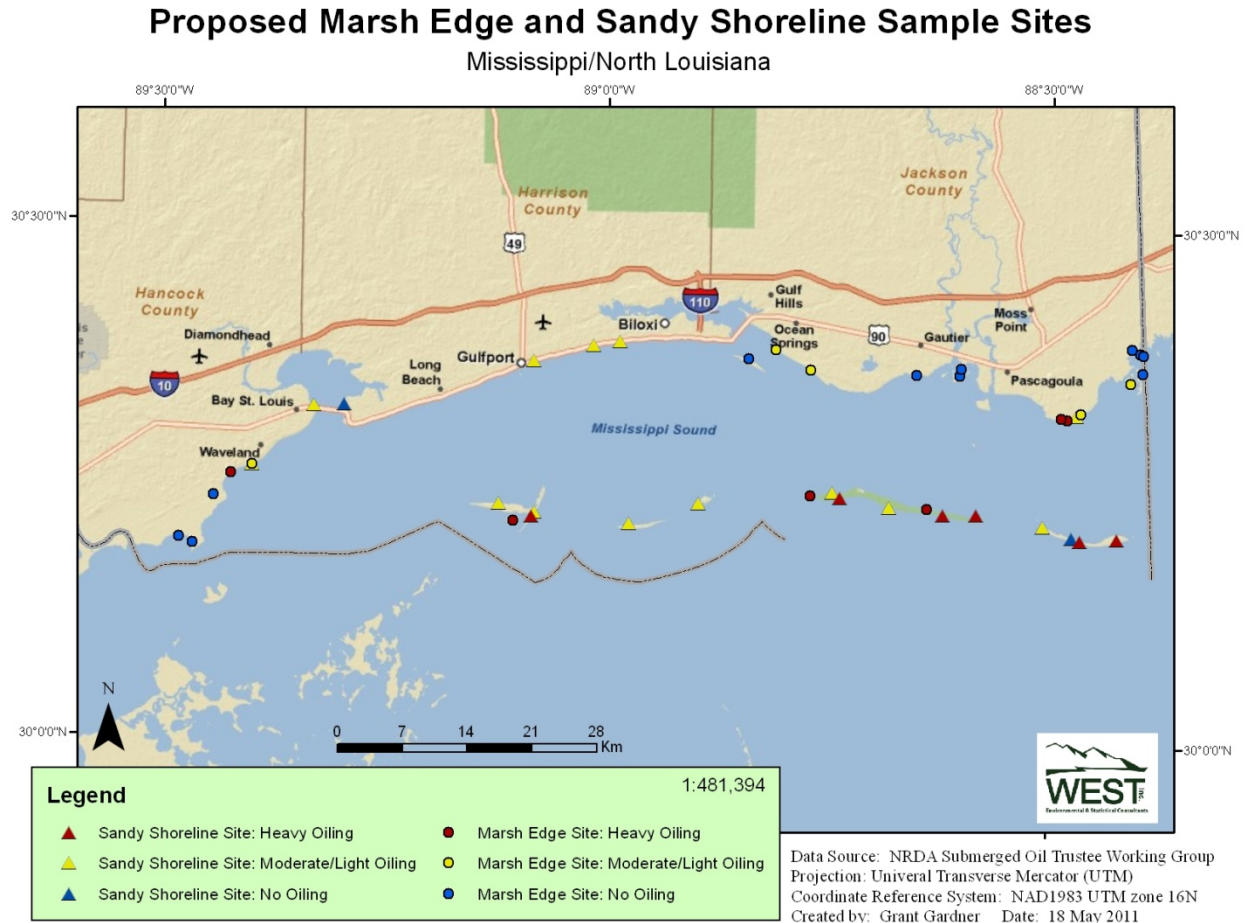


Figure D. Proposed marsh edge and sandy shoreline sample sites for Mississippi.



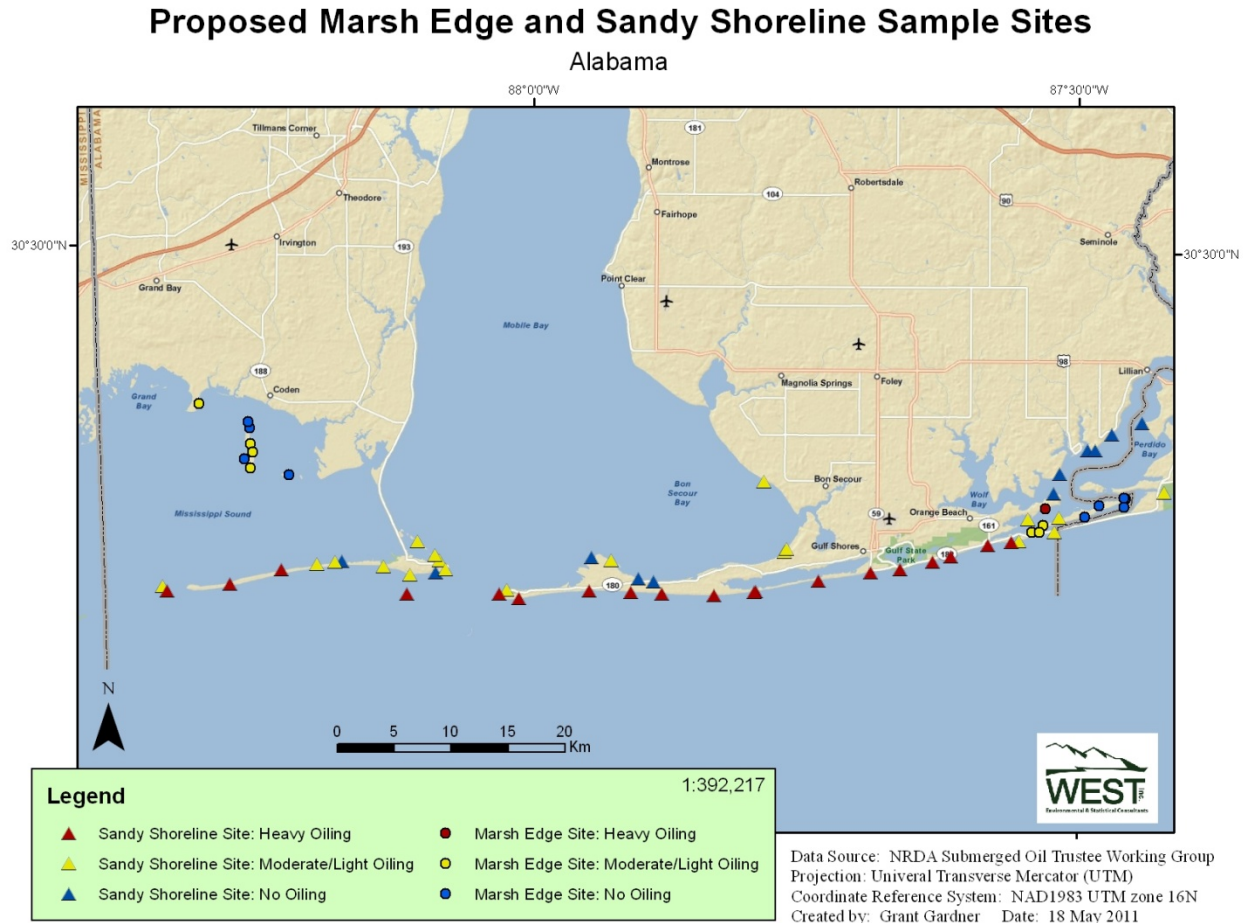


Figure E. Proposed marsh edge and sandy shoreline sample sites for Alabama.

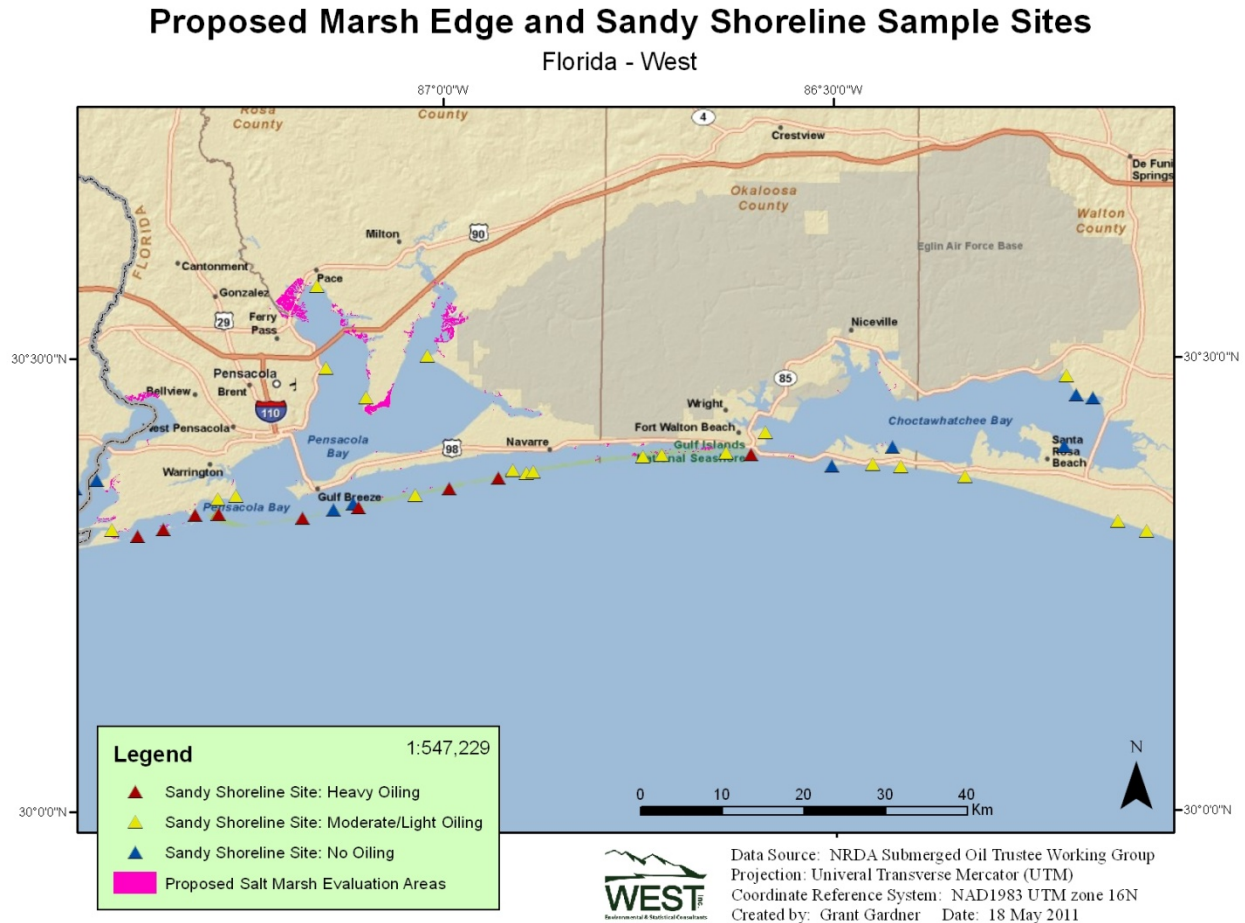


Figure F. Proposed marsh edge and sandy shoreline sample sites for western Florida.

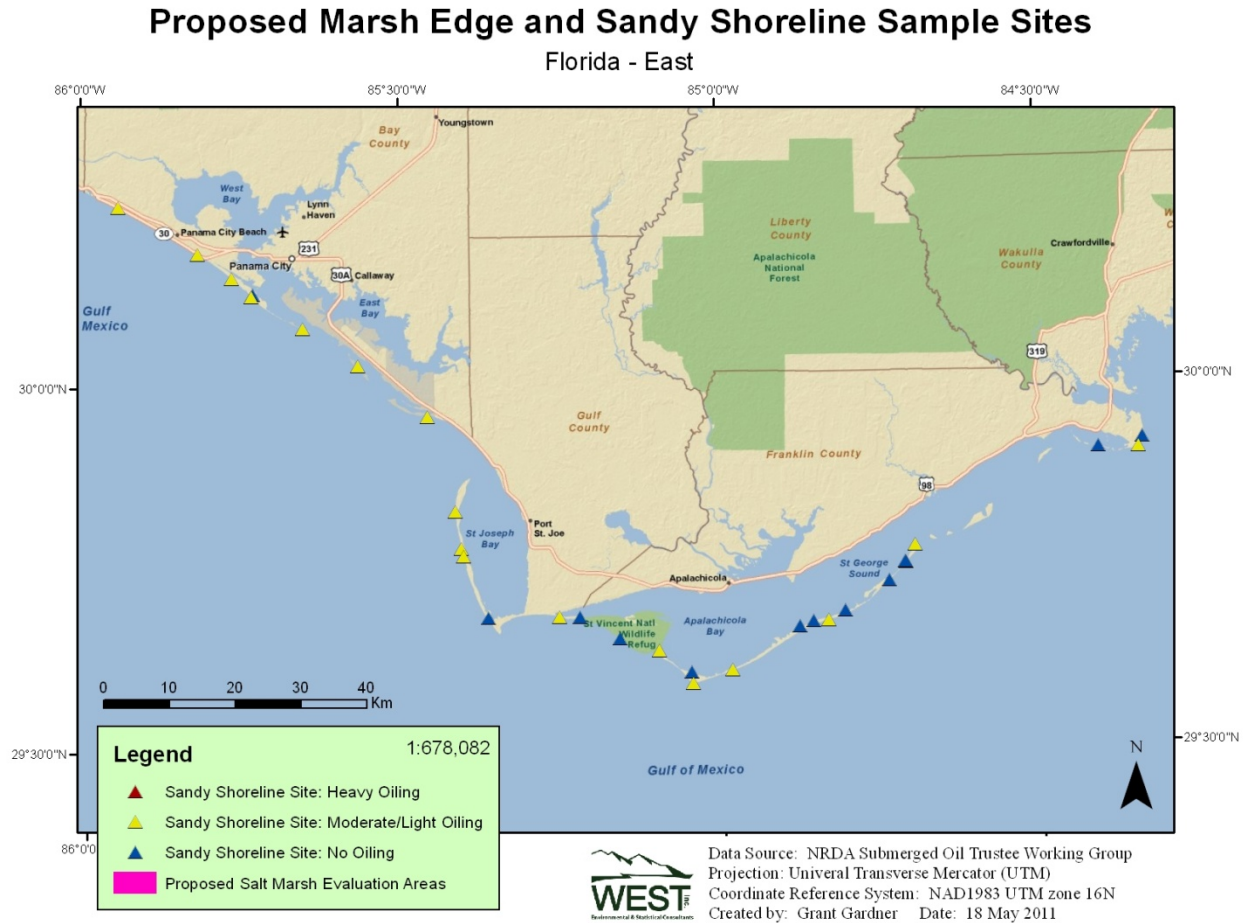


Figure G. Proposed marsh edge and sandy shoreline sample sites for eastern Florida.



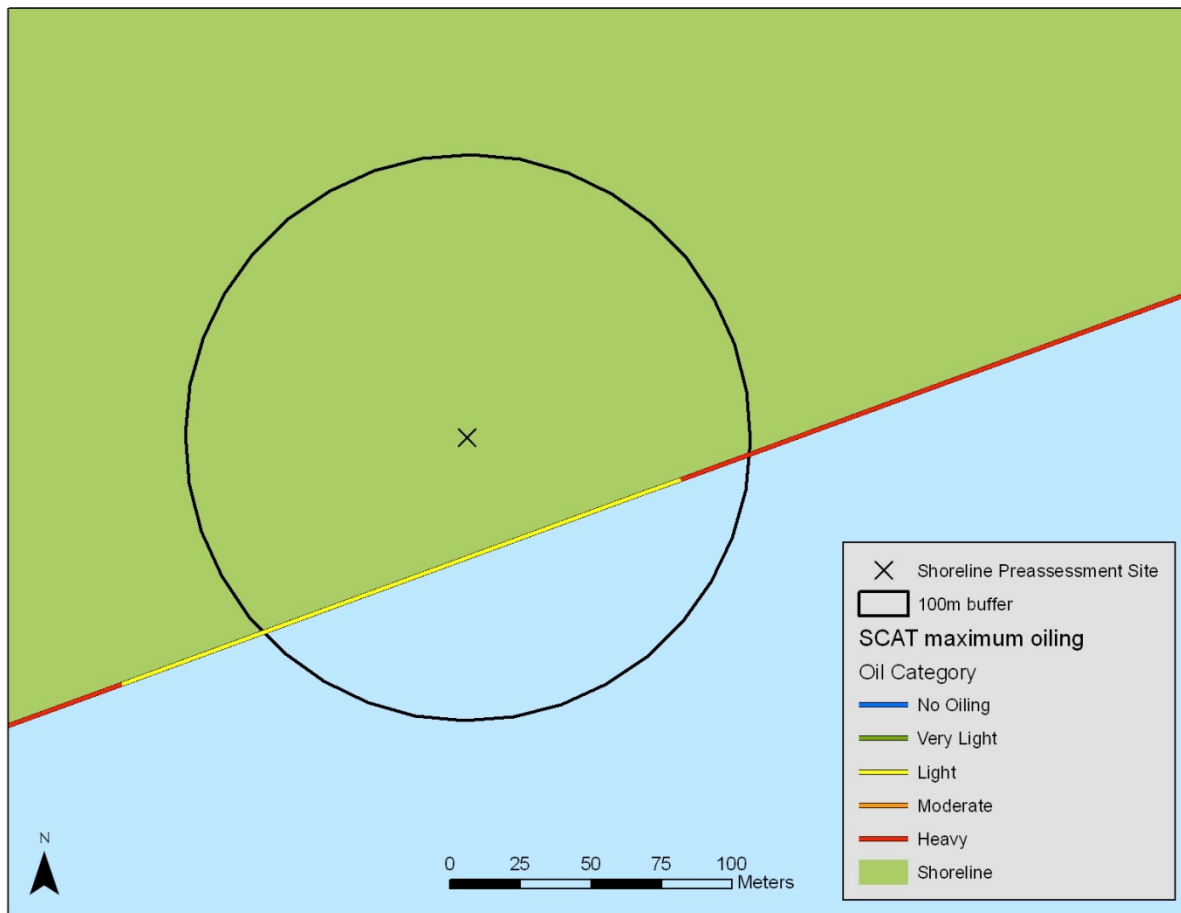


Figure H. Example marsh edge or sandy shoreline site oiling category assignment based on the intersection of a 100 meter buffer applied to the site and the maximum surface shoreline oiling characteristics as observed along the intertidal zone of the shoreline by ongoing field surveys performed by Shoreline Cleanup Assessment Techniques (SCAT) teams. This site would receive an oiling category of H (Heavily oiled).

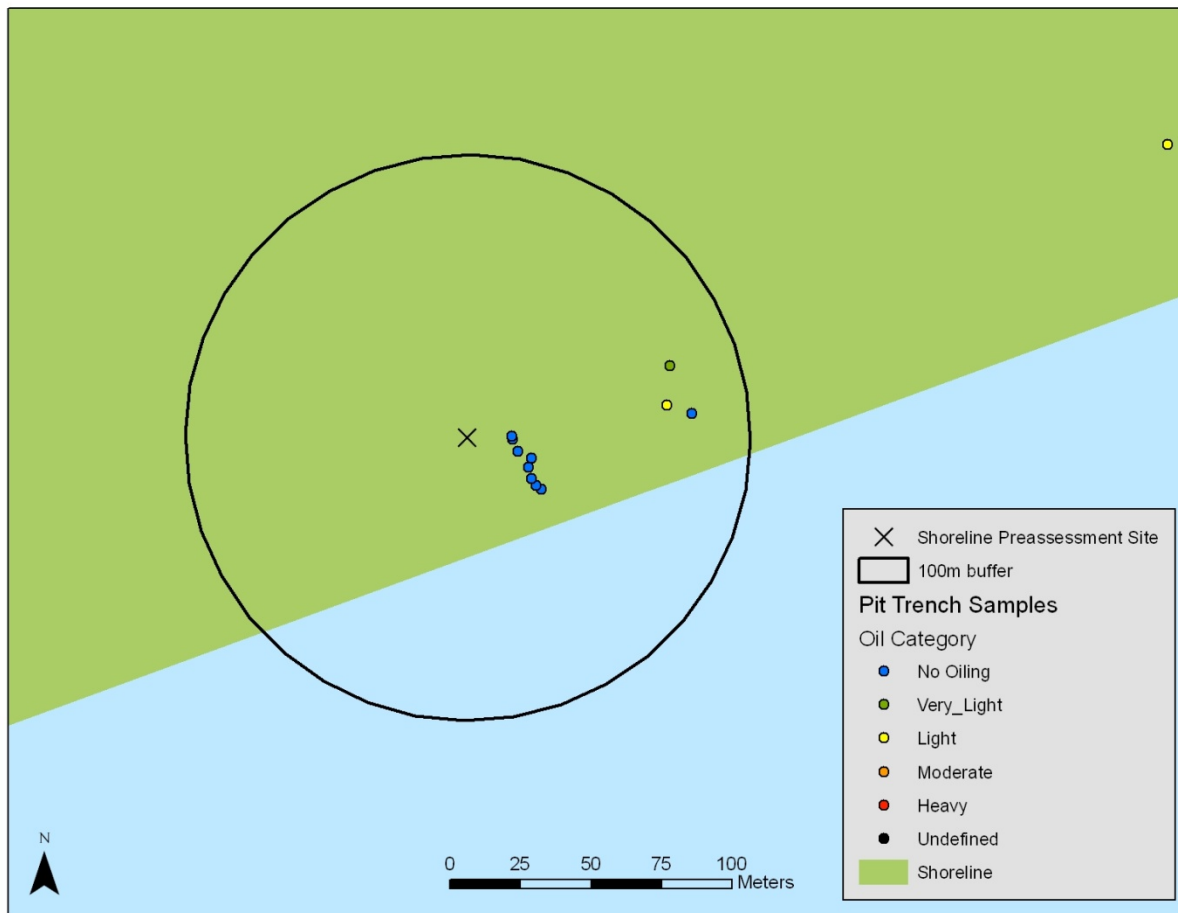


Figure I. Example marsh edge or sandy shoreline site oiling category assignment based on the intersection of a 100 meter buffer applied to the site and the maximum subsurface shoreline oiling characteristics as observed along the intertidal zone of the shoreline by ongoing field surveys performed by Shoreline Cleanup Assessment Techniques (SCAT) teams. This site would receive an oiling category of L (lightly oiled).

**XII. Appendix 2.**

**NRDA Trustee Field Decontamination Procedures for Sediment and Biota Sampling Equipment**

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STANDARD OPERATING PROCEDURE  
DECONTAMINATION PROCEDURES FOR SAMPLING EQUIPMENT  
MC252 FISH TECHNICAL WORK GROUP WORK PLANS

August 24, 2011

### **1.0 Scope and Applicability**

This Standard Operating Procedure (SOP) describes equipment and field procedures necessary to properly decontaminate equipment utilized for the MC252 2011 Submerged Oil, Marsh Edge Sandy Shore, and Sargassum Work Plans under which sediment, tissue, and water sampling are conducted. This process is designed to minimize the potential for constituent migration and/or cross contamination. This procedure does not apply to personnel decontamination.

### **2.0 Summary of Method**

The objective of these multimedia sampling programs is to determine and quantify the presence of oil-related chemicals in marsh edge and sandy shore habitats, as well as in biota residing in each. Decontamination procedures appropriate to the oil-related chemicals being assessed may improve the prevention of cross contamination. This SOP presents an adaptive approach to decontamination that ensures sufficiency of decontamination while minimizing the use of and personnel exposure to solvents.

### **3.0 Equipment and Supplies**

- PPE (including disposable Neoprene gloves, chemical splash goggles; see Section 4.0 below for additional information including safe work practices)
- Small dry chemical Fire Extinguisher (BC or ABC Rated - 5 lb or larger)
- Bristled Brushes compatible with the solutions being used
- Low Phosphate Detergent (Alconox or Liquinox), diluted in accordance with instructions provided with the product.
- Acetone and Hexane (pesticide grade or better stored in ETFE Bottles)
- Distilled/DI water
- Designated solvent-compatible container for collection of decon waste/rinsates (HDPE ok for hexane and acetone, if acetone concentrations are less than 5%. Otherwise a PTFE liner is needed).
- Secondary containment vessel such as a cooler that can be closed to reduce the likelihood of spills and reduce volatilization
- Clean Ambient/Tap water source
- Wash/rinse tubs compatible with the solutions being used
- Specified area of vessel for decon away from other contaminant sources and other personnel

- If collecting a rinsate blank, small container appropriate for the collection
- Field documentation materials

#### 4.0 Health and Safety

Health and safety hazards associated with this procedure can be mitigated by the following engineering, administrative, and PPE controls:

| HAZARD   | CONTROL(S)   |
|--|--|
| Bodily injury due to pinch points or dropped equipment | <ul style="list-style-type: none"> <li>• Leather gloves and steel-toe boots should be worn while equipment is being handled</li> <li>• Equipment safety features (e.g., lock pins) should be engaged while equipment is being handled</li> </ul>   |
| Vapor inhalation                                       | <ul style="list-style-type: none"> <li>• Use solvents only in well-ventilated areas</li> <li>• Remain upwind of solvent decon work</li> <li>• Advise other workers in the area of the nature of your task and ask them to remain upwind</li> </ul>   |
| Skin irritation  | <ul style="list-style-type: none"> <li>• Don proper chemical-resistant gloves (disposable Neoprene 5ml or greater thickness) prior to handling organic solvent</li> <li>• Rinse solvent from gloves before removing</li> <li>• Promptly wash any areas of skin which may have encountered contact with organic solvent and always wash after completing work with hazardous materials</li> </ul>   |
| Eye contact  | <ul style="list-style-type: none"> <li>• Don chemical splash goggles prior to retrieving and handling organic solvent</li> <li>• Do not use solvent wash bottle near face</li> </ul>   |
| Fire   | <ul style="list-style-type: none"> <li>• Store organic solvents in approved, leak-proof containers (ETFE plastic for either solvent) in a cool, shaded area; do not store in direct sun</li> <li>• Do not smoke near solvent storage or work areas</li> <li>• Do not use or place solvent near flame or other heat source</li> <li>• 5- or 10-pound dry chemical fire extinguisher (Type BC or Type ABC) should be readily accessible during the decon process</li> </ul>                      |
| Solvent spill  | <ul style="list-style-type: none"> <li>• Place equipment to be decontaminated in containers to capture rinsate</li> <li>• Inspect solvent containers for leaks prior to handling</li> <li>• Have an organic solvent spill kit available and near solvent storage and work areas; workers should be trained in spill kit use before the start of each mission</li> </ul>  |
| Environmental detriment                                | <ul style="list-style-type: none"> <li>• Keep solvent bottles tightly capped to prevent leakage and minimize vaporization. Store in secondary containment vessels</li> <li>• Promptly clean spilled solvent with paper towels and discard in solid used waste container</li> <li>• Maintain solid used materials (e.g., paper towels, disposable gloves, etc.) in a bucket or other container to prevent litter</li> <li>• Promptly replace lids onto rinsate buckets and secondary</li> </ul> |

|  |                                |
|--|--------------------------------|
|  | containers to prevent spillage |
|--|--------------------------------|

NOTE: The above information was determined from job hazard analysis of the work tasks (Attachment A).

## 5.0 Decontamination Procedures

### Levels of Decontamination Procedures and their Selection

All equipment and non-disposable materials that directly contact a sample medium shall be must undergo Level 1 Decontamination (see below) or be pre-cleaned by the manufacturer, in compliance with the protocols described here.

The Level 1 Decontamination procedure shall be the default decontamination procedure for all non-disposable equipment, followed by Level 2 Decontamination when applicable. The observation of oil in the general vicinity of the sampling does not necessitate Level 2 or Level 3 Decontamination (use of solvents; see below), but Level 2 or Level 3 Decontamination can be used at the field crew's discretion.

Level 3 Decontamination must be used when Level 1 and Level 2 Decontamination procedures are not successful (i.e. visible oil is still observed on the equipment or the equipment rinsate).

#### Level 1- Default decontamination procedure

Scrub<sup>1</sup> all equipment and parts with a dilute detergent mixture and rinse with deionized or distilled water. Inspect the equipment and rinse water for signs of residual oil, other contaminants, or incomplete decontamination.

#### Level 2 – Inspection and secondary decontamination

Whenever, after the Level 1 Decontamination procedure, there remains some evidence of incomplete decontamination and residual oil (i.e. sheen in rinse water, dark spots on net, etc.) the field team shall repeat Level 1 decontamination.

After the Level 1 Decontamination procedure is repeated, the equipment and rinse shall again be inspected. If after visual inspection there remains evidence of incomplete decontamination and residual oil (i.e. sheen in rinse water, dark spots on the net, etc.) the team shall utilize small quantities of solvents to spot clean the area of residual oil. The decontamination procedures using two solvents are described below.

#### Level 3 – Expanded solvent decontamination procedures

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<sup>1</sup> The full decontamination process using detergent washing procedures is described below.

If after the Level 2 Decontamination procedures the field team determines the decontamination procedures were not adequate, the field team shall cease using the sampling equipment. The equipment shall be isolated and secured while on the work boats. More thorough decontamination, including additional detergent washing, additional solvent spot treatment and/ or expanded solvent treatment, can be conducted upon returning to shore.

### **Specific Protocols**

These protocols are to be followed for all sampling apparatus (e.g., sediment collectors, nets, mixing bowls, etc.). Sediment samples collected for grain size analysis shall require the default procedure only.

#### **All sampling devices between sample collections**

- Collect the samples following the Work Plan's sampling protocol
- Wash and scrub with a clean mixture of distilled/DI water and low phosphate detergent
- Rinse equipment with distilled/DI water
- Inspect devices and rinse water; if sheen or oil is observed, repeat the above steps; if not, decontamination is complete
- If sheen or oil is observed after a second decontamination with water and detergent, proceed to the solvent rinsing steps below

#### **Oil/sheen observed after repeated decontamination with water and detergent scrub**

- Wash and scrub with a clean mixture of distilled/DI water and low phosphate detergent
- Rinse equipment with distilled/DI water
- Use a ETFE bottle to apply Acetone sparingly<sup>2</sup> to the piece of equipment being decontaminated
- Use a ETFE squirt bottle to apply Hexane sparingly to the piece of equipment being decontaminated
- Thoroughly rinse with DI/distilled water

Oiled rinsate must be collected in the designated solvent-compatible container. Keep a lid on this container at all times while not in use and apply the designated rinsate label to the side of the container. These materials will be turned over to appropriate personnel for disposal. Collect non-oiled rinsate in a bucket with lid for disposal.

NOTE: In the event that the total duration of solvent application for either Acetone or Hexane reaches 24 minutes cumulatively over the course of your work day, please discontinue solvent use for that day and contact your Supervisor and Project Safety for further direction.

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<sup>2</sup> Use the minimum possible to remove the contamination. Teams are limited to 1000ml of each solvent and 24 minutes of total use per day. Delivery rate is also limited by the nozzle size of the squeeze bottles.

## **6.0 Storage and Disposal of Chemicals and Chemical Waste**

Solvents and rinsates will be handled following the specific guidelines listed below:

### **Solvents**

- All solvents will be transported in small amounts (500ml-1000ml)
- All solvents will be transported/stored within closeable secondary containment to prevent spills and volatilization
- Keep all solvents and secondary containment as cool as possible
- Do not store solvents or rinsate materials in vehicles or hotel rooms, utilize the storage facility identified for your sampling crew – acquire the necessary solvent amount in PTFE/Teflon squirt bottles from the storage facility each morning, and return the unused portion and containers after the sampling day

### **Rinsates Containing Oil and/or Solvents**

- Collect all rinsates in the designated solvent-compatible container with the appropriate label on the side
- Place rinsate containers in a secondary containment system to reduce the likelihood of spills and prevent volatilization
- All rinsates containing oil and/or solvents will be transported by authorized persons to the appropriate waste disposal site
- All rinsates will be captured in the same container.<sup>3</sup>

### **Rinsates Containing Water and/or Low-phosphate Detergents**

- Rinsates containing only low phosphate detergents and water will also be containerized and transported to the appropriate waste disposal site
- Place rinsate containers in secondary containment during transportation and storage to reduce the likelihood of spills

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<sup>3</sup> Diluting the rinsate from level 1 with the rinsate from level 1 is a key safety factor, reducing both concentration and volatility.





## Material Safety Data Sheet

Creation Date 28-Apr-2009

Revision Date 22-Sep-2009

Revision Number 1

### 1. PRODUCT AND COMPANY IDENTIFICATION

|                     |  |
|---------------------|--|
| Product Name        | Acetone  |
| Cat No.             | A9-4; A9-20; A9-200; A11-1; A11-4; A11-20; A11-200; A11S-4; A16F-1GAL; A16P-1GAL; A16P-4; A16S-4; A16S-20; A18-1; A18-4; A18-20; A18-200; A18-200LC; A18-500; A18CU1300; A18FB-19; A18FB-50; A18FB-115; A18FB-200; A18P-4; A18POP-19; A18POPB-50; A18RB-19; A18RB-50; A18RB-115; A18RB-200; A18RS-28; A18RS-50; A18RS-115; A18RS-200; A18S-4; A18SK-4; A18SS-19; A18SS-28; A18SS-50; A18SS-115; A18SS-200; A19-1; A19-4; A19RS-115; A19RS-200; A40-4; A928-4; A929-1; A929-4; A929RS-19; A929RS-50; A929RS-200; A929SK-4; A929SS-28; A929SS-50; A929SS-115; A929SS-200; A946-4; A946-4LC; A946FB-200; A946RB-19; A946RB-50; A946RB-115; A946RB-200; A949-1; A949-4; A949CU-50; A949N-119; A949N-219; A949POP-19; A949RS-28; A949RS-50; A949RS-115; A949SK-1; A949SK-4; A949SS-19; A949SS-28; A949SS-50; A949SS-115; A949SS-200; BP2403-1; BP2403-4; BP2403-20; BP2404-1; BP2404-4; BP2404SK-1; BP2404SK-4; HC-300-1GAL |
| Synonyms            | 2-Propanone; Dimethyl ketone; (Certified ACS, HPLC, OPTIMA, Histological, Spectranalyzed, NF/FCC/EP, Pesticide, Electronic, GC Resolv, SAFE-COTE)  |
| Recommended Use     | Laboratory chemicals   |
| Company             | Emergency Telephone Number   |
| Fisher Scientific   | CHEMTREC®, Inside the USA: 800-  |
| One Reagent Lane    | 424-9300   |
| Fair Lawn, NJ 07410 | CHEMTREC®, Outside the USA: 703-   |
| Tel: (201) 796-7100 | 527-3887   |

### 2. HAZARDS IDENTIFICATION

#### DANGER!

#### Emergency Overview

Flammable liquid and vapor. Irritating to eyes and skin. May cause irritation of respiratory tract. Vapors may cause drowsiness and dizziness. Repeated exposure may cause skin dryness or cracking.

Appearance Colorless

Physical State Liquid

odor sweet

Target Organs

Central nervous system (CNS), Eyes, Respiratory system, Skin, Kidney, Liver, spleen

**Potential Health Effects****Acute Effects****Principle Routes of Exposure**

|                   |  |
|-------------------|--|
| <b>Eyes</b>       | Irritating to eyes.  |
| <b>Skin</b>       | Irritating to skin. May be harmful in contact with skin. Repeated exposure may cause skin dryness or cracking.   |
| <b>Inhalation</b> | Inhalation may cause central nervous system effects. May cause drowsiness and dizziness. May cause irritation of respiratory tract. May be harmful if inhaled. |
| <b>Ingestion</b>  | Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea. May be harmful if swallowed.   |

**Chronic Effects**

Experiments have shown reproductive toxicity effects on laboratory animals. May cause adverse liver effects. May cause adverse kidney effects.

See Section 11 for additional Toxicological information.

**Aggravated Medical Conditions**

Central nervous system disorders. Preexisting eye disorders. Skin disorders. Kidney disorders. Liver disorders.

**3. COMPOSITION/INFORMATION ON INGREDIENTS****Haz/Non-haz**

| Component | CAS-No  | Weight % |
|-----------|---------|----------|
| Acetone   | 67-64-1 | >95      |

**4. FIRST AID MEASURES**

|                           |  |
|---------------------------|--|
| <b>Eye Contact</b>        | Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention. |
| <b>Skin Contact</b>       | Wash off immediately with plenty of water for at least 15 minutes. Obtain medical attention.                       |
| <b>Inhalation</b>         | Move to fresh air. If breathing is difficult, give oxygen. Get medical attention immediately if symptoms occur.    |
| <b>Ingestion</b>          | Do not induce vomiting. Obtain medical attention.  |
| <b>Notes to Physician</b> | Treat symptomatically.   |

**5. FIRE-FIGHTING MEASURES**

|                                     |  |
|-------------------------------------|--|
| <b>Flash Point</b>                  | -20°C / -4°F   |
| <b>Method</b>                       | No information available.  |
| <b>Autoignition Temperature</b>     | 465°C / 869°F  |
| <b>Explosion Limits</b>             |  |
| <b>Upper</b>                        | 12.8 vol %   |
| <b>Lower</b>                        | 2.5 vol %  |
| <b>Suitable Extinguishing Media</b> | CO <sub>2</sub> , dry chemical, dry sand, alcohol-resistant foam. Cool closed containers exposed to fire with water spray. |

**Unsuitable Extinguishing Media**

Water may be ineffective.

**Hazardous Combustion Products**

No information available.

**Sensitivity to mechanical impact**

No information available.

**Sensitivity to static discharge**

No information available.

**Specific Hazards Arising from the Chemical**

Flammable. Risk of ignition. Containers may explode when heated. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back.

**Protective Equipment and Precautions for Firefighters**

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

**NFPA****Health 1****Flammability 3****Instability 0****Physical hazards N/A****6. ACCIDENTAL RELEASE MEASURES****Personal Precautions**

Use personal protective equipment. Remove all sources of ignition. Take precautionary measures against static discharges.

**Environmental Precautions**

Should not be released into the environment.

**Methods for Containment and Clean Up**

Remove all sources of ignition. Soak up with inert absorbent material. Take precautionary measures against static discharges. Keep in suitable and closed containers for disposal.

**7. HANDLING AND STORAGE****Handling**

Wear personal protective equipment. Keep away from open flames, hot surfaces and sources of ignition. Do not breathe vapors or spray mist. Do not get in eyes, on skin, or on clothing. Use only non-sparking tools. Use explosion-proof equipment. Take precautionary measures against static discharges.

**Storage**

Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from heat and sources of ignition. Flammables area.

## 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

### Engineering Measures

Ensure adequate ventilation, especially in confined areas. Use explosion-proof electrical/ventilating/lighting/equipment. Ensure that eyewash stations and safety showers are close to the workstation location.

### Exposure Guidelines

| Component | ACGIH TLV                     | OSHA PEL  | NIOSH IDLH   |
|-----------|-------------------------------|---|--|
| Acetone   | TWA: 500 ppm<br>STEL: 750 ppm | (Vacated) TWA: 750 ppm<br>(Vacated) TWA: 1800 mg/m <sup>3</sup><br>(Vacated) STEL: 1000 ppm<br>(Vacated) STEL: 2400 mg/m <sup>3</sup><br>TWA: 1000 ppm<br>TWA: 2400 mg/m <sup>3</sup> | IDLH: 2500 ppm<br>TWA: 250 ppm<br>TWA: 590 mg/m <sup>3</sup> |

| Component | Quebec  | Mexico OEL (TWA)   | Ontario TWAEV                 |
|-----------|---|--|-------------------------------|
| Acetone   | TWA: 1190 mg/m <sup>3</sup><br>TWA: 500 ppm<br>STEL: 1000 ppm<br>STEL: 2380 mg/m <sup>3</sup> | TWA: 1000 ppm<br>TWA: 2400 mg/m <sup>3</sup><br>STEL: 1260 ppm<br>STEL: 3000 mg/m <sup>3</sup> | TWA: 500 ppm<br>STEL: 750 ppm |

**NIOSH IDLH:** Immediately Dangerous to Life or Health

### Personal Protective Equipment

#### Eye/face Protection

Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

#### Skin and body protection

Wear appropriate protective gloves and clothing to prevent skin exposure.

#### Respiratory Protection

Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

## 9. PHYSICAL AND CHEMICAL PROPERTIES

### Physical State

Liquid

### Appearance

Colorless

### odor

sweet

### Odor Threshold

No information available.

### pH

No information available.

### Vapor Pressure

247 mbar @ 20 °C

### Vapor Density

2.0 (Air = 1.0)

### Viscosity

0.32 mPa.s @ 20 °C

### Boiling Point/Range

56°C / 132.8°F

### Melting Point/Range

-95°C / -139°F

### Decomposition temperature °C

No information available.

### Flash Point

-20°C / -4°F

### Evaporation Rate

(Butyl Acetate = 1.0)

### Specific Gravity

0.790

### Solubility

Soluble in water

### log Pow

No data available

### Molecular Weight

58.08

### Molecular Formula

C<sub>3</sub> H<sub>6</sub> O

## 10. STABILITY AND REACTIVITY

## 10. STABILITY AND REACTIVITY

|   |   |
|---|---|
| <b>Stability</b>                        | Stable under normal conditions.   |
| <b>Conditions to Avoid</b>              | Incompatible products. Heat, flames and sparks.                                 |
| <b>Incompatible Materials</b>           | Strong oxidizing agents, Strong reducing agents, Strong bases, Peroxides        |
| <b>Hazardous Decomposition Products</b> | Carbon monoxide (CO), Carbon dioxide (CO <sub>2</sub> ), Formaldehyde, Methanol |
| <b>Hazardous Polymerization</b>         | Hazardous polymerization does not occur.  |
| <b>Hazardous Reactions .</b>            | None under normal processing..  |

## 11. TOXICOLOGICAL INFORMATION

### Acute Toxicity

#### Component Information

| Component | LD50 Oral          | LD50 Dermal | LC50 Inhalation |
|-----------|--------------------|-------------|-----------------|
| Acetone   | 5800 mg/kg ( Rat ) | Not listed  | Not listed      |

|   |  |
|---|--|
| <b>Irritation</b>                           | Irritating to eyes and skin  |
| <b>Toxicologically Synergistic Products</b> | Carbon tetrachloride; Chloroform; Trichloroethylene; Bromodichloromethane; Dibromochloromethane; N-nitrosodimethylamine; 1,1,2-Trichloroethane; Styrene; Acetonitrile, 2,5-Hexanedione; Ethanol; 1,2-Dichlorobenzene |
| <b><u>Chronic Toxicity</u></b>              |  |
| <b>Carcinogenicity</b>                      | There are no known carcinogenic chemicals in this product  |
| <b>Sensitization</b>                        | No information available.  |
| <b>Mutagenic Effects</b>                    | Mutagenic effects have occurred in experimental animals.   |
| <b>Reproductive Effects</b>                 | Experiments have shown reproductive toxicity effects on laboratory animals.  |
| <b>Developmental Effects</b>                | Developmental effects have occurred in experimental animals.   |
| <b>Teratogenicity</b>                       | Teratogenic effects have occurred in experimental animals..  |
| <b>Other Adverse Effects</b>                | The toxicological properties have not been fully investigated.. See actual entry in RTECS for complete information.  |
| <b>Endocrine Disruptor Information</b>      | No information available   |

## 12. ECOLOGICAL INFORMATION

### Ecotoxicity

| Component | Freshwater Algae | Freshwater Fish  | Microtox                 | Water Flea   |
|-----------|------------------|--|--------------------------|--|
| Acetone   | Not listed       | Leuciscus idus: LC50 = 11300 mg/L/48h<br>Salmo gairdneri: LC50 = 6100 mg/L/24h | EC50 = 14500 mg/L/15 min | EC50 = 39 mg/L/48h<br>EC50 = 12700 mg/L/48h<br>EC50 = 12600 mg/L/48h |

**Persistence and Degradability**      Readily biodegradable.

**Bioaccumulation/ Accumulation**      No information available

**Mobility**      .

| Component | log Pow |
|-----------|---------|
| Acetone   | -0.24   |

## 13. DISPOSAL CONSIDERATIONS

**Waste Disposal Methods**      Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

| Component         | RCRA - U Series Wastes | RCRA - P Series Wastes |
|-------------------|------------------------|------------------------|
| Acetone - 67-64-1 | U002                   | -                      |

## 14. TRANSPORT INFORMATION

### DOT

|                      |         |
|----------------------|---------|
| UN-No                | UN1090  |
| Proper Shipping Name | ACETONE |
| Hazard Class         | 3       |
| Packing Group        | II      |

### TDG

|                      |         |
|----------------------|---------|
| UN-No                | UN1090  |
| Proper Shipping Name | ACETONE |
| Hazard Class         | 3       |
| Packing Group        | II      |

### IATA

|                      |         |
|----------------------|---------|
| UN-No                | UN1090  |
| Proper Shipping Name | ACETONE |
| Hazard Class         | 3       |
| Packing Group        | II      |

## 14. TRANSPORT INFORMATION

**IMDG/IMO**

|                             |         |
|-----------------------------|---------|
| <b>UN-No</b>                | UN1090  |
| <b>Proper Shipping Name</b> | ACETONE |
| <b>Hazard Class</b>         | 3       |
| <b>Packing Group</b>        | II      |

## 15. REGULATORY INFORMATION

**International Inventories**

| Component | TSCA | DSL | NDSL | EINECS    | ELINCS | NLP | PICCS | ENCS | AICS | CHINA | KECL          |
|-----------|------|-----|------|-----------|--------|-----|-------|------|------|-------|---------------|
| Acetone   | X    | X   | -    | 200-662-2 | -      |     | X     | X    | X    | X     | KE-29367<br>X |

**Legend:**

X - Listed

E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.

F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.

N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.

P - Indicates a commenced PMN substance

R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.

S - Indicates a substance that is identified in a proposed or final Significant New Use Rule

T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.

XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B)).

Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.

Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

**U.S. Federal Regulations****TSCA 12(b)** Not applicable**SARA 313**

Not applicable

**SARA 311/312 Hazardous Categorization**

|  |     |
|--|-----|
| <b>Acute Health Hazard</b>               | Yes |
| <b>Chronic Health Hazard</b>             | No  |
| <b>Fire Hazard</b>                       | Yes |
| <b>Sudden Release of Pressure Hazard</b> | No  |
| <b>Reactive Hazard</b>                   | No  |

**Clean Water Act**

Not applicable

**Clean Air Act**

Not applicable

**OSHA**

Not applicable

**CERCLA**

This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

| Component | Hazardous Substances RQs | CERCLA EHS RQs |
|-----------|--------------------------|----------------|
| Acetone   | 5000 lb                  | -              |

**California Proposition 65**

This product does not contain any Proposition 65 chemicals.

**State Right-to-Know**

| Component | Massachusetts | New Jersey | Pennsylvania | Illinois | Rhode Island |
|-----------|---------------|------------|--------------|----------|--------------|
| Acetone   | X             | X          | X            | -        | X            |

**U.S. Department of Transportation**

Reportable Quantity (RQ): Y

DOT Marine Pollutant N

DOT Severe Marine Pollutant N

**U.S. Department of Homeland Security**

This product contains the following DHS chemicals:

| Component | DHS Chemical Facility Anti-Terrorism Standard |
|-----------|---|
| Acetone   | 2000 lb STQ                                   |

**Other International Regulations****Mexico - Grade**

Serious risk, Grade 3

**Canada**

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

**WHMIS Hazard Class**

B2 Flammable liquid

D2B Toxic materials





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**16. OTHER INFORMATION**

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**Prepared By** Regulatory Affairs  
Thermo Fisher Scientific  
[REDACTED]

**Creation Date** 28-Apr-2009

**Print Date** 22-Sep-2009

**Revision Summary** "\*\*\*\*", and red text indicates revision

**Disclaimer**

The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

**End of MSDS**



# Fisher Scientific

Part of Thermo Fisher Scientific

## Material Safety Data Sheet

Creation Date 26-Oct-2009

Revision Date 26-Oct-2009

Revision Number 1

### 1. PRODUCT AND COMPANY IDENTIFICATION

**Product Name** Hexane

**Cat No.** BP2615-100; H291-4; H291-20; H291-200; H291-500; H291FB-19; H291FB-50; H291FB-200; H291RB-19; H291RB-50; H291RB-115; H291RB-200; H291RS-19; H291RS-28; H291RS-50; H291RS-115; H291RS-200; H291S-4; H291SS-28; H291SS-50; H291SS-115; H291SS-200; H300-4; H302-1; H302-4; H302-4LC; H302N-119; H302N-119LC; H302N-219; H302POP-19; H302POP-50; H302RS-19; H302RS-28; H302RS-50; H302RS-115; H302RS-200; H302SK-1; H302SK-4; H302SS-19; H302SS-28; H302SS-50; H302SS-115; H302SS-200; H303-1; H303-4; H303-4LC; H303RS-19; H303RS-28; H303RS-50; H303RS-115; H303RS-200; H303SK-4; H303SS-19; H303SS-28; H303SS-50; H303SS-115; H303SS-200; H307-4; H334-1; H334-4; N3-20; N3-200; O3386-20

**Synonyms** n-Hexane with < 5% various methyl pentanes; Lignoine; Naphtha Solvent (Anhydrous/Certified ACS/Pesticide/HPLC/OPTIMA/GC Resolv/Spectranalyzed/Technical/Laboratory)

**Recommended Use** Laboratory chemicals

**Company**  
Fisher Scientific  
One Reagent Lane  
Fair Lawn, NJ 07410  
Tel: (201) 796-7100

**Emergency Telephone Number**  
CHEMTREC®, Inside the USA: 800-424-9300  
CHEMTREC®, Outside the USA: 703-527-3887

### 2. HAZARDS IDENTIFICATION

#### DANGER!

#### Emergency Overview

Extremely flammable liquid and vapor. Inhalation may cause central nervous system effects. Irritating to eyes and skin. May cause irritation of respiratory tract. Aspiration hazard if swallowed - can enter lungs and cause damage. Danger of serious damage to health by prolonged exposure. Possible risk of impaired fertility. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

**Appearance** Colorless

**Physical State** Liquid

**odor** Petroleum distillates

**Target Organs** Skin, Respiratory system, Eyes, Central nervous system (CNS), Heart, Blood, Liver, Reproductive System

## Potential Health Effects

### Acute Effects

#### Principle Routes of Exposure

|                   |   |
|-------------------|---|
| <b>Eyes</b>       | Irritating to eyes.   |
| <b>Skin</b>       | Irritating to skin. May be harmful in contact with skin.  |
| <b>Inhalation</b> | Inhalation may cause central nervous system effects. May cause irritation of respiratory tract. May be harmful if inhaled.      |
| <b>Ingestion</b>  | Aspiration hazard. May be harmful if swallowed. Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea. |

### Chronic Effects

Tumorigenic effects have been reported in experimental animals.. Experiments have shown reproductive toxicity effects on laboratory animals. Possible risk of impaired fertility. Danger of serious damage to health by prolonged exposure. May cause adverse liver effects.

See Section 11 for additional Toxicological information.

**Aggravated Medical Conditions** Central nervous system disorders. Preexisting eye disorders. Skin disorders.

## 3. COMPOSITION/INFORMATION ON INGREDIENTS

### Haz/Non-haz

| Component | CAS-No   | Weight % |
|-----------|----------|----------|
| Hexane    | 110-54-3 | >95      |

## 4. FIRST AID MEASURES

|                           |  |
|---------------------------|--|
| <b>Eye Contact</b>        | Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention.   |
| <b>Skin Contact</b>       | Wash off immediately with plenty of water for at least 15 minutes. Obtain medical attention.   |
| <b>Inhalation</b>         | Move to fresh air. If breathing is difficult, give oxygen. Do not use mouth-to-mouth resuscitation if victim ingested or inhaled the substance; induce artificial respiration with a respiratory medical device. Obtain medical attention. |
| <b>Ingestion</b>          | Do not induce vomiting. Call a physician or Poison Control Center immediately.   |
| <b>Notes to Physician</b> | Treat symptomatically.   |

## 5. FIRE-FIGHTING MEASURES

|                                     |  |
|-------------------------------------|--|
| <b>Flash Point</b>                  | -22°C / -7.6°F   |
| <b>Method</b>                       | No information available.  |
| <b>Autoignition Temperature</b>     | 223°C / 433.4°F  |
| <b>Explosion Limits</b>             |  |
| Upper                               | 7.5 vol %  |
| Lower                               | 1.1 vol %  |
| <b>Suitable Extinguishing Media</b> | CO <sub>2</sub> , dry chemical, dry sand, alcohol-resistant foam. Cool closed containers exposed to fire with water spray. |

**Unsuitable Extinguishing Media**

Water may be ineffective. This material is lighter than water and insoluble in water. The fire could easily be spread by the use of water in an area where the water cannot be contained..

**Hazardous Combustion Products**

No information available.

**Sensitivity to mechanical impact**

No information available.

**Sensitivity to static discharge**

No information available.

**Specific Hazards Arising from the Chemical**

Flammable. Risk of ignition. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back. Containers may explode when heated.

**Protective Equipment and Precautions for Firefighters**

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

**NFPA****Health 1****Flammability 3****Instability 0****Physical hazards N/A****6. ACCIDENTAL RELEASE MEASURES****Personal Precautions**

Use personal protective equipment. Remove all sources of ignition. Take precautionary measures against static discharges.

**Environmental Precautions**

Should not be released into the environment.

**Methods for Containment and Clean Up**

Soak up with inert absorbent material. Keep in suitable and closed containers for disposal. Remove all sources of ignition. Use spark-proof tools and explosion-proof equipment.

**7. HANDLING AND STORAGE****Handling**

Use only under a chemical fume hood. Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Do not breathe vapors or spray mist. Keep away from open flames, hot surfaces and sources of ignition. Use only non-sparking tools. Use explosion-proof equipment. Take precautionary measures against static discharges.

**Storage**

Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from heat and sources of ignition. Flammables area.

## 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

### Engineering Measures

Use only under a chemical fume hood. Use explosion-proof electrical/ventilating/lighting/equipment. Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

### Exposure Guidelines

| Component | ACGIH TLV           | OSHA PEL   | NIOSH IDLH  |
|-----------|---------------------|--|---|
| Hexane    | TWA: 50 ppm<br>Skin | (Vacated) TWA: 180 mg/m <sup>3</sup><br>(Vacated) TWA: 50 ppm<br>TWA: 500 ppm<br>TWA: 1800 mg/m <sup>3</sup> | IDLH: 1100 ppm<br>TWA: 180 mg/m <sup>3</sup><br>TWA: 50 ppm |

| Component | Quebec  | Mexico OEL (TWA)                          | Ontario TWAEL                             |
|-----------|---|---|---|
| Hexane    | TWA: 176 mg/m <sup>3</sup><br>TWA: 50 ppm<br>Skin | TWA: 176 mg/m <sup>3</sup><br>TWA: 50 ppm | TWA: 176 mg/m <sup>3</sup><br>TWA: 50 ppm |

**NIOSH IDLH:** Immediately Dangerous to Life or Health

### Personal Protective Equipment

#### Eye/face Protection

Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

#### Skin and body protection

Wear appropriate protective gloves and clothing to prevent skin exposure.

#### Respiratory Protection

Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

## 9. PHYSICAL AND CHEMICAL PROPERTIES

### Physical State

Liquid

### Appearance

Colorless

### odor

Petroleum distillates

### Odor Threshold

No information available.

### pH

No information available.

### Vapor Pressure

160 mbar @ 20 °C

### Vapor Density

2.97 (Air = 1.0)

### Viscosity

0.31 mPa s at 20 °C

### Boiling Point/Range

69°C / 156.2°F @ 760 mmHg

### Melting Point/Range

-95°C / -139°F

### Decomposition temperature

No information available.

### Flash Point

-22°C / -7.6°F

### Evaporation Rate

No information available.

### Specific Gravity

0.659

### Solubility

Insoluble in water

### log Pow

No data available

### Molecular Weight

86.18

### Molecular Formula

C<sub>6</sub> H<sub>14</sub>

## 10. STABILITY AND REACTIVITY

### Stability

Stable under normal conditions.

### Conditions to Avoid

Incompatible products. Heat, flames and sparks. Exposure to light.

**Incompatible Materials**

Strong oxidizing agents, Halogens

**Hazardous Decomposition Products**Carbon monoxide (CO), Carbon dioxide (CO<sub>2</sub>)**Hazardous Polymerization**

Hazardous polymerization does not occur

**Hazardous Reactions .**

None under normal processing.

**11. TOXICOLOGICAL INFORMATION****Acute Toxicity****Component Information**

| Component | LD50 Oral       | LD50 Dermal           | LC50 Inhalation       |
|-----------|-----------------|-----------------------|-----------------------|
| Hexane    | 25 g/kg ( Rat ) | 3000 mg/kg ( Rabbit ) | 48000 ppm ( Rat ) 4 h |

**Irritation**

Irritating to eyes and skin

**Toxicologically Synergistic Products**

No information available.

**Chronic Toxicity****Carcinogenicity**

There are no known carcinogenic chemicals in this product

**Sensitization**

No information available.

**Mutagenic Effects**

Mutagenic effects have occurred in experimental animals.

**Reproductive Effects**

Experiments have shown reproductive toxicity effects on laboratory animals.

**Developmental Effects**

Developmental effects have occurred in experimental animals.

**Teratogenicity**

Teratogenic effects have occurred in experimental animals..

**Other Adverse Effects**

Tumorigenic effects have been reported in experimental animals.. See actual entry in RTECS for complete information.

**Endocrine Disruptor Information**

No information available

**12. ECOLOGICAL INFORMATION****Ecotoxicity**

. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

| Component | Freshwater Algae | Freshwater Fish | Microtox   | Water Flea          |
|-----------|------------------|-----------------|------------|---------------------|
| Hexane    | Not listed       | Not listed      | Not listed | EC50: 3.87 mg/L/48h |

**Persistence and Degradability** No information available

**Bioaccumulation/ Accumulation** No information available

**Mobility** .

| Component | log Pow |
|-----------|---------|
| Hexane    | 4.11    |

### 13. DISPOSAL CONSIDERATIONS

**Waste Disposal Methods** Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

### 14. TRANSPORT INFORMATION

#### DOT

UN-No UN1208  
Proper Shipping Name Hexanes  
Hazard Class 3  
Packing Group II

#### TDG

UN-No UN1208  
Proper Shipping Name HEXANES  
Hazard Class 3  
Packing Group II

#### IATA

UN-No UN1208  
Proper Shipping Name Hexanes  
Hazard Class 3  
Packing Group II

#### IMDG/IMO

UN-No UN1208  
Proper Shipping Name Hexanes  
Hazard Class 3  
Packing Group II

### 15. REGULATORY INFORMATION

## 15. REGULATORY INFORMATION

## International Inventories

| Component | TSCA | DSL | NDSL | EINECS    | ELINCS | NLP | PICCS | ENCS | AICS | CHINA | KECL          |
|-----------|------|-----|------|-----------|--------|-----|-------|------|------|-------|---------------|
| Hexane    | X    | X   | -    | 203-777-6 | -      |     | X     | X    | X    | X     | KE-18626<br>X |

## Legend:

X - Listed

E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.

F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.

N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.

P - Indicates a commenced PMN substance

R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.

S - Indicates a substance that is identified in a proposed or final Significant New Use Rule

T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.

XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B)).

Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.

Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

## U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

| Component | CAS-No   | Weight % | SARA 313 - Threshold Values % |
|-----------|----------|----------|-------------------------------|
| Hexane    | 110-54-3 | >95      | 1.0                           |

## SARA 311/312 Hazardous Categorization

|                                   |     |
|-----------------------------------|-----|
| Acute Health Hazard               | No  |
| Chronic Health Hazard             | No  |
| Fire Hazard                       | Yes |
| Sudden Release of Pressure Hazard | No  |
| Reactive Hazard                   | No  |

## Clean Water Act

Not applicable

## Clean Air Act

| Component | HAPS Data | Class 1 Ozone Depletors | Class 2 Ozone Depletors |
|-----------|-----------|-------------------------|-------------------------|
| Hexane    | X         |                         | -                       |

## OSHA

Not applicable

## CERCLA

This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

| Component | Hazardous Substances RQs | CERCLA EHS RQs |
|-----------|--------------------------|----------------|
|-----------|--------------------------|----------------|



| Component | Hazardous Substances RQs | CERCLA EHS RQs |
|-----------|--------------------------|----------------|
| Hexane    | 5000 lb                  | -              |

**California Proposition 65**

This product does not contain any Proposition 65 chemicals.

**State Right-to-Know**

| Component | Massachusetts | New Jersey | Pennsylvania | Illinois | Rhode Island |
|-----------|---------------|------------|--------------|----------|--------------|
| Hexane    | X             | X          | X            | X        | X            |

**U.S. Department of Transportation**

Reportable Quantity (RQ): Y

DOT Marine Pollutant N

DOT Severe Marine Pollutant N

**U.S. Department of Homeland Security**

This product does not contain any DHS chemicals.

**Other International Regulations**

**Mexico - Grade** Serious risk, Grade 3

**Canada**

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

**WHMIS Hazard Class**

B2 Flammable liquid

D2A Very toxic materials

D2B Toxic materials

**16. OTHER INFORMATION****Prepared By**

Regulatory Affairs  
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[REDACTED]

**Creation Date**

26-Oct-2009

**Print Date**

26-Oct-2009

**Revision Summary**

"\*\*\*\*", and red text indicates revision

**Disclaimer**

The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

**End of MSDS**