MC 252 Stage III

SCAT- Shoreline Treatment Implementation Framework

for Louisiana

20 December 2010

APPROVED

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Abbreviations

cm	centimeter
EUL	Environmental Unit Leader
ICP	Incident Command Post
JIC	Joint Information Center
m	meter
NEBA	Net Environmental Benefit Analysis
NFT	No Further Treatment
NOLA	New Orleans Louisiana
NOAA	National Oceanic and Atmospheric Administration
SCAT	Shoreline Cleanup Assessment Technique
SIR	Shoreline Inspection Report
SR	Surface Residues
STR	Shoreline Treatment Recommendation
TWG	Technical Working Group
USFWS	U.S. Fish and Wildlife Service

Purpose and Scope

This Stage III SCAT- Shoreline Treatment Implementation Framework encompasses treatment options for all oiling conditions found on the different shoreline types, not just heavy/moderate conditions covered under Stages I-II, and delivers guidance on the No Further Treatment 2010 (NFT 2010) requirements. Treatment options other than those contained herein may be considered for evaluation by the Core group.

This document has been written with a single objective in mind:

Stage III Shoreline Treatment is to ensure shorelines are treated to the degree required to satisfy stakeholder concerns over natural/environmental, cultural, amenity and other utility matters.

This document is the product of the Core and Technical Working Groups, involving a broad range of Stakeholders and Constituents from Federal and State agencies, and BP. A full list of all the stakeholders involved is provided in Appendix B of this document.

The following issues were considered to meet the objective:

- Treatment should not cause more damage than the oil itself
- Oiling conditions
- Stakeholders/constituents issues of concern relative to oiling conditions and potential treatment options
- Treatment techniques and options readily available (or under close development), including operating parameters and limitations
- Use of the most appropriate but least intrusive methods; if several methods provide the same result, the least intrusive method should be considered for use
- Clarity, recognition and acceptance of what can be achieved before treatment actions become unsafe, impractical, give no significant benefit, or could start to cause further damage to a shoreline habitat/resource (the Net Environmental Benefit Analysis - NEBA - balance)

Overview

Stage III builds on previous shoreline data and information; however, new Shoreline Treatment Recommendations (STRs) will be created to reflect the changes required by the 2010 NFT requirements. The new STRs will be based on a complete resurvey of the affected area taking into account updated oiling conditions. The method for resurvey is provided in Appendix A.

Figure 1 shows the four different phases of Stage III, correlated with the Levels in the UAC Transition Plan. This Stage III Treatment Implementation Framework describes the process for Stage III.1. A separate Monitoring and Maintenance Plan for Stage III.2 has been developed for review and approval. In early 2011, additional planning documents will be developed for Stage III.3.

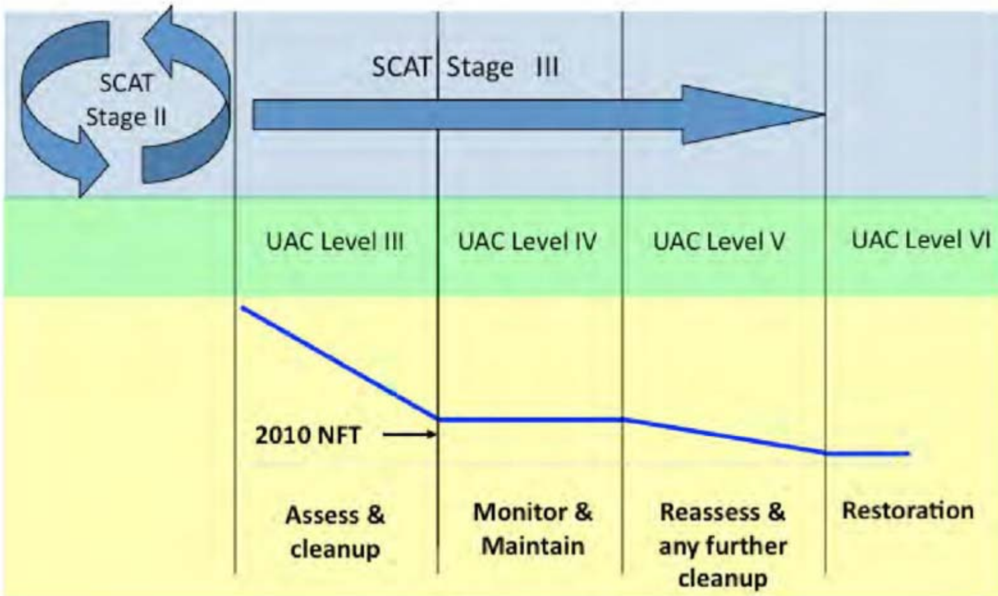

Figure 1. The Stage III Shoreline Treatment Program.

Core Groups

Each Incident Command Post (ICP) had a Core Group. The Core Groups reported to their respective Environmental Unit Leaders (EUL). The ICPs are now consolidated in New Orleans and the Houma Core Group for Louisiana and Mobile Core Group for Mississippi, Alabama, and Florida report to the New Orleans EUL. Each Core Group comprises the key stakeholder representatives from their respective states and the Federal government that are involved in the emergency response and the decision process regarding shoreline treatment to satisfactory completion. A list of Louisiana Core Group members can be found in Appendix B. Other stakeholder input (e.g., affiliated federally and state-recognized tribes, The Wisner Foundation, ConocoPhillips, Apache Corporation, etc.) is incorporated into the Core Group process, as appropriate, through their State representation on the Houma Core Group.

The Core Groups' role is to develop the key decisions on the STRs based on the technical reference materials provided by the individual Technical Working Groups (TWGs) and based on the wider issues and concerns of the Core Group members and other Constituents. The Houma Core Group makes the decisions relating to Louisiana shorelines, whereas the Mobile Core Group makes decisions relating to the shorelines of Mississippi, Alabama and Florida.

The Core Groups were tasked to deliver:

- Convergent views on shoreline treatments and NFT conditions as appropriate to Stage III cleaning in 2010 and 2011

- Stage III Shoreline Cleaning Plans in two parts:
  A - methodology for survey, verification and documentation of oiling conditions (Appendix A)
  B – site-specific treatment methods and 2010 NFT (2010 No-Further-Treatment guidelines)

- Engagement with wider constituents that they represent or normally engage with; to gain wider understanding, recognition, convergence and acceptance of Stage III response decisions

Technical Working Groups

Technical Working Groups (TWGs) have been established to deliver clear technical guidance/reference to the Houma Core Group and Mobile Core Group on:

- Oiling conditions to be treated
- Treatment methods (including expected performance, effectiveness, operational parameters, limitations, etc.)
- Best practice features for inclusion in new Stage III STRs (includes ecological, historic/cultural constraints, etc.)

Three TWGs have been set up to address:

- Sand Shorelines (Appendix C)
- Coastal Marshes and Mangroves (Appendix D)
- Man-made Shorelines (Appendix E)

The Technical Working Groups have been directed to focus on response, not on scientific study and research. Their key deliverable was clear technical guidance to support the Core Groups, and the final Stage III.1 reports can be found in the Appendix listed for each group.

2010 No Further Treatment Guidelines

The Tables 1, 2 and 3 below in this section summarize the No Further Treatment guidelines as developed by the Houma Core Group. Refer to Appendices C, D, and E for additional detail on shoreline oiling conditions, treatment methods, and the basis for determining the need for further treatment or not.

Sandy Shoreline Oiling Conditions

The sandy shorelines in Louisiana can be classified by degree of oiling and use into four general groups:

- Heavily Oiled Residential Beaches (e.g., Grand Isle and a buffer 100 yards on either side of the public access point at Elmers Island)
- Heavily Oiled Non-Residential Beaches (e.g., Fourchon, Elmers Island outside of the buffer around the public access area, Grand Terre, East Grand Terre)

- Other Oiled Non-Residential Beaches (which may have a mix of areas with Heavy, Moderate, and Light Oiling, e.g. East and West Timbalier Islands)
- Other Oiled Beaches in Special Management Areas (refuges, parks, wilderness areas, which may also have a mix of oiling conditions (e.g., Chandeleur Islands, Isle Dernieres)

Guidelines for the development of appropriate treatment strategies are based on the following considerations:

- Most of the barrier islands in Louisiana are highly erosional, with landward retreat rates of tens of meters per year. Therefore, minimizing removal of sand from the littoral system on each of the islands is very important. There are concerns that even tilling could de-stabilize the sediments and increase the rate of sediment loss, particularly at the inlets. Therefore, use of mechanical methods should be minimized.
- Wherever possible, oiled sediments removed from the shoreline should be treated and replaced, either at the removal site or up littoral current, so the sediment is not lost from the system during redistribution (particularly of concern for sediments removed adjacent to the inlets of barrier islands).
- With the exceptions of Grand Isle, Elmer's Island, and Fourchon Beach, the sandy shorelines have no road access, meaning that the workforce and supplies have to be transported to the work site daily. Daily weather hazards and the continued threat of high waves and water during tropical depressions and hurricanes cause many stand-downs.
- Sandy shorelines in Louisiana are habitat for the federally listed piping plover, a migratory and wintering shorebird. Mixed sand and shell beaches and shell beaches and berms are also used by piping plover. The barrier island beaches and certain other locations are additionally Critical Habitat for wintering piping plover, a special designation under the U.S. Endangered Species Act. In addition to the presence of oil, the presence of large numbers of cleanup workers, vehicle use, and heavy equipment on the beach can negatively affect piping plovers. Mechanical removal, sediment tilling, sediment relocation, and sand cleaning treatments may also cause reductions in faunal food resources for piping plovers and other shorebirds.
- Impacts to cultural resources during intrusive sediment excavation, mixing, and removal are of significant concern and will require extensive investigations prior to any such activities.
- Various special management areas, including National Wildlife Refuges, federal Wilderness Areas, State Wildlife Refuges, and State Parks may have access and use limitations, sensitive natural resources, resource management guidelines, and other considerations and constraints that may affect the choice of appropriate cleanup methods. In these areas, decisions on the appropriate cleanup methods will be made by the agencies that own/manage these properties in close coordination with the Unified Command.

Treatment Strategies for Sandy Shorelines in Louisiana

Heavily Oiled Residential Beaches (Grand Isle, only example in LA)

The Stage I/II shoreline treatment recommendations (STRs) for Grand Isle have included extensive mechanical and manual sediment removal, tilling, sifting, and testing of sediment relocation. During Stage I/II and part of Stage III.1, an estimated 23,000 cubic yards of removed sediment was treated in the M-I SWACO sand washing plant on Grand Isle prior its demobilization on 3 November 2010. Because Grand Isle is the only inhabited barrier island, and the Town of Grand Isle includes two state-managed recreational beaches with road access, Grand Isle State Park and Elmers Island, a high degree of treatment is required to support the high level of public amenity use of these beaches. Therefore, treatment will continue with use of mechanical and manual removal, under close supervision to minimize the removal of clean sand. Pending approval and permitting of sediment relocation as a final polishing step, the 2010 No Further Treatment guideline will be no visible oil and no oiled debris above background levels, including subsurface oil. Augers will be used to inspect for subsurface oil layers; areas with subsurface oil will be treated using approved mechanical methods. Once the 2010 NFT guideline has been met, Quick Response Forces will be on standby to respond to re-oiling events or oiling discovered during the maintenance and monitoring phase.[1] Pursuant to the Deepwater Horizon Response Unified Area Command Louisiana Transition Plan ("UAC Transition Plan"), levels may revert where re-oiling events or newly discovered oiling result in a failure to meet the 2010 NFT guideline.

Heavily Oiled Non-Residential Beaches (e.g., Fourchon Beach, Elmer's Island, Grand Terre, East Grand Terre)

The most current SCAT data (as of the end of August 2010) indicate that these sandy shorelines contain areas of thick Surface Oil Residues (SR) in the lower intertidal zone, typically associated with mud/peat platforms and outcrops on the lower beach. These SR "mats" are being eroded and generating Surface Residue Balls and Patties landward of the mats. Depending on tidal and wave conditions, these Surface Residue mats are intermittently covered by a thin layer of sediments.

Mechanical removal of these SR mats using track hoes and similar equipment to date has resulted in the development of detailed STRs to prevent damage to live root systems in the mud/peat platforms and excessive removal of sand. In some cases, depending on access and substrate stability, beach-cleaning (grooming) equipment that can also be used for fine-scale mechanical grading may be able to carefully remove the SR mats and minimize sand and mud/peat platform removal during low tides. Other mechanical equipment and methods may also be appropriate, dependent on field tests. However, any use of mechanical equipment on these beaches must first be pre-approved by the state, and performed under the strict supervision of La. OCPR representatives whom would have authority to terminate the activity. Otherwise, manual removal during low tides will be required for those few areas where live plants are present on the platform surface. The specific locations of these SR mats have been mapped as oil zones and marked in the field as needed, to facilitate their removal and minimize the removal of clean sediments.

Heavy Surface Oil Residues have also been documented in the upper intertidal and supratidal zones as a result of high water levels and storm tides associated with Hurricane Alex and other recent tropical

[1] Maintenance and monitoring during this phase will be carried out under the detailed monitoring plan referenced in the UAC Louisiana Transition Plan.

storms. These residues break up into Surface Residue Balls and Patties with time, and may also become partially or completely buried, especially in overwash areas. Heavy surface residues in these areas can be removed manually, being careful to minimize clean sand removal.

Remaining Surface Residue Balls and Patties occurring across intertidal and supratidal zones can be manually removed in most instances. Large concentrations of Surface Residue Balls, particularly in intertidal areas, may be removed by beach cleaning (grooming) machines where this method is effective. As a final treatment in some areas, thin surface residue crusts, light oiling by remaining surface residue balls, and surface stains may be treated by sediment tilling, as appropriate. However, any use of mechanical equipment on these beaches must first be pre-approved by the state, and performed under the strict supervision of La. OCPR representatives whom would have authority to terminate the activity. 2010 NFT guidelines for these areas will be less than 1% visible surface oil and oiled debris. Once the 2010 NFT guidelines have been met, Quick Response Forces will be on standby to respond to re-oiling events or oiling discovered during the maintenance and monitoring phase. Pursuant to the UAC Louisiana Transition Plan, levels may revert where re-oiling events or newly discovered oiling result in a failure to meet the 2010 NFT guideline.

Subsurface oil on these beaches varies from mostly thin (1-2 cm) sporadic to patchy oil residues including subsurface residue "balls" to a few areas with oil-filled pores or partially filled pores that are thicker and more continuous. Depths of subsurface oiling range from 5 cm to up to 90 cm. Clean sediments frequently overlie buried oil layers. Because of the concern that excessive sediment removal or disturbance will increase the already high rates of shoreline retreat, natural recovery will be the preferred method for most areas with thin sporadic to patchy subsurface oil residues. Sediment tilling may be appropriate for some areas with shallow, thin layers of more continuous subsurface oil residue, followed by manual removal and/or treatment with beach cleaning (grooming) machines for oil brought to the sediment surface, as appropriate. Heavier and/or deeper more continuous subsurface oiling may require removal using mechanical methods, moving aside clean overlying sediments prior to oil removal. However, any use of mechanical equipment on these beaches must first be pre-approved by the state, and performed under the strict supervision of La. OCPR representatives whom would have authority to terminate the activity.

Smaller "hot spots" of heavier subsurface oiling may be appropriate for manual removal (e.g., heavier oiling in small overwash fans). 2010 NFT guidelines for subsurface oiling will be no subsurface oil exceeding thin (1-3 cm) and patchy (10-50% distribution) of sediments with oiling that is greater than Oil Residue (defined as sediments are visibly oiled with black/brown coat or cover on the clasts, but little or no accumulation of oil within the pore spaces). Once the 2010 NFT guidelines have been met, Quick Response Forces will be on standby to respond to re-oiling events or oiling discovered during the maintenance and monitoring phase. Pursuant to the UAC Louisiana Transition Plan, levels may revert where re-oiling events or newly discovered oiling result in a failure to meet the 2010 NFT guideline.

Plans are under consideration to have a second M-I SWACO sand treatment system installed to process buried oil for the most heavily oiled areas and to minimize removal of sediments from these beaches. Following treatment, cleaned sand would be placed back on the beach in the appropriate locations to facilitate sand retention. Sediment relocation will generally not be considered for these beaches.

Other Oiled Non-Residential Beaches (which may have mix of areas with Heavy, Moderate, Light Oiling, e.g., East Timbalier Island, West Timbalier Island)

The most current SCAT data (as of the end of August 2010) indicates that these sandy shorelines contain mostly Surface Residue Balls and Patties and oiled debris, varying in distribution from <1% over large areas to relatively small patches of higher concentrations up to 50%. These beaches occur mostly on the isolated barrier islands (e.g., West Timbalier Island, East Timbalier Island, Pelican Island to Pass Chaland, and Pass Chaland to Grand Bayou Pass) that are important shorebird overwintering habitats. They are also highly erosional and are sites of priority coastal restoration.

The distribution of surface oil along the outer beaches varies widely, from <1 to 4% Surface Residue Balls (mostly on the eastern beaches) to bands that are up to 5 m wide and with 25-90% distribution of Surface Residue on the western end of Pelican Island. Treatment strategies will consist of manual removal of surface oil. The 2010 NFT guideline will be less than 1% distribution of surface oil and oiled debris. Once the 2010 NFT guidelines have been met, Quick Response Forces will be on standby to respond to re-oiling events or oiling discovered during the maintenance and monitoring phase. Pursuant to the UAC Louisiana Transition Plan, levels may revert where re-oiling events or newly discovered oiling result in a failure to meet the 2010 NFT guideline.

The degree and extent of subsurface oil needs to and will be better quantified during the Stage III.1 SCAT survey outlined in Appendix A. 2010 NFT guidelines for subsurface oiling will be no subsurface oil exceeding 5 cm in thickness and patchy (10-50% distribution) of sediments with oiling that is greater than Oil Residue (defined as sediments are visibly oiled with black/brown coat or cover on the clasts, but little or no accumulation of oil within the pore spaces). These beaches will be periodically inspected during the maintenance and monitoring phase. Quick Response Forces will be on standby to respond to re-oiling events or newly discovered oiling. Pursuant to the UAC Louisiana Transition Plan, levels may revert based on re-oiling events that exceed the 2010 NFT guideline.

Other Oiled Beaches in Special Management Areas (state and federal wildlife refuges, parks, wilderness areas, which may also have a mix of oiling conditions)

The Chandeleur Islands are part of the Breton National Wildlife Refuge and a designated Wilderness under the management of the U.S. Fish and Wildlife Service (USFWS). SCAT surveys on 3-4 August identified specific areas of 30-40% distribution of Surface Residue balls, with the rest of the sand beaches having from 1-2% to <1% Surface Residue balls. The USFWS has determined that the cleanup recommendations to meet the 2010 NFT guidelines for these sand beaches are manual removal of the oil in the specific areas of higher concentrations and natural removal for the remaining areas.

The Isle Dernieres Barrier Islands Refuge includes the barrier islands, from east to west, East Island, Raccoon Island, Whiskey Island, Trinity Island, and Wine Island under the management of the Louisiana Department of Wildlife and Fisheries. These islands have limited public access by State of Louisiana regulations.

The degree of both surface and subsurface oil is lightest on western islands and increases to the east. Raccoon Island has mostly <1 to 1% Surface Residue with four small areas in the supratidal zone with up to 20% distribution; there is no subsurface oil. In contrast, Trinity Island has 1-10 m wide bands of 1-40% Surface Residue in the upper intertidal and supratidal zones. Subsurface oiling primarily consists of subsurface thin layers (1-3 cm) of mostly Surface Residue "balls" in trace amounts (<1% distribution) to depths of 10-20 cm in the upper intertidal and supratidal zones. Proposed 2010 NFTs are less than 1% surface oil and oiled debris. Once the 2010 NFT guidelines have been met, Quick Response Forces will be on standby to respond to re-oiling events or oiling discovered during the maintenance and monitoring phase. Pursuant to the UAC Louisiana Transition Plan, levels may revert where re-oiling events or newly discovered oiling result in a failure to meet the 2010 NFT guideline.

Subsurface oil on these beaches is infrequent and occurs mostly as a thin (mostly 1-2 cm) trace to patchy layer at depths up to 20 cm. Because of the concern of that excessive sediment removal or disturbance will increase the already high rates of shoreline retreat, there will be no attempt to remove subsurface oil layers, subject to U.S. Fish and Wildlife Service and Louisiana Department of Wildlife and Fisheries concurrence for their respective properties.

These beaches will be periodically inspected during the maintenance and monitoring phase. Quick Response Forces will be on standby to respond to re-oiling events or oiling discovered during the maintenance and monitoring phase. The No Further Treatment guidelines for sandy shorelines are summarized in Table 1.

Table 1. NFT Guidelines for Sandy Shorelines

Oiling Group	Cleanup Methods Recommended	Surface Oil	Subsurface Oil
Heavily Oiled Residential Beaches (e.g. Grand Isle and 100 yards on either side of the public access point on Elmers Island)	Mechanical removal Manual removal Grooming Sediment tilling/mixing Sediment relocation Sand treatment (M-I SWACO)	No visible oil above background levels	No visible oil above background levels
Heavily Oiled Non-Residential Beaches (e.g., Fourchon Beach, Elmers Island, Grand Terre, East Grand Terre)	Mechanical (fine-scale) [With approval by the State] Manual removal Grooming Sediment tilling/mixing Sand treatment (M-I SWACO) Natural recovery	< 1% visible surface oil and oiled debris	No subsurface oil exceeding 1-3 cm in thickness and patchy (10-50% distribution) that is greater than Oil Residue
Other Oiled Non-Residential Beaches (Mix of Heavy, Moderate, Light Oiling) (e.g., West Timbalier, East Timbalier)	Manual removal Natural recovery	< 1% distribution of oil and oiled debris	No subsurface oil exceeding 5 cm and patchy (10-50% distribution) of oiling that is greater than Oil Residue
Other Oiled Beaches in Special Management Areas (state and federal wildlife refuges, parks, wilderness areas, with	Manual removal Natural recovery	< 1% surface oil and oiled debris	No attempt to remove subsurface oil

a mix of oiling conditions)			

Coastal Marshes and Mangroves

A detailed discussion of the oiling conditions, treatment options, oiling impacts, and trade-off issues for coastal marshes and mangroves is included in Appendix D. Table 2 is a summary of the No Further Treatment guidelines for coastal marshes and mangroves.

Table 2. NFT Guidelines for Coastal Marshes and Mangroves

Cleanup Methods Recommended	NFT Guidelines
Low-pressure, ambient-temperature flushing	No more flushable oil on the vegetation or soils
Use of sorbents (on water)	No more release of sheens that can affect sensitive resources
Manual removal **Use of sorbents (on substrate)** **Vacuum**	No more thick or pooled oil at the edges of - The marsh - The beach/shell berm/ overwash areas No more thick or pooled oil in the marsh interior, including isolated oiling patches within the marsh
Vegetation cutting	No more pooled oil inside dense Roseau cane, that cannot be accessed by other means
Natural recovery	For all other oiling conditions

Man-Made Shorelines

A detailed discussion of the oiling conditions, treatment options, and guidelines for man-made structures is included in Appendix E. Table 3 is a summary of the No Further Treatment guidelines for man-made structures.

Table 3. NFT Guidelines for Man-made Shorelines

Cleanup Methods Recommended	NFT Guidelines
Use of sorbents Low/high-pressure, ambient-temperature water flushing Low/high-pressure, heated-water flushing Manual removal Shoreline cleaning agents Vacuum Natural recovery	No accessible oiled debris For non-amenity areas, no surface oil greater than Stain or Coat > 20 % distribution No oil on surfaces that rubs off on contact In high public use or high visibility areas, no surface oil greater than Stain or 10% Coat distribution on solid surfaces In inaccessible or remote areas where oil removal was not possible because of safety restrictions or ecological/cultural restraints, no longer generates petrogenic sheens that can affect sensitive resources under all weather conditions

Local Government and Public

As soon as the details of the Stage III shoreline treatment strategies become clearer, a program of engagement with local governments (Parishes, Towns) and the general public will be initiated, to achieve a wider understanding of the technical issues involved and their significance for cleaning local shorelines to acceptable degrees. The State will have a State/Parish Liaison who will be responsible for assuring parish participation and concurrence in the entire Stage III process.

Prior to initiating Stage III SCAT, individual meetings (or conference calls) with each of the parishes within the affected area will take place. These meetings will be attended by BP SCAT coordinators for Louisiana, representatives from the National Oceanic and Atmospheric Administration (NOAA), the State, the U.S. Coast Guard, and representatives from the parishes and stakeholders (Rockefeller, Wisner, Miller, Chevron, Audubon Society, etc.) as each parish deems appropriate.

These meetings will be tailored to the individual parish and will discuss the following:

- A review of their Parish Transition Plan as it specifically relates to SCAT issues (if relevant - some transition plans do not address SCAT at all);
- A review of the evolution and development of the MC 252 Stage III Shoreline Treatment Implementation Framework for Louisiana;
- A review of the process for developing Shoreline Inspection Reports (SIRs) and Shoreline Treatment Recommendations (STRs);
- Identification of the process for coordinating parish participation on Stage III SCAT Teams;
- A review of the process for transition from the SCAT Stage III phase to the maintenance and monitoring phase; and,
- Any questions and other issues.

This program will comply with and effectuate the coordination and consultation provisions of the UAC Louisiana Transition Plan and will require the full engagement and support from Core Groups' membership, the Unified Command Joint Information Centers (JICs), Parish Liaisons, and the Community Outreach program. There will be a need to generate technical briefing materials and talking points to support this outreach program.

Shoreline Treatment Operations Implementation and Facilitation

Surface treatment operations as defined in the Stage I-II shoreline treatment plan will continue as required until Stage III activities are adopted, at which time Stage I-II plans and activities will be immediately superseded by the adopted Stage III plans. Subsurface cleaning activities based on Stage I-II STRs will be immediately terminated, and will not be resumed until the adoption of Stage III STRs. New Stage III STRs will be issued to Operations, upon the delivery of this framework for Stage III Shoreline Treatment Implementation Framework by the Core Groups. Stage III STRs will be numbered #S3-XXX so that they can be easily distinguished from Stage I-II STRs.

New Stage III STRs will be issued to Operations, upon the delivery of this framework for Stage III Shoreline Treatment Implementation Framework by the Core Groups. Stage III STRs will be numbered #S3-XXX so that they can be easily distinguished from Stage I-II STRs.

Throughout Stage III shoreline treatment operations, the SCAT-Ops Liaison function will continue working with Operations Branches to:

- Ensure STRs are understood and utilized by the shoreline operational branches
- Provide assistance to the shoreline operational branch staff in selecting the correct resources to execute the clean-up recommendations
- Provide technical support / advice to operational staff in the effective use of response equipment
- Report to SCAT on specific STR implementation
- Maintain working relationships with Coast Guard and other observer/monitoring personnel in field locations
- Provide clean-up site training at shoreline operational branch level and other in-field locations as required

Monitoring and Progress Tracking

SCAT Teams will continue to provide documentation of the oiling conditions while Stage III Shoreline Treatment Operations are in place as defined in Appendix A.

An important consideration in the development of the 2010 NFT guidelines is the current degree of oil weathering and the expected rate of both physical removal and continued degradation of oil stranded on the shorelines. Appendix G provides a summary of the oil weathering processes to date.

With this in mind, SCAT will be supported by trained sampling teams. They will collect samples at selected areas over time to generate the data on which to document the rate of natural attenuation and shoreline treatment progress for surface as well as subsurface oil. Appendix F provides a preliminary illustration of current oil weathering which provides an indication of how attenuation is likely to progress through 2010 and 2011.

The key features of the Stage III Shoreline Treatment are the following:

- Stage III shoreline treatment will continue in varying forms, for as long as it takes to achieve acceptable conditions.
- One size does not fit all - there needs to be flexibility in the way Core Groups and constituents build consensus and reach convergence on acceptable completion.
- Completion will be achieved in some shoreline areas relatively quickly, whereas other areas will likely take longer.
- The same technical concept (Net Environmental Benefit Analysis or NEBA) will be used consistently throughout the process - providing a sound basis and approach to decision-making.
- Stage III provides a flexible framework within which to work, recognizing that for some shoreline segments or areas, the operational time lines will be shorter whereas for others completion will take longer.

Appendix A

SCAT Survey-Shoreline Treatment Recommendations Plan

MC 252 RESPONSE

STAGE III.1

SCAT SURVEY-SHORELINE TREATMENT RECOMMENDATIONS PLAN – LOUISIANA

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1. INTRODUCTION

The Shoreline Cleanup Assessment Technique (SCAT) process involves teams of trained observers who survey the affected coastal area to document the shoreline oiling conditions. These data are used to plan the shoreline treatment program and an inspection process is developed to ensure that the treatment goals are achieved by common agreement within the Unified Command (UC).

This draft document has been prepared for Stage III.1 of the MC 252 Response Shoreline Cleanup Assessment Technique (SCAT) program for Louisiana. The UC Nearshore and Shoreline Stage I and II Response Plan defines the three stages of the SCAT program:

Stage I	*On-water recovery of floating oil slicks in near shore waters*
Stage II	*Initial cleaning of bulk oil from intertidal areas until the source is controlled*
Stage III	*Removal of oil to habitat-specific no further treatment guidelines once source control is achieved(Levels III, IV, V and VI in the UAC Transition Plan)*

Stage III begins when the UC determines that there is “No recoverable oil on water” and has four phases:

Stage III.1	*<u>Re-Baseline SCAT</u> Survey, generation of STR/SIR Forms, shoreline treatment (Level III UAC Transition Plan)*
Stage III.2	*Post-treatment <u>Maintenance and Monitoring</u>: Periodic shoreline surveys and Quick Response Forces (Level IV UAC Transition Plan)*
Stage III.3	*<u>Revaluation</u> SCAT Survey and Treatment Completion (Level V UAC Transition Plan)*
Stage III.4	*Transition out of SCAT program to <u>Long-Term Monitoring and Maintenance</u>(Level VI UAC Transition Plan)*

2. OBJECTIVES FOR STAGE III.1

The objectives of Stage III.1 of the SCAT program are to:

- Survey the shorelines within the affected area by air and ground to document the oiling conditions.
- Generate Shoreline Treatment Recommendation (STR) forms for segments that do not meet the 2010 No Further Treatment (NFT) conditions, as defined by the Core Group, and to identify (a) appropriate treatment techniques and (b) ecological, historic/cultural resource, or safety constraints.
- Liaise with Operations to ensure that they understand the STRs for segments.
- Initiate an inspection process with the participation of the land owner/manager

and/or resource trustee/manager for segments that meet the Stage III.1 NFT for that habitat type and complete a Shoreline Inspection Report (SIR) that is signed by the UC representatives.

3. STAGE III.1 STRATEGY

Stage III.1 of the SCAT program involves the following steps:

- An **aerial videotape shoreline survey** to be flown at low altitude (typically <150 feet) and slow speed (~60 knots) during low tides.
- A **ground SCAT survey** of the affected area in Louisiana from the Texas border to northern Breton Sound by foot and/or boat. Followed by the generation for each segment of either a:
    - Shoreline Treatment Recommendation (**STR**) form that specifies the appropriate treatment for those locations where oil is observed and treatment is required to meet the appropriate the 2010 No Further Treatment (NFT) condition, or
    - Shoreline Inspection Report (**SIR**) form that specifies no further treatment for those locations where observed oil meets the appropriate the 2010 No Further Treatment (NFT) condition, or
    - Shoreline Inspection Report (**SIR**) for locations where no oil is observed (NOO).
- An **inspection of segments in which treatment is undertaken** after Operations considers that they have achieved the 2010 No Further Treatment (NFT) condition.
- A **ground SCAT survey** with the land owner/manager to prepare an SIR that sufficient treatment has been completed and that either:
    - no oil is present (NOO), or
    - the oiling meets the 2010 NFT condition and the segment can be transferred to a Maintenance and Monitoring status (Stage III.2 = Level IV UAC Transition Plan).

4. STAGE III.1 FIELD SURVEY METHOD

4.1 Aerial Videotape Survey

OBJECTIVE

To fly the entire affected area in Louisiana to obtain low altitude aerial videotape coverage with audio commentary on shoreline oiling conditions.

SURVEY AREA

The geographic area to be surveyed is:

- The Louisiana coast west to the Texas border (93° 50' W), north to the I-10 bridge in Lake Pontchartrain, and east to the Mississippi border.
- The Mississippi River channels below Venice.

SURVEY METHOD

The shoreline to be surveyed will be flown

- at a low altitude (~150 feet, except where not permitted),
- in a helicopter with a sliding or open door, and using

- a videotape camera linked to
    1. an audio system for a detailed commentary,
    2. a real time, moving map display, and
    3. a Geographic Positioning System (GPS).

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The flights will be timed to coincide with low tides with predicted water levels of 0.5 feet or less. The flights will track with the shoreline on the port (left) side of the helicopter.

The two-person BP survey team will consist of a camera operator/commentator and a navigation/video data specialist. A government representative may assist the BP team on the low altitude shoreline video survey. The BP survey team will provide pre-designated state and federal government representatives with a minimum of 3 days notice in advance of conducting any and all aerial video surveys.

SURVEY DURATION

Based on similar prior surveys in Louisiana, it is anticipated that this aerial video survey will involve an estimated 20 to 26 hours (approximately 4 to 6 days) of survey time, to cover the outer coast and inner bay shorelines.

A key component of the survey will be the commentary which will focus on heavy and moderate shoreline oiling conditions using the video imagery as a frame for the data.

4.2 Ground SCAT Survey

The objective of the Ground SCAT Survey will be to determine what, if any, treatment actions are necessary to meet Stage III.1 2010 NFT conditions on a segment-by-segment basis.

SCAT teams with BP, federal, and state representation will conduct a systematic ground-based shoreline survey of the affected area, as defined above, by foot, boat, or ATV.

The team lead will be a BP representative who will be responsible for the safe conduct of the survey and the submission of appropriate field documentation. Opinions or recommendations shall be made by consensus between BP, federal, and state representatives.

For segments where no oil was observed (NOO) in the Stage II surveys, the following ground-based field strategy applies:

- The SCAT Coordinator notifies the Land Owner/Manager and/or resource manager/trustee that a ground survey is scheduled and invites a representative to accompany the SCAT ground survey team.
- If the team documents that there is NOO after completing the ground-based field survey, a Shoreline Inspection Report (SIR) is completed with the NOO box checked. This form is countersigned by all three members on the SCAT team who represent the UC, in consultation with the land owner/manager and/or resource manager/trustee, if present, to ensure that the recommendation to the

UC is unanimous.
- These consultations with land owners/managers will be documented.
- The segment is then transferred to a Maintenance and Monitoring status (Stage III.2 = Level IV UAC Transition Plan).

For segments where oil is present but meets the Stage III.1 2010 NFT condition(s), the SCAT team generates a Shoreline Inspection Report (SIR) form with the NFT box checked. After the ground-based field survey, the same procedures are followed as described above for a NOO SIR so that the segment can be transferred to a Maintenance and Monitoring status (Stage III.2 = Level IV UAC Transition Plan).

For segments where oil is present and does not meet the 2010 NFT condition(s), the SCAT team will recommend the generation of a Shoreline Treatment Recommendation (STR) form to identify (a) appropriate treatment techniques and (b) ecological, cultural resource, or safety constraints. The generation of the STR will involve Section 7 and Section 106 consultations. The STR is reviewed, signed by the appropriate UC representatives, and then submitted through the ICS 204 process The STR effectively is a work order for Operations to conduct the treatment within the defined guidelines and constraints.

4.3 Inspection of Segments with a treatment STR

When Operations consider that sufficient treatment has been completed and that the 2010 NFT conditions have been met, SCAT teams will inspect the segment and, if the conditions have been achieved, notify the SCAT Coordinator. If the 2010 NFT condition is not met within a segment, the SCAT team may prepare an STR amendment to identify what and where additional treatment is necessary to achieve that status.

4.4 Post Treatment Ground SCAT Inspection

When notified that a segment has met the 2010 NFT condition, the SCAT Coordinator will arrange a post-treatment inspection to include the land owner/manager, the resource manager/trustee (if resource present in segment), and the Parish representative. If the survey shows that the segment meets the NFT condition, the UC representatives will complete and sign an SIR which states that sufficient treatment has been completed and that either:

- no oil is present (NOO), or
- the oiling meets the 2010 NFT condition, so that the segment can be transferred to a Maintenance and Monitoring status (Stage III.2 = Level IV UAC Transition Plan).
- If the oiling conditions are above the 2010 NFT conditions and further treatment is recommended, an STR will be completed.

Consultations with land owners/managers throughout this process will be documented.

4.5 Consultations for Threatened and Endangered Species/Cultural Resources

During Stage I/II and continuing in Stage III, comprehensive surveys have been conducted by trained teams of Archaeologists, under the direction of the National Park Service (NPS), State Historic Preservation Office (SHPO), and Tribal representatives.

These data have been combined with existing cultural resources data into a Geographical Information Systems database. Draft STRs are submitted to a team of representatives of these agencies for consultation under Section 106 of National Historic Preservation Act, SHPO, and tribal cultural resources. These representatives review the STR, review the database for the presence of cultural resources and additional information, and prepare a Section 106 Consultation Signature Sheet, indicating their concurrence with the STR and providing segment-specific constraints and advisory notes. This signed sheet becomes part of the final STR, and specific requirements, such as the presence of an Archaeologist during treatment activities, are included on the STR under the section on Cultural/Historic Concerns.

The draft STR is also submitted to the USFWS and NOAA National Marine Fisheries Service under the consultation requirements of Section 7 of the Endangered Species Act. Both agencies review the STR and provide comments (that are included in the STR under the section on Ecological Concerns) and prepare a Best Management Practices (BMPs) and Signature Sheet, indicating their concurrence and listing the BMPs and other guidance that must be implemented during treatment operations. These signed sheets and BMPs become part of the final STR.

5. GEOGRAPHIC AREA OF THE SURVEY (LOUISIANA)

The geographic area to be surveyed is:

- The Louisiana coast west to the Texas border (93° 50’ W) and north to the I-10 bridge in Lake Pontchartrain.
- The Mississippi River below Venice.

6. SCHEDULE

Stage III begins when the UC determines that the threat of new oiling from the source is *de minimis*. At this time the Aerial Videotape Survey (Section 4.1) and the Ground SCAT Survey (Section 4.2) will be initiated.
The proposed strategy is:

- Initial focus on shoreline segments where Heavy and Moderate oiling were documented in Stage II, or segments adjacent to such segments (e.g., canals or creeks);
- Segments where the Aerial Videotape Survey identifies segments with Heavy or Moderate oiling not covered by the above;
- Segments where the Rapid Shoreline Pre-Assessment undertaken by the Natural Resource Damage Assessment Shoreline Technical Working Group identified segments with Heavy or Moderate oiling not covered by the above; and
- All other segments in the survey area.

The timing of the survey would be based on low tide windows with predicted water levels of 0.5 feet or less. A “low water window” table has been prepared - for example:

Green = allows> 2 hours between 7am and 4pm (normal working hours)
Amber = allows >2 hours after 4pm (before sunset)
Red = No ≤0.5ft tides during daylight for ≥2 hours

Point Au Fer 29.3333 N / 91.3533 W

Date	High Tide	≤0.5ft From	≤0.5ft Until	Low (ft)	Daylight
1-Jul	8:54			0.51	06:09-20:08
2-Jul	9:09			0.81	06:09-20:08
3-Jul	7:44			0.67	06:10-20:08
4-Jul	9:22	14:00	16:30	0.42	06:10-20:08
5-Jul	9:03	13:40	19:00	0.16	06:10-20:08
6-Jul	8:10	13:50	19:45	-0.1	06:11-20:08
7-Jul	7:27	14:00	20:45	-0.37	06:11-20:08
8-Jul	4:35	14:30	21:45	-0.61	06:12-20:08
9-Jul	5:07	15:20	22:30	-0.81	06:12-20:08
10-Jul	5:40	16:00	23:30	-0.92	06:13-20:08
11-Jul	6:12	17:00	→	-0.93	06:13-20:07
12-Jul	6:42	[illegible]	→	-0.79	06:14-20:07
13-Jul	7:10	[illegible]	→	-0.51	06:14-20:07
14-Jul	7:36	[illegible]	→	-0.12	06:15-20:07
15-Jul	7:59	[illegible]	→	0.36	06:15-20:06
16-Jul	8:20	12:00	14:00	0.43	06:16-20:06
17-Jul	8:37	12:00	16:30	0.06	06:16-20:06
18-Jul	8:50	12:15	18:50	-0.24	06:17-20:05
19-Jul	8:49	12:50	19:40	-0.47	06:17-20:05
20-Jul	3:55	13:20	20:40	-0.61	06:18-20:04
21-Jul	4:42	14:00	22:20	-0.68	06:19-20:04
22-Jul	5:19	15:00	22:20	-0.69	06:19-20:03
23-Jul	5:48	16:00	0:00	-0.63	06:20-20:03
24-Jul	6:09	16:40	23:30	-0.53	06:20-20:02
25-Jul	6:23	17:30	0:00	-0.39	06:21-20:02
26-Jul	6:36	[illegible]	→	-0.2	06:21-20:01
27-Jul	6:50	[illegible]	→	0.02	06:22-20:01
28-Jul	7:05	[illegible]	[illegible]	0.27	06:23-20:00
29-Jul	7:20			0.54	06:23-19:59
30-Jul	7:32			0.82	06:24-19:59
31-Jul	7:40			0.67	06:24-19:58

Caminada Pass 29.2000 N / 90.0500 W

Date	High Tide	≤0.5ft From	≤0.5ft Until	Low (ft)
1-Jul	13:37			0
2-Jul	10:41	[illegible]	→	0.3
3-Jul	7:32	11:00	→	0.3
4-Jul	6:57	11:20	→	0.2
5-Jul	6:59	11:30	→	0.1
6-Jul	7:23	12:30	→	0
7-Jul	8:02	13:30	→	-0.1
8-Jul	8:52	14:30	→	-0.2
9-Jul	9:45	15:30	→	-0.3
10-Jul	10:39	16:30	→	-0.4
11-Jul	11:31	[illegible]	→	-0.4
12-Jul	12:21	[illegible]	→	-0.3
13-Jul	13:11			-
14-Jul	14:02	6:00	8:00	-0.1
15-Jul	15:01	6:00	9:30	0.1
16-Jul	16:32	-	-	0.5
17-Jul	5:39	9:30	→	0.3
18-Jul	5:46	10:30	→	0.1
19-Jul	6:20	12:00	→	-0.1
20-Jul	7:09	13:00	→	-0.1
21-Jul	8:07	14:00	→	-0.2
22-Jul	9:07	15:00	→	-0.2
23-Jul	10:02	16:00	→	-0.2
24-Jul	10:49	16:30	→	-0.2
25-Jul	11:28	[illegible]	→	-0.1
26-Jul	12:01	[illegible]	→	0
27-Jul	12:30	[illegible]	→	0.1
28-Jul	12:58	[illegible]	→	0.2
29-Jul	13:31			0.3
30-Jul	14:21			0.6
31-Jul	15:27			0.4

Chandeleur Light 30.0483 N / 88.8717 W

Date	High Tide	≤0.5ft From	≤0.5ft Until	Low (ft)	Daylight
1-Jul	13:25	→	→	0.2	05:57 -20:00
2-Jul	13:18	→	→	0.46	05:57 -20:00
3-Jul	7:38			0.49	05:57 -20:00
4-Jul	6:16	13:40	22:30	0.38	05:57 -20:00
5-Jul	6:15	12:50	23:10	0.2	05:59-20:00
6-Jul	6:38	13:00	→	0.03	05:59-20:00
7-Jul	7:14	13:30	→	-0.12	06:00-20:00
8-Jul	7:57	14:10	→	-0.24	06:00-20:00
9-Jul	8:44	15:00	→	-0.32	06:01-19:59
10-Jul	9:34	15:50	→	-0.35	06:01-19:59
11-Jul	10:24	16:40	→	-0.31	06:02-19:59
12-Jul	11:18	17:40	→	-0.19	06:02-19:59
13-Jul	12:01	[illegible]	→	0	06:03-19:59
14-Jul	12:47	[illegible]	→	0.24	06:03-19:58
15-Jul	13:27	→	→	0.46	06:04-19:58
16-Jul	6:01	-	-	0.55	06:04-19:58
17-Jul	4:48	12:15	21:00	0.38	06:05-19:57
18-Jul	5:06	11:50	22:00	0.14	06:05-19:57
19-Jul	5:45	12:30	23:10	-0.04	06:06-19:56
20-Jul	6:32	13:10	→	-0.14	06:07-19:56
21-Jul	7:24	14:00	→	-0.18	06:07-19:55
22-Jul	8:16	15:00	→	-0.17	06:08-19:55
23-Jul	9:07	15:40	→	-0.13	06:08-19:54
24-Jul	9:55	16:40	→	-0.06	06:09-19:54
25-Jul	10:39	17:30	→	0.03	06:10-19:53
26-Jul	11:18	[illegible]	→	0.14	06:10-19:53
27-Jul	11:54	[illegible]	→	0.27	06:11-19:52
28-Jul	12:27	[illegible]	→	0.4	06:11-19:52
29-Jul	12:59			0.54	06:12-19:51
30-Jul	13:28			0.64	06:13-19:50
31-Jul	4:02			0.65	06:13-19:50

7. MANAGEMENT AND PARTICIPATION

7.1 Management

- Bea Stong, Mary Cocklan-Vendl, and Richard Santner are the SCAT Program Managers.
- The SCAT Coordinator is Gary Hayward.
- The Houma back-to-back Deputy Coordinators from NOAA are Jacqueline Michel and Scott Zengel.

7.2 Team Participation

Each team has, at a minimum:

- The Team Leader who is a BP representative, who is an experienced shoreline oil observer, who participated in the Stage II SCAT program and who will be responsible for completing the oiling documentation
- A federal representative, who is an experienced shoreline observer, who participated in the Stage II SCAT Program, and who will be responsible for providing input on completing the oiling documentation and ecological and cultural resources of concern, and
- A state representative, who is an experienced shoreline observer, who participated in the Stage II SCAT Program, and who will be responsible for providing input on completing the oiling documentation and ecological and cultural resources of concern.

Depending on the segment to be surveyed, the team may also include:

- A land owner or land manager representative,
- A resource manager or trustee if Section 106 or Section 7 resource(s) present in the segment, and

- A local community representative.

One person may fill more than one role on the team, other than the Team Lead.

7.3 Team Assignments

The Team Leader ensures that the following activities are completed and a consensus decision is reached by the team members on items requiring opinions or recommendations:

- Completion of the Shoreline Oiling Summary (SOS), the Wetland Oiling Summary (WOS) or the Tar Ball Oiling Summary (TBOS) Form;
- Preparation of sketch(es) or "photo-sketches" of the zone/segment if oil is observed – **no sketch is required if no oil is observed in the segment**;
- Recording GPS coordinates of the zone/segment boundaries and other specific features;
- Taking digital photographs and log date/time/location – **no photos are required if no oil is observed in the segment including subsurface oil**, but one alongshore general photograph typically should be taken at the high water level to record the shore-zone character;
- Digging pits/trenches; and
- Cleanup recommendations that will be used in preparation of an SIR or STR.

7.4 SOS/WOS Versus Tar Ball Oiling Summary Forms

Teams will continue with the forms as they exist, even though this may involve having to fill out two separate (SOS/WOS and TBOS) forms for a single segment. The SOS/WOS will be used:

if ≥ 1% distribution
or > one 10 cm sq TB (tar ball) or SOP (small oil particle) per square meter,
or > one hundred 1 cm sq TB/SOP per square meter,
or > ten thousand 1mm sq TB/SOP per square meter.

Where oiling conditions drop below these cut offs, then use the TBOS. If the SOS/WOS is used, concentrations reported <1% are calculated as 1% even if reported as <0.1%.

Stage III.1 Completion Process

1		**UC** – Determine that the threat of new oiling from the source has sufficiently diminished for Stage III to begin.
2		**SCAT** – Conduct aerial videotape survey of shoreline in the affected area to establish baseline and priority areas.
3		**SCAT** – Conduct ground survey (foot – boat)

4		**SCAT** –
		• Generate Shoreline Treatment Recommendation (STR) Reports for segments that require further treatment - *go to Step 5*.
		• Generate Shoreline Inspection Report (SIR) for segments with no observed oil (NOO) or no further treatment (NFT) recommended.
		    o NOO segments will be deemed complete.
		    o If NFT is recommended, proceed to Step 9.

5		**OPS** – Undertake cleanup in segments as recommended by the STR.
6		**OPS** – Report that shoreline treatment recommendations have been completed in a segment.
7		**SCAT** – Conduct ground inspection of segment with the land owner/ manager to document that sufficient treatment has been completed. • If further treatment is recommended, return to Step 5 • If NFT is recommended, proceed to Step 8.
8		**SCAT** – Submit SIR for segment that either NOO or NFT is recommended. • NOO segments will be deemed complete. • If NFT is recommended, proceed to Step 9.
9		**SCAT** – Transfer segments with observed oil remaining to "Maintenance and Monitoring" status. (STAGE III.2)

Appendix B

List of the Core Groups Members for Louisiana

Houma ICP Core Group	
AGENCY / ORGANIZATION	**Name**
NOAA SCAT	Jacqueline Michel, Chair
NOAA SSC	Ed Levine
NOAA SSC	Jordan Stout
BP/SCAT Technical Advisor	Ed Owens
LDEQ	Pat Breaux
LA OCPR	Daniel Dearmond
US DOI	Stephen Spencer/ Douglas Mutter
USCG	Jerald Motyka/Eric Whipple
USFWS	Terry Delaine
LA SHPO	Melissa Braud
NPS (Section 106 Consultation)	Bill Hunt
BP	Gary Hayward
BP	Bea Stong

List of the Sand Technical Working Group Members
(active participants in meetings)

Sand Technical Working Group Participants	
AGENCY / ORGANIZATION	**Name**
NOAA SCAT	Jacqueline Michel, Chair
NOAA SSC	Scott Zengel
NOAA SSC	Ed Levine/Jordan Stout
NOAA SSC	John Tarpley
NOAA SSC	Gary Ott
NOAA SSC	Brad Benggio
NOAA SSC	Ruth Yender
NOAA SSC	Liz Jones
BTNEP	Kerry St. Pé
BP/SCAT Technical Advisor	Ed Owens
BP/Oil Spill Response	Nick Marsh
BP/SCAT Technical Advisor	Elliott Taylor
Houma SCAT	Andy Graham
Mobile SCAT	Robert Simmons/Gary Mauseth
Mobile SCAT	Greg Challenger/Bob Castle
Houma SCAT	Gary Hayward
BP/ARTES	Jim Best
BP	Kirk O'Reilly
LDEQ	Ed Ballow
LDEQ	Stephen Lorio
LDEQ	Jason Bridges
LA OCPR	Syed Khalil
LA OCPR	Rick Rainey
Alabama DEM	Allen Phelps/ Phil Wood
FLDEP	Bob Brantly
Mississippi DEQ	Jason Bridges
FLDEP	Bob Brantly
FLDEP	George Henderson
US DOI	Allison O'Brien
US DOI	Steve Spencer /Doug Mutter
USFWS	Susi von Oettingen
USFWS	Maury Bedford
USFWS	Daniel Breaux
USFWS	Felix Lopez
NPS	Chris Lydick

USFWS	Stephen Gard/John Nuss
USEPA	Lance Richman
USCG	Eric Whipple
NPS	Mark Ford
LA SHPO	Melissa Braud
NPS (Section 106 Consultation)	Bill Hunt/Jay Sim
ARTES	Ellen Faurot Daniels
BP	Richard Santner
HITT	Randy O'Boyle
BP	Richard Santner
BP	Bea Stong
BP	Mary Conklin-Vendl
BP	Judy Kitagawa

List of the Marsh Technical Working Group Members
(active participants in meetings)

Marsh Technical Working Group Participants	
AGENCY / ORGANIZATION	**Name**
NOAA SCAT	Jacqueline Michel, Chair
NOAA SCAT	Scott Zengel
NOAA SSC	Jordan Stout
NOAA SSC	Ed Levine
NOAA SSC	Ruth Yender
BP/SCAT Technical Advisor	Ed Owens
BP/Oil Spill Response	Nick Marsh
Mobile SCAT	Robert Simmons
Mobile SCAT	Greg Challenger
BP/Houma SCAT	Gary Hayward
LDEQ	Vincent Cheramie
LA OCPR	John Troutman
Alabama DEM	Allen Phelps/ Phil Wood
Mississippi DEQ	Charles Thompson/David Ruple
FLDEP	Bob Brantly
FLDEP	George Henderson
US DOI	Steve Spencer
USFWS	Rhonda Brewer
USFWS	Terry Delanie
USFWS	John Nuss
USFWS	Felix Lopez
USCG	Eric Whipple
ARTES	Michael Storino

List of the Man-made Structures Technical Working Group Members
(active participants in meetings)

Man-made Structures Technical Working Group Participants	
AGENCY / ORGANIZATION	**Name**
NOAA SCAT	Jacqueline Michel, Chair
NOAA SCAT	Scott Zengel
NOAA SSC	Ed Levine
BP/SCAT Technical Advisor	Ed Owens
BP/Oil Spill Response	Nick Marsh
Mobile SCAT	Robert Simmons
Mobile SCAT	Greg Challenger
BP/Houma SCAT	Gary Hayward
LDEQ	Vincent Cheramie
LA OCPR	John Troutman
Alabama DEM	Allen Phelps
US DOI	Steve Spencer
NPS	Chris Lydick
USCG	Eric Whipple
BP/Mobile SCAT	Michael LaTorre

Appendix C

MC252 Stage III SCAT Treatment Framework
Sandy Shorelines

02 September 2010

1. Document Aim and Purpose

The purpose of this document is to describe the types of oiling observed on sandy shorelines in the Deepwater Horizon (DWH) response arena and the appropriate treatment strategy with respect to shoreline locations. This document will be used to select the most appropriate treatment strategy depending on oiling type.

The intention of cleanup is to remove oil from shoreline areas as necessary to minimize or mitigate damage to the public health or welfare or adverse environmental impacts, including but not limited to, fish, shellfish, wildlife, and public and private property, and shoreline habitats. The choice of techniques is influenced by the amount and type of oil, the environmental and socio-economic importance of the affected areas, and physical characteristics such as wave energy. A number of treatment options are available for sandy shorelines relevant to the degree of oiling and a short description of each strategy is useful to understand the relative merits of each.

2. Overview of Sandy Shoreline Habitats and Oiling Conditions

Description

- Flat to moderately sloping and relatively hard-packed.
- There can be heavy accumulations of wrack (e.g., *Sargassum*, seagrass blades, *Spartina* stems).
- They are used by birds and turtles for feeding and/or nesting throughout the affected area and by endangered small mammals in Alabama and Florida. Specific Best Management Practices for listed species and migratory shorebirds will be identified during the Section 7 review of site-specific STRs.
- Upper beach fauna include ghost crabs and amphipods; lower beach fauna may be highly variable, but can include coquina clams (*Donax*), mole crabs, amphipods, polychaetes, etc. on high-energy beaches, and a much wider variety of species on lower energy beaches.
- Occasionally historic shipwrecks, normally wood hulled with iron and/or brass spikes, are found on the beaches; some are covered quickly by sands and exposed as sands shift during storm events. Some are occasionally buried in dunes. In many cases, portions of wrecks are visible on the surface, but there are occasions where an entire vessel may be buried by sand.
- Other kinds of historic properties that may be present on sandy shoreline include prehistoric and historic sites that may be located on nearby terraces that have eroded onto the beach surface below an exposed/eroding bank. While not in situ, these resources are indicative of the presence of nearby historic properties.
- Most of the barrier islands of Louisiana have a high rate of retreat in a generally northerly direction; therefore, the oil that is buried may be exposed within a few months. This could assist natural recovery in some cases, or it could reintroduce oil to the system in other cases.
- Mechanical activities relating to moving and scraping sand on barrier islands of Louisiana could potentially affect sediment transport and retention.

Observed Oiling Conditions as of the end of August 2010

Appendix C-1 gives oil descriptions used by the SCAT field teams to describe the oiling conditions on the different sand beaches in the DWH impacted area. Detailed maps of current oiling conditions will be used by the Stage III Core Groups in each Incident Command Post to develop general guidelines by type and degree of use (e.g., amenity beaches versus designated Wilderness Areas) and oiling condition.

A wide range of surface and subsurface[2] oiling conditions is present on sand beaches. Most of the oil burial occurred during "normal" storm erosional/depositional events; thus, the removal of the oil by beach erosion during normal storm events is expected.
Below are short summaries for each state.

Louisiana

- Louisiana has 4,800 miles of tidal shoreline; the percent sand is not readily available because of the high rates of shoreline erosion. Approximately 89 miles of sandy shoreline has been oiled to some extent. Currently approximately 13.5 miles are heavily oiled and 6.4 miles are moderately oiled with some oil buried to various extents. Beach width varies from 5 to 100 meters.
- Surface oil occurs often in the form of Surface Residues (SR) that range from large (3 m x 15 m) mats up to 20 cm thick in the lower intertidal zone (they can be also attached to peat surfaces), to SR balls and patties (often generated by erosion of the SR mats) in the intertidal zone, to SR stranded in the supratidal zone. SRs can range in distribution from <1% over large areas, with patches of >50%. The thickness of the SR is usually 1-3 cm. The SR is often highly weathered, meaning that it is not cohesive and readily crumbles into pieces when disturbed.
- Subsurface oil is not common on western barrier islands and increases to the east, with maximum burial found on Fourchon Beach to the Grand Terre islands. On Grand Terre 2, there are up to 4 bands of buried oil, ranging from continuous layers of oil that flowed out of the sediments, to discontinuous layers of SR balls and buried SR mats. Maximum burial is about 45 cm.
- The following table reflects the miles of sandy shoreline with different oiling conditions as of 27 August 2010:

Total Surveyed	Heavy	Moderate	Light	Very Light	Trace (<1%)	No oil observed	Oiled as of Last Survey
146.3	13.5	6.4	42.8	26.1	0.3	57.1	89.2

Sector Mobile (Mississippi, Alabama, Florida)

- Mississippi has 285 miles of shoreline. Approximately 127 miles (45%) is sand, of which 84 miles has been oiled to some extent. Currently approximately 3.5 miles are heavily or

[2] Subsurface oiling refers to the standard SCAT terminology for oil located more than 5 cm below the sediment surface, including oil that has penetrated the substrate or become buried. Subsurface oiling, as used here, does not refer to oil located below the water surface in open waters.

moderately oiled with some oil buried to various extents. Beach width varies from 10 to 150 meters.

- Alabama has 262 miles of shoreline. Approximately 119 miles (45%) is sand, of which 118 (see table) miles have been oiled to some extent. Currently, approximately 3.4 miles are heavily or moderately oiled with some oil buried to various extents. Beach width varies from 10 to 150 meters.
- Florida has 496 miles of shoreline in Sector Mobile. Approximately 389 miles (78 %) is sand, of which 128 miles have been oiled to some extent. Currently approximately 10.6 miles are heavily or moderately oiled with some oil buried to various extents. Beach width varies from 10 to 150 meters.
- The following information reflects data as of September 26, 2010:

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All lengths shown are in MILES

State	Total Surveyed	Heavy	Moderate	Light	Very Light	Trace Oiling (< 1%)	No Oil Observed	Oiled
Mississippi	96.1	6.2	1.0	29.4	0.2	31.2	28.1	68.0
Alabama	72.0	0.1	0.0	15.0	0.3	37.7	18.9	53.2
Florida	173.5	1.2	0.0	13.6	2.3	98.0	58.3	115.2

3. Sand Beach Treatment Options

The NOAA document "Characteristic Coastal Environments" (NOAA, 2000) includes matrices (Figure 1) to assist in selection of appropriate response options on different shoreline types. The following matrix for sand beaches assigns the relative impact of the different response options for different oil types. The DWH oil is considered to be Oil Category III type of oil.

Based on the oiling conditions, the following response options have been determined to be NOT APPROPRIATE for Stage III of the DWH spill.

<u>Vacuum</u>: There are not significant amounts of liquid oil that could be effectively recovered using vacuum systems.

<u>Vegetation Cutting</u>: Most sandy shorelines do not have any vegetation; those that do are considered to be either salt marsh or mangroves and are not covered under this habitat type.

<u>Flooding/Flushing</u>: There are not significant amounts of liquid oil that could be effectively recovered using flooding or flushing methods on sand beaches.

<u>Solidifiers</u>: There are not significant amounts of liquid oil that could be effectively recovered using solidifiers on sand beaches.

<u>Shoreline Cleaning Agents</u>: Products that are "lift and disperse" agents are not considered for use because they do not allow recovery of the released oil. Products that are "lift and float" agents

are not appropriate for sandy substrates because they require flushing that could wash heavily contaminated sand into the nearshore environment. Also, recovery of oil in the surf zone will be difficult.

INTERTIDAL

Sand Beaches

Oil Category Descriptions
I – Gasoline products
II – Diesel-like products and light crudes
III – Medium grade crudes and intermediate products
IV – Heavy crudes and residual products
V – Non-floating oil products

The following categories are used to compare the relative environmental impact of each response method in the specific environment and habitat for each oil type. The codes in each table mean:

A – The least adverse habitat impact.
B – Some adverse habitat impact.
C – Significant adverse habitat impact.
D – The most adverse habitat impact.
I – Insufficient information - impact or effectiveness of the method could not be evaluated.
— – Not applicable.

	Oil Category				
Response Method	**I**	**II**	**III**	**IV**	**V**
Natural Recovery	A	B	B	C	D
Barriers/Berms	B	B	B	B	B
Manual Oil Removal/Cleaning	D	B	A	A	A
Mechanical Oil Removal	D	B	B	B	B
Sorbents	–	B	A	A	B
Vacuum	–	–	B	A	A
Debris Removal	–	A	A	A	A
Sediment Reworking/Tilling	D	B	B	B	B
Vegetation Cutting/Removal	–	C	C	C	C
Flooding (deluge)	A	A	A	B	C
Low-pressure, Ambient Water Flushing	B	B	B	B	C
High-pressure, Ambient Water Flushing	–	–	–	–	–
Low-pressure, Hot Water Flushing	–	–	C	C	C
High-pressure, Hot Water Flushing	–	–	–	–	–
Steam Cleaning	–	–	–	–	–
Sand Blasting	–	–	–	–	–
Solidifiers	–	–	B	–	–
Shoreline Cleaning Agents	–	–	C	C	C
Nutrient Enrichment	–	A	A	B	C
Natural Microbe Seeding	–	I	I	I	I
In-situ Burning	–	–	C	C	C

Consult the *Environmental Considerations for Marine Oil Spill Response* document referenced on page 5 before using this table.

Figure 1. Matrix from "Characteristic Coastal Habitats: Choosing Spill Response Alternatives (NOAA, 2000) for sand beaches.

Nutrient Enrichment: Studies are being conducted to determine the effectiveness of this method. However, preliminary results from studies on biodegradation suggest that there are sufficient nutrients in nearshore water, such that nutrients are not limiting the natural degradation rates of the oil.

In-situ Burning: This response option would result in significant adverse habitat impact on sand beaches.

The following response options are considered to be POTENTIALLY EFFECTIVE for sandy substrates and the current oiling conditions for Stage III treatment:

- Natural Recovery
- Manual Removal (oil, oiled sediment, debris)
- Mechanical Removal
- Beach Cleaning Machines (sifters)
- Sediment Mixing/Tilling
- Sediment Relocation
- Sand Treatment Plants

Each of these methods are summarized in the following tables for:

- Method Description
- Applicable Oiling Conditions
- Effectiveness and Rate of Removal
- Best Practices/ Environmental and Cultural Resource Constraints

It is important to note that often a combination of the above methods is the most effective approach. For example, the cleanup strategy for a heavily oiled beach segment might include mechanical removal of the larger accumulation of oiled sediments, followed by manual removal of the remaining pieces of oiled sediments, followed by tilling, as appropriate.

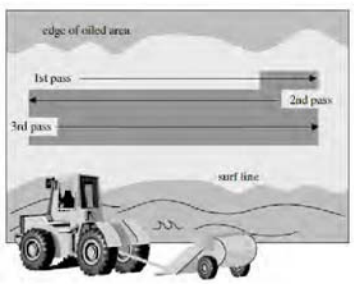
Appendix C-2 includes available documentation on the various field trials using different treatment methods for sandy shorelines.

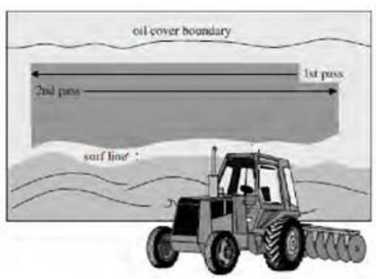
Two of the most important overarching principles of the DWH response are to conserve sand and minimize waste generation; therefore, *in-situ* treatment, particularly of sand, is encouraged wherever possible. In Louisiana and Mississippi, where most of the barrier islands are sand starved and have high rates of landward retreat, shoreline treatment methods must be carefully selected and implemented. Similar concerns apply to eroding, receding or artificially nourished sand beaches. Sand is considered to be a valuable resource that should be conserved; therefore, cleaning and replacement of oiled sand is of high priority. Sand beaches are also valuable habitats and their ecological integrity is also of high priority.

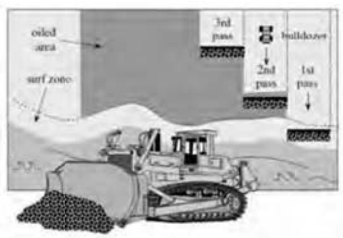
Method Description	Applicable Oiling Conditions	Effectiveness and Rate of Removal	Best Practices/ Environmental and Cultural Resource Constraints
Natural Recovery Oil is left for removal by the following processes on sand beaches: • Physical reworking by wave action • Physical removal by tidal and rainfall flushing • Natural degradation by microbial and photo-oxidation processes	Surface oil <1-2% coverage that is weathered to the point that it is no longer sticky. Thin (1-3 cm), subsurface oil residues that are greater than patchy (11-50%) in distribution. Oiled wrack that is no longer sticky. Note: There are a number of wildlife, amenity and landowner issues that may require a case-by-case assessment of the NFT recommendation.	The DWH oil is highly biodegradable, so natural degradation will be very effective, likely over periods of months. Most of the <u>surface</u> oil meeting these conditions is weathered (as of early August) to the point that the oiled sediments crumble when disturbed. Significant storms are expected over the next couple of months. Storm waves will be very effective at removing both surface and subsurface oil from the intertidal zone. However, oil in the higher supratidal zone may not be removed by storm waves; instead it could become buried deeper. The rollover phenomenon typical of Louisiana barrier islands may expose buried oil and help reworking of oil by wave action.	Avoids all types of disturbances associated with cleanup activities. Of particular concern are cultural resources that could be disturbed by both manual and mechanical removal methods. Avoids erosion and waste disposal from sand removal. Animals could come in contact with oil residues, becoming contaminated, though this risk is likely to be low. It will be important to monitor for oil weathering and physical removal, to confirm assumptions about degradation rates during natural recovery.

Method Description	Applicable Oiling Conditions	Effectiveness and Rate of Removal	Best Practices/ Environmental and Cultural Resource Constraints
Manual Removal The technique involves cleanup crews to pick up oil, oiled sediments, or oily debris with gloved hands, rakes, forks, trowels, shovels, or other implements. Sieving (including screening implements) is best for tar balls and oil residue patties and balls. Manual removal should be carried out from a clean area towards the oiled area to avoid walking on oiled patches and tracking oil into clean areas. Clean sand cover should be side-cast to reach buried oil.	Best for localized oil occurrences of surface oil. Labor intensive for subsurface oil. Preferred option for small amounts of oiled debris removal. Not applicable for trace amounts of oil or stained sands. Applicable for other oiling conditions where environmental, wildlife, cultural, resource management, or land ownership constraints preclude more intrusive treatments.	This is a significantly slower method than mechanical removal, but typically can generate less waste **if** care is taken to separate oil from sand. The waste materials (tar balls, oiled sediment, oiled debris, etc.) can be segregated easily during cleanup using screening tools. Manual removal can require vehicle or vessel support to transfer collected materials to temporary storage or permanent disposal sites.	Minimizes disturbance often associated with mechanical systems although support for waste movement and personnel can be detrimental for beach use (recreational and nesting birds). Avoids erosion and waste disposal from sand removal. Foot traffic and support vehicles/equipment can impact vegetated areas (backshore dunes) by breaking or crushing vegetation, damaging root systems, crushing or breaking prehistoric shell middens and historic artifacts, or by trampling oil into subsurface sediments. Excessive foot traffic or vegetation removal can cause erosion, or disturb adjacent resources, such as nesting birds or overwintering migratory shorebirds. Do not remove unoiled beach wrack.

Method Description	Applicable Oiling Conditions	Effectiveness and Rate of Removal	Best Practices/ Environmental and Cultural Resource Constraints
Mechanical Removal Oil and oiled sediments are collected and removed using mechanical equipment such as backhoes, graders, bulldozers, draglines, etc. Requires systems for temporary storage, transportation, and final treatment and disposal of collected materials. Use of heavy equipment may require placement of boards under the equipment to provide support and minimize sediment disturbance. Use of heavy equipment to remove submerged oil may require operating in shallow water.	When large amounts of surface oil and oiled sediments have to be removed quickly from sandy substrates. Such equipment may be used to remove clean sediments overlying buried oil, which is then removed using either mechanical or manual methods. Not applicable for soft substrates or other areas with various environmental, habitat, wildlife, cultural, resource management, or land management constraints. Most of Louisiana intertidal areas are soft soils. Not applicable in some cases where greater operational precision or control is required.	Removal rates are usually high, except where access to the oiled materials is limited by tides and waves. Biggest concern is the co-removal of large amounts of unoiled sediments, particularly on the sand starved barrier islands or any other eroding, receding, or nourished beaches. Based on experience during the DWH, operations must be closely supervised by knowledgeable staff; otherwise, excessive sediment removal, deep pits, and habitat damage is likely. Need manual removal of remaining oiled materials. Need backshore area for oiled material storage and equipment staging overnight on remote beaches, both of which can be an issue.	May substantially change beach/sediment characteristics and dynamics, including increased erosion, even more so if sediments are removed for offsite disposal. For removal of subsurface oil where there is overlying clean sand, the clean sand should be temporarily placed aside prior to removing the buried oil to avoid removal and contamination of clean sediments. May disturb turtles/bird nesting and infauna and remove wrack accumulations, which are important substrates that provide food for shorebirds. May be constrained in areas with sea turtle nests, nesting seabirds, beach mice, or migratory shorebird aggregations. Use buffers around nests or other sensitive areas and monitoring of operations to avoid impacts. Smooth deep ruts to avoid entrapment of turtle hatchlings during nesting season. Subsurface oil removal will require surveys to identify previously unknown and avoid damages to known cultural resources. Avoid disturbance of dune and marsh areas and all vegetation. Do not remove unoiled beach wrack. Avoid damage to mud/peat platforms and outcrops in the lower intertidal.

Method Description	Applicable Oiling Conditions	Effectiveness and Rate of Removal	Best Practices/ Environmental and Cultural Resource Constraints
Beach Cleaners (BC) Application of commercially available beach grooming devices for recovery or treatment of beaches. Includes: • Towed sand sifters • Self-propelled sand sifters • Large sand sifters 	Oil/sand surface accumulations and oiled debris that can be collected and retained on screens. Buried oil layers or concentrations in the subsurface that can be lifted and retained on screens. Smaller towed and self-propelled beach cleaners are generally limited to a maximum depth of 15 cm. Larger beach cleaners have a maximum depth of approximately 45 cm. Light tilling may be useful in bringing shallow buried accumulations to the surface for recovery, prior to using beach grooming equipment. Some beach cleaning equipment can also be used or modified for use in mechanical removal.	DHW oil mixes with sand on the beach, forming accumulations that can be screened if sufficiently solid. Breakup of these accumulations can occur during the cleaning process, and it has been necessary to conduct night operations when the oil has cooled enough to be effectively recovered. Treatment rate is high (1.5 to 3 kilometers of beach/night is common for the tandem units currently being operated) and recovery efficiencies of approximately 75% have been achieved. Weathering of oil/sand accumulations is occurring in some areas and the accumulations are becoming more solid and easier to screen. Night operations may not be necessary in some cases.	Greatly minimizes potential erosion relative to mechanical removal, but may still affect beach/sediment characteristics and dynamics. Minimizes waste disposal concerns associated with excessive clean sand removal. May disturb turtles/bird nesting and infauna and remove wrack accumulations, which are important substrates that provide food for shorebirds. Cleaning operations may severely impact cultural resources – driving over sites may crush artifacts, both on the surface and buried. Survey and testing will be required to identify potentially buried historic properties. Areas with known cultural resources should be avoided, using buffers and monitoring of operations. Some machines may break the oil into smaller particles that are more difficult to recover. Night operations in some locations may be constrained due to sea turtle and beach mouse lighting considerations. Smooth deep ruts to avoid entrapment of turtle hatchlings on turtle nesting beaches.

Method Description	Applicable Oiling Conditions	Effectiveness and Rate of Removal	Best Practices/ Environmental and Cultural Resource Constraints
Mixing/Tilling Stained or lightly oiled sand is mechanically agitated by agricultural equipment, such as rakes, discs, or harrows, to accelerate natural recovery by evaporation, reworking by wave action, and physical removal by tidal and rainfall flushing. Thin layers of shallow subsurface (buried) oil is brought to the surface with plows so that the oil is more available to reworking by wave action and physical removal by tidal and rainfall flushing (once surfaced "bulk" oil is removed). 	Lightly oiled surface sands with Stain that is discolored sand rather than visible black/brown oil particles. Thin buried oil layers or concentrations of small oil particles. May be applicable after bulk oil removal (following mechanical or manual treatments) as a finishing treatment to accelerate natural removal of small amounts of remaining oil.	The DWH oil is light and this tactic accelerates degradation and weathering by significantly increasing the surface area of the oiled sand and by making shallow buried oil more available to natural removal processes. Most effective in intertidal zone for wave and tide re-working. May also be effective for oil remaining in the upper or supratidal that would be only infrequently re-worked naturally by waves and tides. Exposed subsurface oil residue balls and patties may be recoverable through other techniques (beach sifters, manual).	Greatly minimizes potential erosion relative to sand removal, but may still affect beach/sediment characteristics and dynamics. Avoids waste disposal concerns associated with sand removal. Physically disturbs infauna, potentially affecting migratory shorebirds Wildlife could come in contact with exposed oil residues, though this risk is likely low. Cleaning operations may severely impact cultural resources – driving over sites may crush surface and buried artifacts. Survey and testing will be required to identify potentially buried historic properties. Areas with known cultural resources should be avoided, using buffers and OPS monitoring. May be constrained in areas with sea turtle nests, nesting seabirds, beach mice, or migratory shorebird aggregations. Use buffers around sensitive areas and monitoring of operations to avoid impacts. Smooth deep ruts to avoid entrapment of turtle hatchlings on turtle nesting beaches. For tilling of buried oil where there is overlying clean sand, the clean sand can be temporarily placed aside prior to tilling to avoid contamination of clean sediments. Avoid disturbance to dunes and all vegetation. Do not till unoiled wrack.

Method Description	Applicable Oiling Conditions	Effectiveness and Rate of Removal	Best Practices/ Environmental and Cultural Resource Constraints
Sediment Relocation Sand is mechanically (or manually) moved from the supratidal or intertidal zone to the water (or lower intertidal) during low tides to accelerate natural reworking by wave action and physical removal by tidal flushing. 	Lightly oiled sands with Stain, Film, or small oil/sediment oil particles. Potential method for thin and discontinuous buried oil layers or concentrations of small oil or oil/sediment particles where oiled sediment removal is determined to be inappropriate. Sufficient wave action to re-work the sediments. Appropriate as a "polishing technique" for oil stained sands where bulk oil has been removed by other techniques. Most applicable to high-use amenity or recreational beaches of commercial importance.	The process is effective and rapid (minutes) as the oil and sediment separate in moving water. Experiments have shown that the dispersion process rapidly increases the rates of biodegradation. Relocated sand is quickly (within days) moved back up the beach on rising tides. Sand will need to be replaced in the appropriate locations to optimize retention.	Greatly minimizes erosion relative to sand removal; may affect beach/sediment characteristics and dynamics. On eroding, receding or nourished beaches, any actions that could increase erosion are of serious concern. Beach profiles will be done to document sand loss. Avoids waste disposal concerns associated with sand removal. Physically disturbs infauna, potentially affecting migratory shorebirds, but likely less so relative to other non-manual methods, depending on the degree and extent of treatment. Trials and monitoring needed to ensure sheens are not generated and that bulk oil is not being remobilized or deposited in nearshore subtidal areas during sediment relocation. Cleaning operations may severely impact cultural resources – driving over sites may crush surface and buried artifacts. Survey and testing will be required to identify potentially buried historic properties. Areas with known cultural resources should be avoided, using buffers and OPS monitoring. May be constrained in areas with sea turtle and seabird nests, beach mice, or migratory shorebird aggregations. Use buffers around nests or other sensitive areas and monitoring of operations to avoid impacts. Smooth deep ruts to avoid entrapment of turtle hatchlings on turtle nesting beaches.

Method Description	Applicable Oiling Conditions	Effectiveness and Rate of Removal	Best Practices/ Environmental and Cultural Resource Constraints
Sand Treatment Plant Oiled sands are removed from site and transported to the system. Debris removed by sieving (shaker box) prior to introduction of sand into the system. There are various washing systems that use ambient water (~90-100 deg. F), hot water, and/or chemicals Includes static systems that can be relocated over a period of 3-4 days and portable systems (although the throughput of the portable systems is generally lower than the static systems). 	All types of DWH oiled sands (Thick, Coat, Cover, Stain, oil particles, balls, patties). Not tested for hard tarry residues such as weathered tar balls and tar patties. This method is only applicable in combination with other primary treatment methods, including mechanical removal, beach cleaners, and/or manual removal, including the applicable oiling conditions, effectiveness, and best practices/constraints associated with each.	Throughput rate on the order of 30-50 tons/hour. Can operate continuously (24 hours) with periodic maintenance. Present system reduces TPH concentrations on the order of 10,000's ppm to tens to hundreds ppm. Effectiveness and efficiency could be improved with addition of heated water and/or a surfactant. No sediment loss. Low labor requirement.	For systems that do not involve chemicals, the sand can be replaced on beach immediately. Tests will be required for systems that involve chemicals to determine the need for further treatment (e.g., stockpiling the sand for a period of time) prior to placement on the beach. There may be windows during which placement of sand on the beach may be restricted to minimize disturbances to sea turtles, nesting/overwintering birds, etc. There may be restrictions on the volume of treated sand placed on a length of beach, to minimize impacts to existing infauna). Removal, treatment, and replacement of sand greatly minimizes erosion relative to sand removal for offsite disposal, but may still affect beach/sediment characteristics and dynamics. Sediment relocation of the treated sand could be used to remove any remaining stain/oil and to redistribute the sediments on the beach. Sand should not be place on cultural resources.

CGL001-0221103

4. Evaluation of Promising Technologies from ARTES/HITT

Over 30 technologies were reviewed from various sources. Technologies included sand collectors/sifters, washers (no chemicals), cleaners (chemicals used), thermal, water filtration, some manual, and miscellaneous treatments. Preliminary research on each technology included descriptions, mobility, footprint, efficiency, throughput, operational needs, permit issues, number of units currently available, and results of any desk-top or field tests. The following table reflects the subset of sand treatment technologies that are the most highly recommended based on the above evaluative criteria.

The most highly recommended products for sand treatment plants.

Product Name	Type	Advantages	Comments	Availability	Proposed Next Steps
M-I SWACO (2nd machine)	Either a sand washer (if using just warm water) or a sand cleaner (if using a chemical cleaner)	Permitted, proven. Processed sand meets LA RECAP standards..	- 30+ tons/hour throughput - has removed average 0.7 gallons oil/cubic yard - 24-hour operations: subject to mechanical maintenance several days/month	2 weeks	Houma Core Group to pursue permits and approvals. Operations undertaking site survey for proposed Elmer's Island site.
EM Tech	Sand cleaner (uses cavitation chemistry and oxidant reagents in closed system – potassium permanganate)	Local vendor, proven in other clean-up settings, small footprint, more mobile, self-contained, documentation provided, cost competitive with M-I SWACO, performance based pricing, can treat to any standard.	Mobile units – on 30-ft trailer Would need belt feeder and debris sifter Inspected and rejected by Operations due to low probability of permit approval.	4 units on site in 72 hours 4 weeks for 6 more units	None.
STS-101	Sand washer, using hot water (175-195°F). Chemical surfactant is EPA approved.	Similar to M-I SWACO in footprint and operation but claim 0 TPH treatment standard w/o chemical	- Same footprint as M-I SWACO. - Claim tph reduction to below 500 ppm	First unit in 45 d plus up front contracting time (est. 2 weeks)	Lead time precludes use in 2010 Stage III
Green Earth Technologies	Sand cleaner	No chemicals (uses re-usable sorbent sock), same footprint and operational needs as M-I SWACO, but treatment standard achieved unclear.	- Claim TPH reduction to 200-600 ppm. - 30 to 80 tons/hour	First 30-ton unit in 10 weeks. 80-ton unit in 14 weeks.	Lead time precludes use in 2010 Stage III
ATON 00HR and ATON 2MOS	Thermal (microwave)	Treats both sand and emissions, may not char sand	1 ton/hour throughput	Scheduled to arrive New Orleans Sept. 17	Plan working test and operational approvals

5. Effective Shoreline Treatment Strategies for Sandy Shorelines

The following matrices outline the principal treatment strategies relevant to the degree of oiling and its location on the affected beach. These matrices are relevant to the oiling that has been observed during the DWH incident. The selection of the appropriate treatment strategy varies by degree of oiling and use of the habitat, as well as ecological and cultural resource issues. The Houma and Mobile Core Groups will use these matrices to develop the treatment strategies and 2010 NFT guidelines for implementation during Stage III.

Matrix of potentially effective treatment strategies for surface oiling on sand beaches. Selected treatment method(s) will depend on the extent and distribution of oiling per category; level of recreational and commercial importance; environmental, wildlife, cultural, and resource management constraints; and geomorphological constraints.

Surface Oil Thickness and Character	Natural Recovery	Manual Removal	Beach Sifters	Mechanical Removal	Sediment Tilling	Sediment Relocation	Sand Treatment Plant
Thick oil (>1.0 cm)		X		X			X
Cover (>0.1 to ≤1.0 cm)		X		X			X
Coat (>0.01 to ≤0.1 cm)	X	X		X			X
Stain (≤0.01 cm)	X				X	X	
Film – Sheen	X				X	X	
Tar Patties (>10 cm)		X	X				X
Tar Balls (<10 cm)	X	X	X				X
Small Oil Particles (SOP)	X	X			X		X
Surface Oil Residue (SR)	X	X		X	X		X
Surface Residue Patties (SRP)	X	X	X		X		X
Surface Residue Balls (SRB)	X	X	X		X		X

Matrix of potentially effective treatment strategies for subsurface oiling on sand beaches. Selected treatment method(s) will depend on the extent and distribution of oiling per category; level of recreational and commercial importance; environmental, wildlife, cultural, and resource management constraints; and geomorphological constraints.

Subsurface Oil Thickness and Character	Natural Recovery	Manual Removal	Beach Sifters	Mechanical Removal	Sediment Tilling	Sediment Relocation	Sand Treatment Plant
Thick oil (>1.0 cm)	X	X		X			X
Cover (>0.1 to ≤1.0 cm)	X	X		X	X		X
Coat (>0.01 to ≤0.1 cm)	X	X			X	X	X
Stain (≤0.01 cm)	X				X	X	
Film – Sheen	X				X	X	
Tar Patties (>10 cm)	X		X (till 1st)		X		X
Tar Balls (<10 cm)	X		X (till 1st)		X		X
Small Oil Particles (SOP)	X				X		X
Oil Residue (OR)	X	X	X (till 1st)	X	X		X
Oil Residue Patties (RPs)	X	X	X (till 1st)		X		X
Oil Residue Balls (RBs)	X	X	X (till 1st)		X		X

Appendix C- 1

Sand Beach Oiling Definitions

<u>Oiling definition clarifications for sand beaches</u>

Tarballs/Tarpatties (TB/TP)
Discreet balls (<10cm) or patties (10cm to 1 m) of weathered oil with an *almost solid* consistency.

Small Oil Particles (SOP)
Discreet oil or mousse drops (liquid consistency) that have a thickness associated with them. While there might be some sand mixed in, these particles are "sticky", "gooey" and not "crumbly". These particles should be considered in the "tarball" size and be classified as SOP if they are less than 10cm. Anything greater than 10 cm would be considered mousse (see below).

Surface Oil Residue (SR)
Non-cohesive, oiled surface sediments (up to 5 cm deep) with a "soft" or "crumbly" character. The sediments may contain some oil filled/partially filled pore spaces and have some liquid/"gooey" consistency but the majority of the oiling is sand saturated with oil. SR may or may not be partially buried.

Surface Oil Residue Balls/Patties (SRB/SRP)
Discreet non-cohesive, sand saturated oiled sediments in ball (< 10 cm) or patty (10 cm – 1m). SRB/SRP are either small oil particles (SOP) which have had sand incorporated into them (by wind or rolling in waves) or have broken off of zones of surface oil residue (SR). The balls/patties are "crumbly" and can break apart.

Mousse

Emulsified oil with a rusty orange to dark brown color, liquid consistency. May be "sinking" into the sand and saturating it, causing the formation of SR.

Examples of Surface Oil

Mobile Sector
MC 252
August 2010

Thick oil pooled on sand and peat (south side of Cat Island)

Thick surface oil residue patty being partially covered by wind-blown sand

Thick surface oil pooled on sand (Pte aux Chenes, MS)

Thick surface oil residue patty in MITZ (north side of Cat Island)

Examples Subsurface Oil

Mobile Sector
MC 252
August 2010

Photo 5. Exposed buried oil in scarp in UITZ in FLES2-003.

Subsurface oil residue balls (at 30cm) in scarp

Subsurface oil residue balls at 15cm (under berm crest on east side of Cat Island)

Subsurface oil residue ball (2cm thick) at 15cm (under berm crest on east side of Cat Island)

Subsurface oil residue patty (at 7cm) buried in SUTZ (east side of Cat Island)

Surface oil residue balls being covered by 2-3cm of sand in SUTZ (east side of Cat Island)

Subsurface oil residue ball (at approx. 12cm) in berm crest on east side of Cat Island

Subsurface oil residue patty (at 15cm) on exposed scarp (Horn Island)

SUTZ surface oil residue being buried by sand deposition (and turning into subsurface oil residue) on the backside of the berm crest (Horn Island)

Appendix D

MC252 Stage III SCAT Treatment Framework
Coastal Marsh and Mangrove Shorelines

02 September 2010

1. Document Aim and Purpose

The purpose of this document is to describe the types of oiling observed on vegetated shorelines in the Deepwater Horizon (DWH) response arena and the appropriate treatment strategy with respect to shoreline locations during Stage III of the response. This document will be used to select the most appropriate treatment strategy depending on oiling conditions. Shoreline Cleanup Assessment Technique (SCAT) teams will conduct the field surveys to document the oiling conditions in Stage III and follow the guidelines on selection of appropriate treatment methods.

The intention of cleanup is to remove oil from shoreline areas as necessary to minimize or mitigate damage to the public health or welfare or adverse environmental impacts, including but not limited to, fish, shellfish, wildlife, and public and private property, and shoreline habitats. The choice of techniques is influenced by the amount and type of oil, the environmental and socio-economic importance of the affected areas, and various biological and physical characteristics of the habitat types. A number of treatment options are available for vegetated shorelines relevant to the degree of oiling and a short description of each strategy is useful to understand the relative merits of each.

2. Overview of Vegetated Habitats and Oiling Conditions

Description

- In Louisiana, the vegetated habitats affected by the DWH spill are mainly dominated by three species: *Spartina alterniflora* (smooth cordgrass); *Avicennia germinans* (black mangrove); and *Phragmites australis* (Roseau cane, common reed).
- Smooth cordgrass is generally the dominant lower intertidal salt marsh vegetation. It varies from dense stands, to broken and open marshes, and can occur as a narrow fringe to extensive salt marsh platforms.
- In Louisiana, black mangroves are present on barrier island (back barrier) salt marshes and also in the more southern salt marshes, both as continuous stands of stunted black mangrove and in association with smooth cordgrass.
- Roseau cane occurs as dense, tall stands primarily along the major channels of the Mississippi River along the birdsfoot.
- In Mississippi and Alabama, mixed *Spartina/Juncucs roemarianus* and *Juncus* dominated marshes are found in all estuaries adjacent to the Mississippi Sound.

Observed Oiling Conditions as of the end of August 2010

Appendix D-1 includes descriptions and photographs of the oiling conditions on the different vegetated shorelines in the DWH impacted area. Detailed maps of current oiling conditions will be used by the Stage III Core Groups in each Incident Command Post to develop general guidelines by habitat type and oiling condition.

- A wide range of surface oiling conditions is present on vegetated shorelines.
- Below are short summaries for each state.

Louisiana

- Most of the oiling occurs along the outer fringe of the marshes and mangroves, although there can be interior oiling, for example, where oil penetrated into dense stands of Roseau cane; oil was transported across the marsh and deposited up to tens of meters into the marsh by the high water and waves during Hurricane Alex; oil penetrated tidal channels of marsh islands; and oil accumulated around shell berms inside the marsh during various high-water events.
- The depth of oil penetration into the outer fringe varies from a few centimeters to over ten meters.
- The height of oil on the vegetation varies from a few centimeters to over one meter.
- Along the most Heavily oiled vegetated shorelines, there can be Thick Oil (>1 cm) trapped on and below the vegetation. Along Lightly and Very Lightly oiled vegetated shorelines, the oil occurs as a Stain to Coat on the vegetation only.
- There is evidence of extensive natural removal of the oil on the vegetation and soils.
- There is evidence of vegetative re-growth in many of the oiled areas.

Mississippi

- Nearly all of the oiling in coastal marshes in Mississippi is currently Light, Very Light or Trace. There are 8 meters of heavily oiled marsh on Horn Island.
- The distance of oil penetration into the outer fringe varies from a few centimeters to a few meters.
- Along Lightly and Very Lightly oiled vegetated shorelines, the oil occurs as a Stain to Coat on the vegetation only.
- Based on SCAT surveys, there appears to be minimal penetration of oil into the marsh soils.
- There is evidence of natural removal of the oil on the vegetation and soils.
- There is no visual evidence of plant mortality or growth inhibition in the oiled areas.

Alabama

- All of the oiling in coastal marshes in Alabama is currently Light, Very Light or Trace.
- The distance of oil penetration into the outer fringe varies from a few centimeters to a few meters.
- Along Lightly and Very Lightly oiled vegetated shorelines, the oil occurs as a Stain to Coat on the vegetation only.
- Based on SCAT surveys, there appears to be minimal penetration of oil into the marsh soils.
- There is evidence of natural removal of the oil on the vegetation and soils.
- There is no visual evidence of plant mortality or growth inhibition in the oiled areas.

Florida

- There are no oiled marsh habitats in Florida. There are some Tar Balls in dune vegetation on the outer coast, which fall under the Sandy Beach Technical Working Group recommendations.

3. Vegetated Shoreline Treatment Options

The NOAA document "Characteristic Coastal Environments" (NOAA, 2000) includes matrices to assist in selection of appropriate response options on different shoreline types. The following matrices for 1) coastal marshes (Figure 1) and 2) mangroves (Figure 2) assign the relative impact of the different response options for different oil types. The DWH oil is considered to be Oil Category III type of oil.

The Louisiana Office of Coastal Protection and Restoration (OCPR) prepared a report in May 2010 entitled "Summary of Response Options for Oil Spill Cleanup in Wetlands" which is a succinct summary of the oil impacts on wetlands within the framework of identifying appropriate response options to speed recovery of oiled wetlands in Louisiana.

Based on the oiling conditions, the following response options have been determined to be NOT APPROPRIATE for vegetated habitats affected by the DWH spill, based on both the NOAA and OCPR documents.

Mechanical Oil Removal: This method is likely to cause significant adverse habitat impacts and is not allowed.

Sediment Reworking/Tilling: This method is likely to cause significant adverse habitat impacts and is not allowed.

Flooding (deluge): Most of the oil is coated on the vegetation, where flooding alone would not be effective. Also, by the end of August 2010, most of the oil is strongly adhered to the vegetation and sediments and is not likely to be released by gentle flooding (which occurs regularly during tidal flooding).

Any kind of high-pressure and/or heated-water flushing: These methods are likely to cause significant adverse habitat impacts and are not allowed.

Solidifiers: There are not significant amounts of liquid oil that could be effectively recovered using solidifiers in vegetated habitats.

Shoreline Cleaning Agents: Products that are "lift and disperse" agents are not considered for use because they do not allow recovery of the released oil (Michel et al., 2001). Products that are "lift and float" agents are being tested for effectiveness in field trials that are scheduled for September 2010 in the Bay Jimmy, Louisiana area. The results of these tests will be considered for possible re-evaluation of this treatment type, however, it is anticipated that shoreline cleaning agents would be considered for marshes or mangroves very selectively.

Salt to Brackish Marshes

Oil Category Descriptions

I – Gasoline products
II – Diesel-like products and light crudes
III – Medium grade crudes and intermediate products
IV – Heavy crudes and residual products
V – Non-floating oil products

The following categories are used to compare the relative environmental impact of each response method in the specific environment and habitat for each oil type. This method may cause:

A – The least adverse habitat impact.
B – Some adverse habitat impact.
C – Significant adverse habitat impact.
D – The most adverse habitat impact.
I – Insufficient information - impact or effectiveness of the method could not be evaluated.
— Not applicable.

Response Method	Oil Category I	II	III	IV
Natural Recovery	A	A	B	B
Barriers/Berms	B	B	B	B
Manual Oil Removal/Cleaning	D	D	C	C
Mechanical Oil Removal	D	D	D	D
Sorbents	–	A	A	A
Vacuum	–	B	B	B
Debris Removal	–	B	B	B
Sediment Reworking/Tilling	D	D	D	D
Vegetation Cutting/Removal	D	D	C	C
Flooding (deluge)	B	B	B	B
Low-pressure, Ambient Water Flushing	B	B	B	B
High-pressure, Ambient Water Flushing	–	–	–	–
Low-pressure, Hot Water Flushing	–	–	–	–
High-pressure, Hot Water Flushing	–	–	–	–
Steam Cleaning	–	–	–	–
Sand Blasting	–	–	–	–
Solidifiers	–	C	C	–
Shoreline Cleaning Agents	–	–	B	B
Nutrient Enrichment	–	A	B	B
Natural Microbe Seeding	–	I	I	I
In-situ Burning	–	B	B	B

Figure 1. Matrix from "Characteristic Coastal Habitats: Choosing Spill Response Alternatives (NOAA, 2000) for brackish to salt marshes.

Relative environmental impacts

Mangroves

Oil Category Descriptions

I – Gasoline products
II – Diesel-like products and light crudes
III – Medium grade crudes and intermediate products
IV – Heavy crudes and residual products
V – Non-floating oil products

The following categories are used to compare the relative environmental impact of each response method in the specific environment and habitat for each oil type. This method may cause:

A – The least adverse habitat impact.
B – Some adverse habitat impact.
C – Significant adverse habitat impact.
D – The most adverse habitat impact.
I – Insufficient information - impact or effectiveness of the method could not be evaluated.
— Not applicable.

Response Method	Oil Category I	Oil Category II	Oil Category III	Oil Category IV
Natural Recovery	A	A	A	A
Barriers/Berms	B	B	B	B
Manual Oil Removal/Cleaning	–	D	C	C
Mechanical Oil Removal	–	–	–	–
Sorbents	–	A	A	A
Vacuum	–	B	B	B
Debris Removal	–	A	A	A
Sediment Reworking/Tilling	–	–	–	–
Vegetation Cutting/Removal	–	–	–	–
Flooding (deluge)	–	B	B	B
Low-pressure, Ambient Water Flushing	–	B	C	C
High-pressure, Ambient Water Flushing	–	–	–	–
Low-pressure, Hot Water Flushing	–	–	–	–
High-pressure, Hot Water Flushing	–	–	–	–
Steam Cleaning	–	–	–	–
Sand Blasting	–	–	–	–
Solidifiers	–	C	C	–
Shoreline Cleaning Agents	–	–	I	I
Nutrient Enrichment	–	I	I	I
Natural Microbe Seeding	–	I	I	I
In-situ Burning	–	–	–	–

Figure 2. Matrix from "Characteristic Coastal Habitats: Choosing Spill Response Alternatives (NOAA, 2000) for mangroves.

Nutrient Enrichment: Different products and formulation are being tested for effectiveness in field trials that are scheduled for September 2010 in the Bay Jimmy, Louisiana area. The results of these tests will be considered for possible re-evaluation of this treatment type. However, there is a general consensus that there are sufficient nutrients in nearshore water, such that nutrients are not limiting the natural degradation rates of the oil.

In-situ Burning: The general guidance is that use of in-situ burning in marshes is appropriate only when there are significant amounts of free-floating oil present in the marsh interior and there is a minimum layer of water over the marsh soils (Mendelssohn et al., 1995; Michel et al., 2003). Burning is not appropriate for mangroves. As of the end of August 2010, there is little free-floating oil remaining. Also, most of the oil occurs along the marsh fringe, where low pressure flushing would be more appropriate. However, testing of in-situ burning of heavily oiled vegetation may be considered in small-scale tests.

Loose Organic Sorbents: Field trials were conducted in June 2010 in Barataria Bay, Louisiana using different types of loose organic sorbents (kenaf, bagasse, peat moss, and a cellulose-based product) as a site specific and targeted method to reduce the risk of oil contact with fledgling birds on a large pelican rookery. However, after the passage of several storms in early-mid July, it was determined that the oil on the vegetation was weathering to the point that it was much less sticky, posing a lesser risk to birds and a lower rate of adhesion to the loose sorbent. After consultation with state resource agency representatives, further application for wildlife protection was not recommended. The widespread use of loose organic sorbents in coastal marshes and mangroves is not being considered as a cleanup technique due to concerns related to the decreased efficacy of loose sorbents with weathered oil, the difficulty in recovery of the oiled sorbent materials, the generation of further oily debris and waste, the undetermined fate and effects of such oiled material in the marsh and nearshore waters, and the potential for ingestion of loose oiled sorbents by wildlife and fish.

The following response options are considered to be POTENTIALLY EFFECTIVE for coastal marshes and mangroves and the current oiling conditions:

- Natural Recovery
- Low-pressure, Ambient-temperature Flushing
- Sorbents
- Manual Removal (on sand or shell substrates only)
- Vacuum
- Vegetation Cutting (for limited access to Roseau cane marshes only)

It should be noted that the OCPR (2010) report recommended all of the above response options except for manual removal because “even light foot traffic from response personnel activities can cause significant and long-lasting harm to the integrity of the soft soils underlying Louisiana’s wetlands.” Therefore, manual removal is only considered for sand and shell substrates and where the oil can be accessed without damaging live vegetation or the substrate.

Debris Removal – A Special Problem: There are large amounts of stranded boom and associated materials in coastal marsh and mangrove areas that is causing or has the potential to cause additional physical damage to these habitats over time, as well as creating wildlife entanglement, navigation, and other hazards. Because of the magnitude of the problem, separate shoreline treatment recommendations (STRs) have been developed for removing stranded boom and other debris for both the Houma and Mobile Incident Commands. Only specially trained teams are allowed to remove stranded boom from vegetated habitats; and these teams are being closely monitored to assure that additional damage during stranded boom removal is kept to a minimum.

Each of these methods are summarized in the following tables for:

- Method Description
- Applicable Oiling Conditions
- Effectiveness and Rate of Removal
- Best Practices/ Environmental and Cultural Resource Constraints

Method Description	Applicable Oiling Conditions	Effectiveness and Rate of Removal	Best Practices/ Environmental and Cultural Resource Constraints
Natural Recovery Oil is left for removal by the following processes on vegetated shorelines: • Physical reworking by wave action • Physical removal by tidal and rainfall flushing • Natural degradation by microbial and photo-oxidation processes	Very Lightly to Heavily oiled vegetation where the oil occurs mostly on the vegetation and cannot be released by flushing. Oiled shorelines that do not release sheens that can affect sensitive areas. Oil stranded deep in the marsh interior.	Past experience indicates that the oil will eventually weather to the point that it is no longer sticky. Field observations indicate that the degree of oil on the vegetation has decreased over time; some Very Lightly to Lightly oiled areas no longer have visible oiling. Natural recovery can often be an effective and least damaging treatment method for marshes and mangroves in warm climates	Avoids all types of disturbances and additional impacts associated with cleanup activities. Avoids waste disposal from excessive use of sorbents. Animals could come in contact with oil residues, becoming contaminated, though this risk is diminishing.

Method Description	Applicable Oiling Conditions	Effectiveness and Rate of Removal	Best Practices/ Environmental and Cultural Resource Constraints
Low-pressure, Ambient-temperature Flushing Marsh flushing systems must meet the following requirements: • Vessel based that can be operated from the marsh edge (no foot or boat access allowed on the marsh surface) • Pressure at the spray boom must be less than 25 psi • The water spray angle is less that 35 degrees from the horizontal (do not spray straight down on the marsh) • Spray is applied no closer than 1 ft above the vegetation and 3 ft above the marsh surface • Flushing is terminated if no recoverable oil is released from the spray area after 3 passes not to exceed 5 minutes total duration over a swath • Hard boom is lined with sorbents to contain any released oil. A skimmer is used to recover released oil, to reduce the amount of water collected and quantify the amount of oil recovered. Sorbents are only for final sheen removal.	Where flushable thick or pooled oil is trapped on the vegetation and soils. Over time, monitor currently treated sites to determine the oiling conditions that are amendable to effective flushing.	Most effective on fresh oil. Effectiveness will decrease as the oil weathers. Most Lightly to Moderately oiled marshes do not have enough flushable oil to warrant flushing. There may be a short window of time for this method to be effective on Moderately to Heavily oiled marshes. Less effective on marsh vegetation that is flat or laying over due to oiling or other factors	Stop flushing when no more oil greater than sheen is released. The boom should be placed far enough from the shoreline so that it contains any re-suspended oil. Adjust the boom to contain sheens released outside of the boom. Use when the tides are high enough that the marsh surface is covered with water to minimize the amount of oil (and suspension of sediments) that might contaminate marsh soils. Do not spray on bare soil. Stop before there is evidence of soil erosion or turbidity, such as muddy runoff water or channels forming in the runoff area. Stop flushing and/or lower the pressure if the vegetation appears to be crushed or damaged. Lower pressure can be achieved by increasing the distance of the spray head from the treated surface. Do not flush oil across marsh areas that are not already oiled. Do NOT use on any shell accumulations. They may be archaeological sites.

Method Description	Applicable Oiling Conditions	Effectiveness and Rate of Removal	Best Practices/ Environmental and Cultural Resource Constraints
Sorbents Sorbent material is placed on the water surface adjacent to the shoreline to recover oil being released naturally by tidal flushing and wave action; also used in combination with other active treatment methods such as vacuum and flushing. The most common type used during the DWH spill is sausage boom composed of polypropylene. Other types that have been used or proposed include snare on a rope and loose organic sorbents contained in mesh or other materials.	Should only be deployed where oil is being released from the shoreline, as indicated by the presence of sheens or black oil droplets that can affect sensitive resources.	Sorbents are not very effective in recovery of light sheens; therefore, they should be removed once no more oil adheres to the sorbent material during normal tidal/wave conditions.	Sorbents must be securely deployed to prevent stranding on vegetation during storms. When large waves are predicted, sorbents along exposed shorelines should be removed, to prevent stranding. Sorbents that are water-logged, oiled, or breaking apart must be removed immediately. No foot or vessel traffic in the vegetation is allowed during deployment/ retrieval. Sorbent use should be closely monitored to assure that they are deployed only where appropriate and removed as soon as sheening stops and/or they are no longer effective. Experience during the DWH spill has shown that boom adjacent to mangroves must be securely deployed; once stranded in the mangroves, it causes significant damage and is difficult to remove. Snare boom should not be used against marsh or mangrove shorelines, and should generally be avoided near mangrove areas.

Method Description	Applicable Oiling Conditions	Effectiveness and Rate of Removal	Best Practices/ Environmental and Cultural Resource Constraints
Manual Removal (on sand and shell substrates) Workers use hand tools such as trowels, shovels, and rakes to remove thick accumulations of oil on the sediment surface. Live vegetation is not disturbed.	This method would only be considered on a site-specific basis for recovery of accumulations of Thick Oil stranded on the marsh soils or against shell berms inside the marsh AND where the substrate is sand and/or shell and firm enough to support foot traffic without causing additional impact.	Careful removal of small accumulations of oil will be very slow. The goal is to remove enough oil to speed recovery, rather than trying to remove all of the oil, which would likely cause additional harm.	Foot access to the oil should be over unvegetated areas only. Close monitoring is required to provide guidance on when to stop because of the risk of causing additional harm. Sites adjacent to shell berms will need to be surveyed for the presence of cultural resources. Minimize the removal of clean sediments and disturbance of live plant stems, roots, and mangrove pneumatophores

Method Description	Applicable Oiling Conditions	Effectiveness and Rate of Removal	Best Practices/ Environmental and Cultural Resource Constraints
Vacuum A vacuum unit is attached via a flexible hose to a suction head that recovers free oil. Such systems have to be small and portable, to provide access to potential free oil accumulations that are mostly inside marsh areas. May need to use flushing to float the oil off the substrate.	This method would only be considered on a site-specific basis for recovery of accumulations of Thick liquid Oil stranded on the marsh soils or against shell berms inside the marsh. Current conditions where this technique would be applicable may be relatively rare due to lack of Thick Oiling in most locations and natural attenuation.	Careful vacuuming small accumulations of oil will be very slow. The goal is to remove enough oil to speed recovery, rather than trying to remove all of the oil, which would likely cause additional harm.	All vacuuming operations should be conducted from boats; no foot traffic on the substrate (which is hard to do). Close monitoring is required to provide guidance on when to stop because of the risk of causing additional harm. Care should be taken to avoid vacuuming of muddy sediments and disturbance to soils and plant roots and mangrove pneumatophores. Sites adjacent to shell berms will need to be surveyed for the presence of cultural resources.

Method Description	Applicable Oiling Conditions	Effectiveness and Rate of Removal	Best Practices/ Environmental and Cultural Resource Constraints
Vegetation Cutting To be used for situation- and site-specific access in Roseau cane marsh only, not as a primary cleanup technique. Oiled vegetation is cut with weed wackers, blades, etc. and picked or raked up and bagged for disposal. In Roseau cane, pathways may be cut to provide access to thick accumulations of oil in the vegetation interior.	Thick accumulations of oil stranded in the marsh interior. No other conditions are considered because most of the oil on the vegetation has weathered to the point that it is becoming less sticky and thus less of a threat to wildlife.		All operations are to be conducted from boats; no foot traffic is allowed. Close monitoring by experienced agency representatives is required. Special permission from resource managers is required before using this technique in state or federal wildlife refuges. Not for use in *Spartina*, other marsh types, or mangroves. See Zengel and Michel (1996) for additional constraints and considerations.

4. Evaluation of Promising Technologies from ARTES

The Alternative Response Technologies Evaluation System (ARTES) team has evaluated numerous proposed technologies for use in treating oiled marshes. Based on their technical review, they have developed a plan to study the effectiveness of several nutrient additives and chemical surface washing agents on *Spartina* marshes in the Bay Jimmy, Louisiana area. SCAT has also proposed to field-test surface washing agents, cutting, and possibly burning of oiled vegetation to provide access to oil on the marsh soils along *Spartina* marshes in the Bay Jimmy, Louisiana area, as well. If these proposed tests are approved, the results of the tests will be reviewed to determine if there are promising, alternative treatment options for heavily oiled marshes.

5. Effective Shoreline Treatment Strategies for Vegetated Shorelines

The matrix in Figure 3 outlines the principal treatment strategies relevant to the degree of oiling and its location on vegetated shorelines. This matrix is relevant to the current oiling conditions that have been observed during the DWH incident.

Low Pressure Ambient Water Flushing using a specially designed system that can reach 80-130 feet into the marsh from the water's edge appears to have high potential for operational effectiveness where flushable oiling conditions in the marsh may be present. This equipment is currently available only in St. Bernard Parish, where flushable oiling conditions may be limited. A smaller system was tested in Bay Jimmy at the head of Barataria Bay on 21 August 2010, with limited success (revisions to the design have been recommended, and new tests are planned for other areas). The successful implementation of this method will require identification of shoreline segments with "flushable oil," which will change over time. SCAT teams will identify segments where there appears to be flushable oil present, and the flushing operations will be monitored to determine their effectiveness and recommend when flushing is no longer an effective response option. Though relatively low impact in most instances, flushing does cause some impact including substrate disturbance, redistribution of the oil to throughout the flushed area and nearshore waters, and potential vegetation impacts. Therefore, flushing should not be used excessively, and should not be used in oiled marsh where flushable oil is not present. Flushing should also not be used in an attempt to reduce or remove oil staining or weathered oil coat on marsh and mangrove vegetation.

Sorbents (only contained sorbents or snare, not loose sorbents) will be used only on the water adjacent to shorelines that are creating sheens. Shorelines that meet this requirement will be identified by SCAT teams, and a STR will be issued. All other sorbent materials will be removed to reduce the risk of stranding of additional materials in wetland habitats (and the associated damage from both the stranding and removal) and minimize excessive wastes. NFT = no release of sheens/oiling of the sorbents after one week.

Manual Recovery will be recommended on a case-by-case basis for spot cleaning, with clear identification of the constraints during ingress/egress into the wetland, amounts of oil and methods for oil removal. Close supervision will be required in most cases.

Oiling Conditions	Low-pressure, Ambient-temperature Flushing	Sorbents	Manual Recovery	Vacuum	Vegetation Cutting	Natural Recovery
Flushable oil on the vegetation or soils	X					
Release of sheens that can affect sensitive resources		X				
Thick or pooled oil at the edges of marsh and beach/shell berm/ overwash areas or in the marsh interior, including isolated oiling patches within the marsh		X (where access is feasible; sorbents may be used to recover pooled interior oiling that is too thin to vacuum)	X (on sand or shell substrate which is trafficable)	X		
Pooled oil inside dense Roseau cane, that cannot be accessed by other means					X (to provide access to the oil for recovery by flushing and vacuum)	
All oiling conditions not covered above						X

Figure 3. Matrix showing the recommended shoreline treatment options for vegetated shorelines in Stage III of the DWH response.

Vacuum will be recommended on a case-by-case basis for spot cleaning, with clear identification of the constraints during ingress/egress into the wetland and amounts of oil and methods for oil removal. Close supervision will be required in most cases.

Vegetation Cutting (for access in Roseau cane) will be recommended on a case-by-case basis, with clear identification of the constraints during ingress/egress into the wetland and methods for oil removal. Close supervision by resource agency staff will be required in all cases.

Natural Recovery will be the primary response option for most of the oiled vegetated shorelines because of the lack of effective active response methods. There have been many studies of oiled wetlands and their recovery rates. There are many factors that influence the impact and rate of recovery for oiled wetlands, including:

- Oil Type
- Degree of Oiling of the Vegetation
- Degree of Oiling of the Wetland Soils
- Degree of Exposure to Waves and Tidal Flushing
- Time of Year
- Species Sensitivity to Oil and Cleanup Actions

6. Importance of Maintenance and Monitoring

Once active shoreline treatment in vegetated habitats is no longer effective or causing additional injury, there will be a period of monitoring of selected, representative areas to document the oil persistence and impacts over the winter months. Monitoring sites have been established in different types of habitats, and time-series photography will be used to document and report out the results monthly. There will also be Quick Response Forces that will be on standby to respond to reports of re-oiling.Maintenance and monitoring during this phase will be carried out under the detailed monitoring plan referenced in the UAC Louisiana Transition Plan.

Appendix E

MC252 Stage III SCAT Treatment Framework
Man-made Shorelines
(Version 3.0)

30 August 2010

Contents

Document Aim and Purpose

The purpose of this document is to describe the types of oiling observed on man-made shorelines in the Deepwater Horizon (DWH) response arena and the appropriate treatment strategy with respect to shoreline locations. This document will be used to select the most appropriate treatment strategy depending on oiling type.

The intention of cleanup is to remove oil from shoreline areas as necessary to minimize or mitigate damage to the public health or welfare or adverse environmental impacts, including but not limited to, fish, shellfish, wildlife, and public and private property, and shoreline habitats. The choice of techniques is influenced by the amount and type of oil, the environmental and socio-economic importance of the affected areas, and physical characteristics such as wave energy. Multiple treatment options are available for man-made structures relative to the degree of oiling and a short description of each strategy is useful to understand the relative merits of each.

Overview of Man-made Structures and Oiling Conditions

Descriptions below are taken from NOAA document "Characteristic Coastal Environments" (NOAA, 2000).

Description of solid man-made structures

- These are solid, man-made structures such as seawalls, groins, revetments, piers, and port facilities.
- They are built to protect the shore from erosion by waves, boat wakes, and currents, and thus are exposed to rapid natural removal processes.
- Often there is no exposed substrate at low tide, but multiple habitats may be present.
- Attached animals and plants are sparse to moderate.

Description of riprap

- Riprap structures are composed of cobble- to boulder-sized blocks of bedrock, concrete, or other materials.
- Riprap structures are used as revetment and groins for shoreline protection, and as breakwaters and jetties around inlets and marinas.
- Attached biota are generally sparse on exposed riprap although this may not be the case in certain instances.
- They are common in highly developed waterfront areas.

Observed Oiling Conditions as of August 2010

Louisiana

- The following table reflects the current status of oiled man-made structures as of 28 August 2010 (all lengths shown in miles):

Total Surveyed	Heavy	Moderate	Light	Very Light	Trace (<1%)	NOO	Oiled as of Last Survey
65.3	0.9	1.7	2.9	5.7	0.1	53.9	11.3

Sector Mobile

- The following table reflects the current status for oiled man-made structures as of 28 August (all lengths shown in miles):

Total Surveyed	Heavy	Moderate	Light	Very Light	Trace (<1%)	NOO	Oiled as of Last Survey
93.8	0.0	0.0	1.4	3.3	4.2	84.8	8.9

<u>Man-made Structures and Riprap Treatment Options</u>

The NOAA document "Characteristic Coastal Environments" (NOAA, 2000) includes matrices (Figures 1 and 2) to assist in selection of appropriate response options on different shoreline types. The following matrix for man-made structures and riprap assign the relative impact of the different response options for different oil types. The DWH oil is considered to be an Oil Category III type of oil.

Based on the observed oiling conditions and NOAA guidance, the following response options have been determined to be NOT APPROPRIATE for the DWH spill.

<u>Sandblasting:</u> This method will remove staining but will also increase waste streams without demonstrating any significant environmental advantages.

<u>Solidifiers</u>: There are not significant amounts of liquid oil that could be effectively recovered using solidifiers.

INTERTIDAL

Exposed, Solid Man-made Structures

Oil Category Descriptions

I – Gasoline products
II – Diesel-like products and light crudes
III – Medium grade crudes and intermediate products
IV – Heavy crudes and residual products
V – Non-floating oil products

The following categories are used to compare the relative environmental impact of each response method in the specific environment and habitat for each oil type. The codes in this table mean:

A = The least adverse habitat impact.
B = Some adverse habitat impact.
C = Significant adverse habitat impact.
D = The most adverse habitat impact.
I = Insufficient information - impact or effectiveness of the method could not be evaluated.
— = Not applicable.

Response Method	Oil Category I	II	III	IV	V
Natural Recovery	A	A	A	A	A
Barriers/Berms	–	–	–	–	–
Manual Oil Removal/Cleaning	–	–	B	B	B
Mechanical Oil Removal	–	–	–	–	–
Sorbents	–	B	A	A	A
Vacuum	–	–	–	–	–
Debris Removal	–	–	–	–	–
Sediment Reworking/Tilling	–	–	–	–	–
Vegetation Cutting/Removal	–	–	–	–	–
Flooding (deluge)	–	–	–	–	–
Low-pressure, Ambient Water Flushing	–	A	A	B	B
High-pressure, Ambient Water Flushing	–	B	B	B	B
Low-pressure, Hot Water Flushing	–	–	C	C	C
High-pressure, Hot Water Flushing	–	–	C	C	C
Steam Cleaning	–	–	D	D	D
Sand Blasting	–	–	D	D	D
Solidifiers	–	–	–	–	–
Shoreline Cleaning Agents	–	–	B	B	B
Nutrient Enrichment	–	–	–	–	–
Natural Microbe Seeding	–	–	–	–	–
In-situ Burning	–	–	–	–	–

Consult the *Environmental Considerations for Marine Oil Spill Response* document referenced on page 5 before using this table.

Figure 1. Matrix from "Characteristic Coastal Habitats: Choosing Spill Response Alternatives (NOAA, 2000) for solid man-made structures.

INTERTIDAL

Riprap

Oil Category Descriptions

I – Gasoline products
II – Diesel-like products and light crudes
III – Medium grade crudes and intermediate products
IV – Heavy crudes and residual products
V – Non-floating oil products

The following categories are used to compare the relative environmental impact of each response method in the specific environment and habitat for each oil type. The codes in each table mean:

A = The least adverse habitat impact.
B = Some adverse habitat impact.
C = Significant adverse habitat impact.
D = The most adverse habitat impact.
I = Insufficient information - impact or effectiveness of the method could not be evaluated.
— = Not applicable.

	Oil Category				
Response Method	I	II	III	IV	V
Natural Recovery	A	A	B	B	B
Barriers/Berms	–	–	–	–	–
Manual Oil Removal/Cleaning	–	A	A	A	A
Mechanical Oil Removal	–	–	B	C	C
Sorbents	–	A	A	B	B
Vacuum	–	–	A	A	A
Debris Removal	–	A	A	A	A
Sediment Reworking/Tilling	–	–	–	–	–
Vegetation Cutting/Removal	–	–	–	–	–
Flooding (deluge)	A	A	B	C	C
Low-pressure, Ambient Water Flushing	A	A	B	C	C
High-pressure, Ambient Water Flushing	A	A	B	B	C
Low-pressure, Hot Water Flushing	–	C	C	C	C
High-pressure, Hot Water Flushing	–	C	C	C	C
Steam Cleaning	–	–	D	D	D
Sand Blasting	–	–	D	D	D
Solidifiers	–	B	B	–	–
Shoreline Cleaning Agents	–	–	B	B	B
Nutrient Enrichment	–	A	A	B	B
Natural Microbe Seeding	–	I	I	I	I
In-situ Burning	–	–	D	D	–

Consult the *Environmental Considerations for Marine Oil Spill Response* document referenced on page 5 before using this table.

Figure 2. Matrix from "Characteristic Coastal Habitats: Choosing Spill Response Alternatives (NOAA, 2000) for riprap.

The following response options are considered to be POTENTIALLY EFFECTIVE for man-made structures and the current oiling conditions:

- Natural Recovery
- Manual Removal (oil, oiled debris)
- Sorbents
- Vacuum
- Low/High-pressure, Ambient-temperature Water Flushing
- Low/High-pressure, Heated-water flushing
- Shoreline Cleaning Agents

Each of these methods is summarized in the following tables for:

- Method Description
- Applicable Oiling Conditions
- Effectiveness and Rate of Removal
- Best Practices/ Environmental and Cultural Resource Constraints

It is important to note that often a combination of the above methods is the most effective approach. For example, the cleanup strategy for a heavily oiled segment might include high-pressure washing of ambient water followed by recovery of the sheen on the water surface by sorbent booms.

One of the overarching principles of the DWH response is to minimize waste generation and encourage *in-situ* treatment, wherever possible.

Historical man-made structures are considered to be a valuable resource that should be conserved; cleanup guidelines and endpoints for these are to be determines by resource owners/managers and a cultural recourses specialist.

Method Description	Applicable Oiling Conditions	Effectiveness and Rate of Removal	Best Practices/ Environmental and Cultural Resource Constraints
Natural Recovery Oil is left for removal by the following processes: • Physical reworking by wave action • Physical removal by tidal and rainfall flushing • Natural degradation by microbial and photo-oxidation processes	Surface oil of Stain or Coat and <20% coverage that is weathered to the point that it is no longer sticky. Riprap that no longer generates sheens that will affect sensitive resources.	The DWH oil is highly biodegradable, so natural degradation will be very effective, likely over periods of months. Most of the surface oil meeting these conditions is weathered (as of early August). Significant storms are expected over the next couple of months. Storm waves will be very effective at removing surface oil from exposed man-made structures.	Avoids all types of disturbances associated with cleanup activities. Of particular concern are historical man-made structures which may have cultural resources that could be disturbed by manual and other removal methods. Animals could come in contact with oil residues, becoming contaminated, though this risk is likely to be low.

Method Description	Applicable Oiling Conditions	Effectiveness and Rate of Removal	Best Practices/ Environmental and Cultural Resource Constraints
Manual Removal The technique involves cleanup crews to pick up oil, oiled sediments, or oily debris with gloved hands, rakes, forks, trowels, shovels, or other implements. The hard surfaces are cleaned manually with trowels and scrapers and brushing with wire brushes. Manual removal should be carried out from a clean area towards the oiled area to avoid walking on oiled patches and tracking oil into clean areas. Sorbents may be placed below the work area to capture released oil particles. It may be necessary to place sorbents in the adjacent water to collect sheens released from the treated areas during high tide.	Best for localized oil occurrences of surface oil. Preferred option for small amounts of oiled debris removal. Not applicable for Trace amounts of oil or Stained structures. Applicable for other oiling conditions where environmental, cultural, resource management, or land ownership constraints preclude more intrusive treatments.	This is a significantly slower method than flushing. Is not as effective as some other methods. A Stain/discoloration will usually remain and is more apparent on porous surfaces, especially concrete.	Minimizes disturbance often associated with flushing.

Method Description	Applicable Oiling Conditions	Effectiveness and Rate of Removal	Best Practices/ Environmental and Cultural Resource Constraints
Sorbents Sorbent material is placed on the water surface adjacent to the shoreline to recover oil being released naturally by tidal flushing and wave action; also used in combination with other active treatment methods such as flushing. The most common type used during the DWH spill is sausage boom composed of polypropylene. Other types that have been used or proposed include snare on a rope which can be effective in riprap areas	Should only be deployed where oil is being released from the man-made structure/riprap, as indicated by the presence of sheens or black oil droplets that can affect sensitive resources.	Sorbents are not very effective in recovery of light sheens; therefore, they should be removed once no more oil adheres to the sorbent material during normal tidal/wave conditions.	Sorbents that are water-logged, oiled, or breaking apart must be removed immediately. Sorbent use should be closely monitored to assure that they are deployed only where appropriate and removed as soon as sheening stops and/or they are no longer effective

Method Description	Applicable Oiling Conditions	Effectiveness and Rate of Removal	Best Practices/ Environmental and Cultural Resource Constraints
Vacuum A vacuum unit is attached via a flexible hose to a suction head that recovers free oil. Such systems have to be small and portable, to provide access to potential free oil accumulations that may be in between the riprap structure.	This method would only be considered on a site-specific basis for recovery of accumulations of Thick liquid oil stranded inside the riprap. Current conditions where this technique would be applicable may be relatively rare due to lack of Thick Oiling in most locations and natural attenuation.	Vacuuming small accumulations of oil will be slow.	Avoid vacuuming natural sediments

Method Description	Applicable Oiling Conditions	Effectiveness and Rate of Removal	Best Practices/ Environmental and Cultural Resource Constraints
Low/High-pressure, Ambient-temperature Water Flushing Low-pressure, high-volume ambient temperature water flushing can be used to mobilize any free-floating oil out of riprap. High-pressure ambient temperature washing can be used to mobilize oil that has been 'baked' onto any man-made structure. Conducted during mid- to high tides so the wash water and released oil float on the water surface. A skimmer is used to recover released oil, to reduce the amount of water collected and quantify the amount of oil recovered. Sorbents are only for final sheen removal.	Liquid oil trapped in the crevices of riprap. Thick oil coating on solid structures.	May not be effective on highly weathered oil.	Seawater should be used for the process of flushing. Low-pressure, ambient-temperature water flushing should be initiated in the first instance; this is more likely to successfully remobilize fluid oils. Avoid driving oil into sediments or mobilizing sediments and increasing turbidity.

Method Description	Applicable Oiling Conditions	Effectiveness and Rate of Removal	Best Practices/ Environmental and Cultural Resource Constraints
Low/High-pressure, Heated Water Flushing Low-pressure, high-volume heated water flushing can be used to mobilize any free-floating oil out of riprap. High-pressure heated washing can be used to mobilize oil that has been 'baked' onto any man-made structure. Conducted during mid- to high tides so the wash water and released oil float on the water surface. A skimmer is used to recover released oil, to reduce the amount of water collected and quantify the amount of oil recovered. Sorbents are only for final sheen removal.	Weathered oil trapped in the crevices of riprap. Thick oil coating on solid structures.	Can be highly effective where the spray can be directly applied to the oiled surface. Less effective on oil trapped in crevices that is inaccessible to direct spray.	High-pressure, heated water flushing should be initiated once all other methods of flushing have been tried to remobilise the oil and only at locations where there are no living organisms on the riprap. High-pressure, heated water flushing can adversely affect fauna located on the structures. Avoid driving oil into sediments or mobilizing sediments and increasing turbidity.

Method Description	Applicable Oiling Conditions	Effectiveness and Rate of Removal	Best Practices/ Environmental and Cultural Resource Constraints
Shoreline Cleaning Agents These products contain surfactants, solvents, and/or other additives that work to remove oil from substrates. Products are sprayed either neat or diluted with water. For small applications, hand-held units such as hudson sprayers are used; larger, diluted applications use eduction systems coupled with fire hoses, power washers, etc A shoreline cleaning agent (only lift and float types) is sprayed on the oil, allowed to soak according to the manufacturer's guidelines, then flushed with either ambient-temperature or heated water. Generally applied at mid- or high tide so that the released oil can be floated on the water surface and recovered with either skimmers or sorbents.	Shoreline cleaning agent application should be considered to assist with the remobilization of weathered oil, to increase the amount of oil removal.	Can be highly effective on even weathered oil.	RRT approval will be required. Not appropriate for use in areas with sensitive intertidal or nearshore resources such as seagrass beds and oyster beds. The toxicity of the product and the recoverability of the treated oil should be carefully evaluated when determining potential impacts at the treatment site. Water velocity at the treated area must be less than 1 knot. This will help ensure refloated oil does not escape containment and contaminate clean areas down current. The treated area should not be exposed to breaking waves. The surface washing agents require a soaking time. Flushing from waves will reduce effectiveness See Appendix C-1, Surface Washing Agents chapter from the Selection Guide (2009).

Effective Treatment Strategies for Man-made Structures

The matrix below outlines the principal treatment strategies relevant to the degree of oiling and its location on the affected structures. This matrix is relevant to the current oiling that has been observed during Stage III of the DWH incident and the type of structure (as related to its ecological setting and degree of use).

Oil thickness and Character	Man-made structure type			
	Historical man-made structures	**Type 1: Industrial location or inaccessible**	**Type 2: Coastal protection on barrier islands/marshes**	**Type 3: High-use, amenity**
Thick Oil (> 1 cm)	Requires site-specific methods	*NR, MAN, WF*	*VAC, WF*	*VAC, WF, SCA*
Cover (>0.1 to ≤1.0 cm)	Requires site-specific methods	*NR, WF*	*VAC, WF*	*VAC, WF, SCA*
Coat (>0.01 to ≤0.1 cm)	Requires site-specific methods	*NR, WF*	*WF, SCA*	*WF, SCA*
Stain (≤0.01 cm)	Requires site-specific methods	*NR*	*WF*	*WF, SCA*
Asphalt Pavement	Requires site-specific methods	*NR, MAN*	*MAN*	*MAN*

Key = Natural Recovery (NR); Vacuum System Removal (VAC); Water Flushing (WF); Shoreline Cleaning Agent Application (SCA); Manual Removal (MAN).

Type 1 structures include those located in industrial areas (such as harbors and marinas) where oil residues would pose little environmental risk, and those that cannot be safely accessed by cleanup workers.

Type 2 structures include riprap located on barrier islands or along exposed marshes for shore protection, inlet stabilization, and erosion control. Therefore, they can be located in environmentally sensitive areas. In fact, birds often roost on them, feed among the crevices, and otherwise use them as habitat. Treatment decisions will be based on the need for oil removal as a contact hazard and damage and disturbance during treatment activities.

Type 3 structures include those located in high-use public areas such as coastal parks, boat ramps, and private residences. They will have the highest need for treatment to reduce both the contact hazard by the public and aesthetic impacts.

Recommended 2010 No Further Treatment Guidelines

The following 2010 No Further Treatment (NFT) Guidelines are recommended by the Man-made Structures Technical Working Group:

- No accessible oiled debris
- For non-amenity areas, no surface oil greater than Stain or Coat > 20 % distribution
- No oil on surfaces that rubs off on contact
- In high public use or high visibility areas, no surface oil greater than Stain or 10% Coat distribution on solid surfaces
- In inaccessible or remote areas where oil removal was not possible because of safety restrictions or ecological/cultural restraints, no longer generates petrogenic sheens that can affect sensitive resources under all weather conditions

Appendix E-1

Technical Information on Shoreline Cleaning Agents
NOAA Selection Guide

SURFACE WASHING AGENTS

(This is a Category on the NCP Product Schedule)

> ***Disclaimer: Decisions for Public Safety Issues for Fires are under the Purview of the Lead Public Emergency Response Agency.***

Mechanism of Action

- These products contain surfactants, solvents, and/or other additives that work to remove oil from substrates.
- Many products are essentially industrial cleaners that emulsify the oil, much in the same way that dishwashing soap cleans the grease off dishes. The treated oil is broken into small droplets that are kept in suspension by the surfactant.

> "Lift and disperse" products are those for which the product literature states that the oil is dispersed, emulsified, or encapsulated. Thus, the washwater from these products should not be flushed into water bodies or left untreated, but must be contained, recovered, and properly treated.
>
> "Lift and float" products are those where the released oil is not dispersed but readily floats on the water surface and is recoverable.

When to Consider Using

- On hard-surface shorelines where there is a strong desire to remove oil residues.
- When the oil has weathered so that it cannot be removed from a substrate using ambient water temperatures and low pressures. Surface washing agents may be used to reduce the temperature and/or pressure needed to achieve cleanup endpoints.
- When the oil is trapped in areas inaccessible to physical removal but which can be flushed and the washwaters contained, such as in sewers, storm drains, and ravines. If physical removal is not possible, it may be difficult to properly apply the surface washing agent.
- For volatile fuel spills that have entered sewers, for vapor suppression, and to enhance flushing recovery, as long as all "lift and disperse" washwaters are recovered and prevented from being discharged into the environment.

Authority Required

- Incident-specific RRT approval is required to use surface washing agents in any manner that would cause for them to be released to the environment.
- Verify state requirements for discharge and waste management.

- **NOTE**: As of June 2009, there were 25 surface washing agents listed on the NCP Product Schedule. **For this Selection Guide, PES-51 and PX-700 (listed on the NCP Product Schedule as Miscellaneous Oil Spill Control Agents) are classified as surface washing agents due to their mechanism of action**. Only products listed on the NCP Product Schedule are reported in **Table 13**. **Appendix G, Table G-4** contains information on Surface Washing Agents that have been removed from the NPC Product Schedule.
- Fire Departments and HAZMAT teams have the authority to "hose down" a spill using a chemical countermeasure if they determine that the spilled oil could cause an explosion and/or threaten human health. All runoff should be contained and recovered for proper disposal.

CONTAINMENT AND RECOVERY OF SURFACE WASHING AGENTS SHOULD BE THE NORM, NOT THE EXCEPTION

Availability

- Varies widely by product. See **Table 13** for specific products.

General Application Requirements

- Products are sprayed either neat or diluted with water. For small applications, hand-held units such as hudson sprayers are used; larger, diluted applications use eduction systems coupled with fire hoses, power washers, etc.
- Application rates vary widely and may be difficult to monitor and control.
- There is some period for soaking or scrubbing, and then the area is flushed with water. Thus, in tidal areas, application should be timed to allow soaking before tidal inundation.
- Heated water (in both spray and flush) is sometimes required for very sticky oils.
- All released oil must be recovered, so systems are needed to contain and treat the washwater from "lift and disperse" products, which can require considerable operational support.
- Washwaters from using "lift and float" products may be discharged after oil separation, **though** there will be site-specific requirements.
- The toxicity of the product and the recoverability of the treated oil should be carefully evaluated when determining potential impacts at the treatment site.
- Only those products which have been documented to be safe to use on vegetation (through independent field studies) should be applied to vegetated areas.
- Use may be restricted in areas with sensitive nearshore resources, such as seagrass beds, or during sensitive time periods, such nearshore spawning or fish migration.
- Water velocity at the impacted area must be less than 1 knot. This will help ensure refloated oil does not escape containment and contaminate clean beaches down current.
- The treated area should not be exposed to breaking waves. The surface washing agents require a soaking time. Flushing from waves will reduce effectiveness of the agent(s).

Health and Safety Issues

- All products required Level D personal protection with splash protection. Always consult the MSDS for proper PPE. Many Surface Washing Agents contain skin, eye, and lung irritants.
- Slips, trips, and falls from working on oily surfaces may be of concern.

Limiting Factors/Best Management Practices

- On shorelines, there are usually restrictions on direct spraying of intertidal biota and flushing across sensitive substrates.
- Under no conditions should washwaters from land surfaces be allowed to enter water bodies without proper treatment. Check with wastewater plant operators before washwaters are flushed into sewers to make sure that they can accept the wastes.
- Use of lift and float products may be required, to allow oil recovery. An exception would be in high energy environments where the oil cannot be recovered (so it would be better to let it disperse rather than re-oil adjacent areas).
- Test areas must be accessible to observers, monitors, sample collectors, and contract workers.
- Also consider personnel health and safety when selecting test areas.
- High wind and high temperatures can reduce the effectiveness of certain surface washing agents through product evaporation.
- Shoreline cleaner testing is not recommended near operating water intakes. Oil lifted from the substrate may disperse into the water column or escape floating containment, potentially fouling water supplies.

Monitoring Requirements/Suggestions

- Conduct effectiveness testing of selected products to determine the best one for the spill conditions.
  - Effectiveness testing will be required by EPA as soon as a protocol has been developed.
- May need effects monitoring if sensitive resources are at risk during use.
- On shorelines, "first use" monitoring of sensitive biota should be conducted to make sure that adverse effects are not occurring under actual use conditions.
- For land application, monitor downstream water bodies to detect fish kills or other impacts from inadvertent discharges from the cleanup area. Immediately contain any discharges.

Waste Generation and Disposal Issues

- Because released oil must be recovered, waste generation is a function of recovery method. Sorbents are often used with "lift and float" products. Local conditions will determine whether the water must also be collected and treated, or can be discharged safely.
- When the oil is dispersed, all of the washwater must be contained and treated prior to discharge, often to wastewater treatment plants if the oil concentrations are low. For high oil concentrations, oil recovery can be increased by the use of emulsion-breaking agents.

References

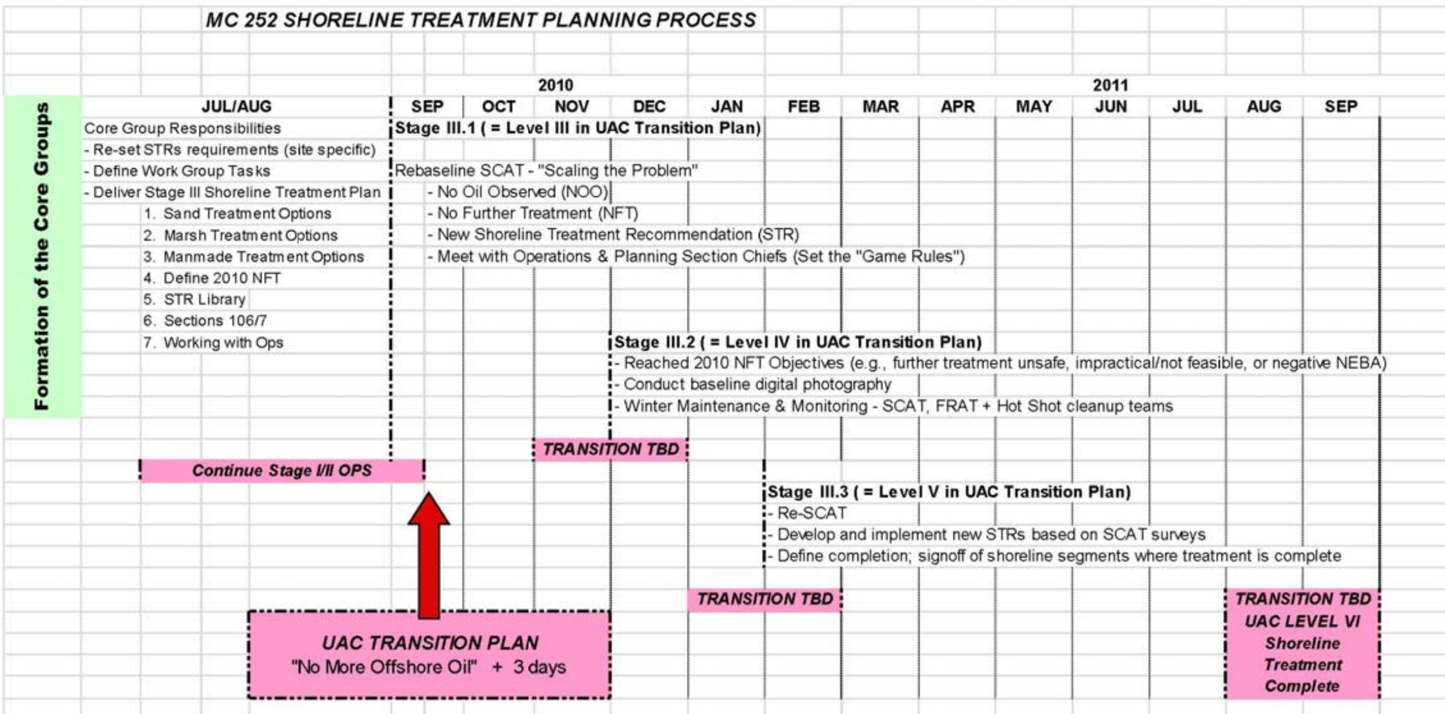
Michel, J. and B.L. Benggio. 1995. Testing and use of shoreline cleaning agents during the *Morris J. Berman* spill. Proc. 1995 Intl. Oil Spill Conference, API Publication No. 4620, American Petroleum Institute, Washington, DC. pp. 197-202.

Michel, J., A.H. Walker, D. Scholz, and J. Boyd, 2001. Surface-washing agents: product evaluations, case histories, and guidelines for use in marine and freshwater habitats. Proc. 2001 International Oil Spill Conference, American Petroleum Institute, Washington, D.C., pp. 805-813.

Region 5 Regional Response Team Surface Washing Agent protocols.

Thumm, S.J., C. Henry, and J. Gahn. 2003. Use of surface washing agents during the M/V Genmar Hector oil spill. Proc. 2003 Intl. Oil Spill Conference. 3 p.

Appendix F – Shoreline Treatment Activities Timeline



Appendix G – Current Oil Weathering Process Summary

Weathering of MC252 oil

1. The chemical composition of MC252 oil has been established through multiple analyses. It is classed as a light (rich in short-chain alkanes) sweet (low sulphur content) crude oil with high naphthalene content (54% of the total PAHs). There are relatively few 4+ ring PAHs present in this oil. MC252 oil is liquid at room temperature with a low viscosity.

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2. During ascent from the seafloor to the surface, substantial loss of the more water-soluble components occurs leading to depletion of the majority of the naphthalene, alkylated naphthalenes, and BTEX. A small portion of the light alkanes is also lost in this process. Weathering indices based on the PAHs indicate *ca.* 50% loss during ascent.
3. On the surface, the light alkanes evaporate and several compounds undergo photo-oxidation. Wave action may lead to the formation of emulsions of oil in water or water in oil. The size of the water droplets suspended within the oil may lead to red / orange colouration. The density of the oil and oil emulsions is less than that of water and both types of oil will remain at the water surface.

4. The source of the MC252 oil is approximately 50 miles from the Louisiana coastline and by the time the oil washes ashore it has typically lost all alkanes shorter than C_{17}. An example of the GC-FID trace is shown in Figure 1. The peak alkane chain length is *ca.* C_{20} which has a melting point of 36.7°C. This oil will have a soft texture and may flow during the heat of the day but remain solid at night.
5. The emulsified oil that stranded on beaches was viscous and did not initially penetrate into the sand. When exposed to high daytime temperatures, the emulsion may lose the water, resulting in the release of fresher oil to the sand.
6. When oil / emulsions contact vegetation, the viscous oil adheres as a black – brown “bath tub ring” on the

stems and leaves. These zones are biologically active due to the availability of nutrients in the root zone and bacterial metabolism may be very high. This will lead to the accelerated biodegradation of oil with many of the readily degradable components transformed into biomass or carbon dioxide and water. In the case of MC252 oil, some modification of the terpane biomarker compounds (which are generally considered more resistant to degradation) has also been observed, indicating extensive microbial degradation is taking place.

7. When stranded on sand beaches, the oil may adhere to sediment, making it heavier than water. When eroded by wave action, the oil/sediment mixture can accumulate in the nearshore subtidal zone. The oil can also become bound up with organic matter and fine sediments and become incorporated into the bottom sediments adjacent to marsh shorelines.
8. Most of the oil stranded on beaches as of early September 2010 occurs oil/sediment residues, rather than tarballs. True tar balls are considerably more inert than these patties, typically have a hard black exterior and are usually flattened disks. Chemical analysis will show that in true tar balls, almost all of the alkanes have been lost and a relatively high proportion of "Unresolved Complex Matter" remains. True tar balls of MC252 oil have not yet washed ashore. An example of the GC-FID trace from a non-MC252 is shown at the end of this document

9. The weathering of oil may be followed through the changes in the polynuclear aromatic hydrocarbons (PAH) profiles. One approach is to ratio the naphthalenes, the most readily lost PAHs, by the chrysenes, the most resistant in this oil. The MC252 oil near the source has a high ratio (=22). Figure 2 shows that this ratio decreases with distance from the source, both on the water and on the shoreline. Figure 3 provides a general spatial and temporal comparison of the degree of weathering of the oil. The top figure includes all oil samples collected prior to 15 July, at which time the discharge was stopped. The weathering index of the oil closer to the source indicates relatively fresh oil. However, after 15 July, the PAHs in the MC252 oil are highly degraded. Note that the occasional high values seen on the coast tend not to be MC252 but are from different crude oils.
10. The weathering of oil will be highly dependent on the environmental and biological conditions at the site of the oiling. In biologically active zones, which are generally characterised by fine-grained, muddy sediments, bacteria will rapidly metabolise a large proportion of the oil. In contrast, in low productivity zones such as sandy beaches, buried oil is likely to degrade at a slower rate. Introducing the oil into the water column (*e.g.* surf washing) would increase the degradation rate of the oil.

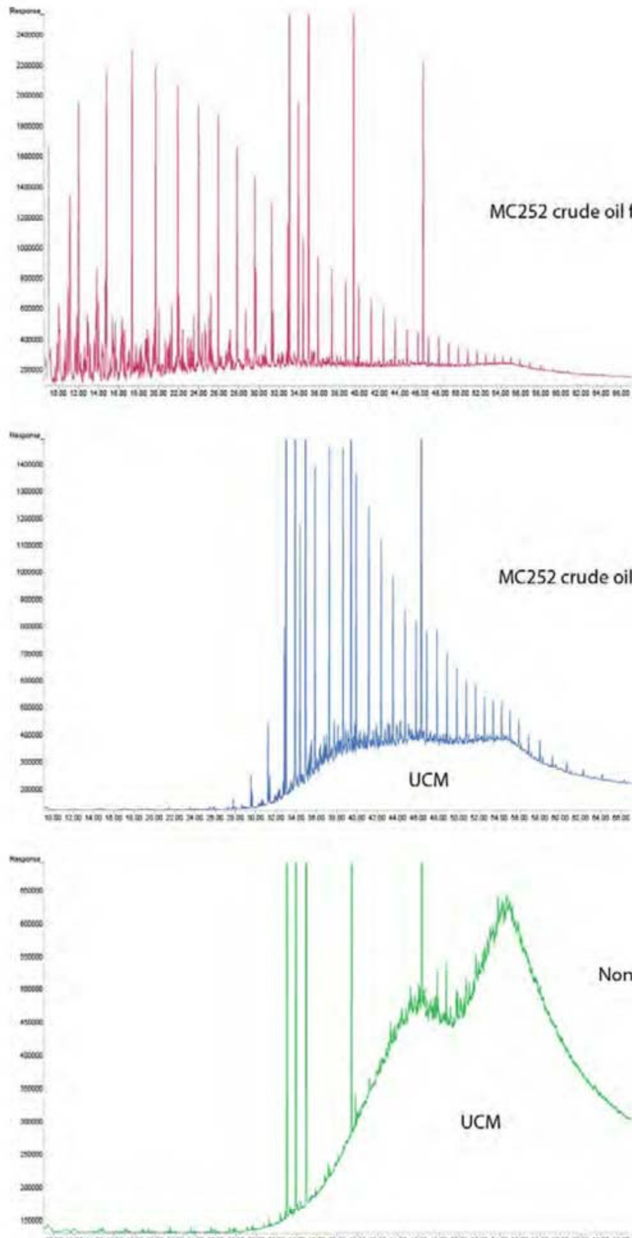
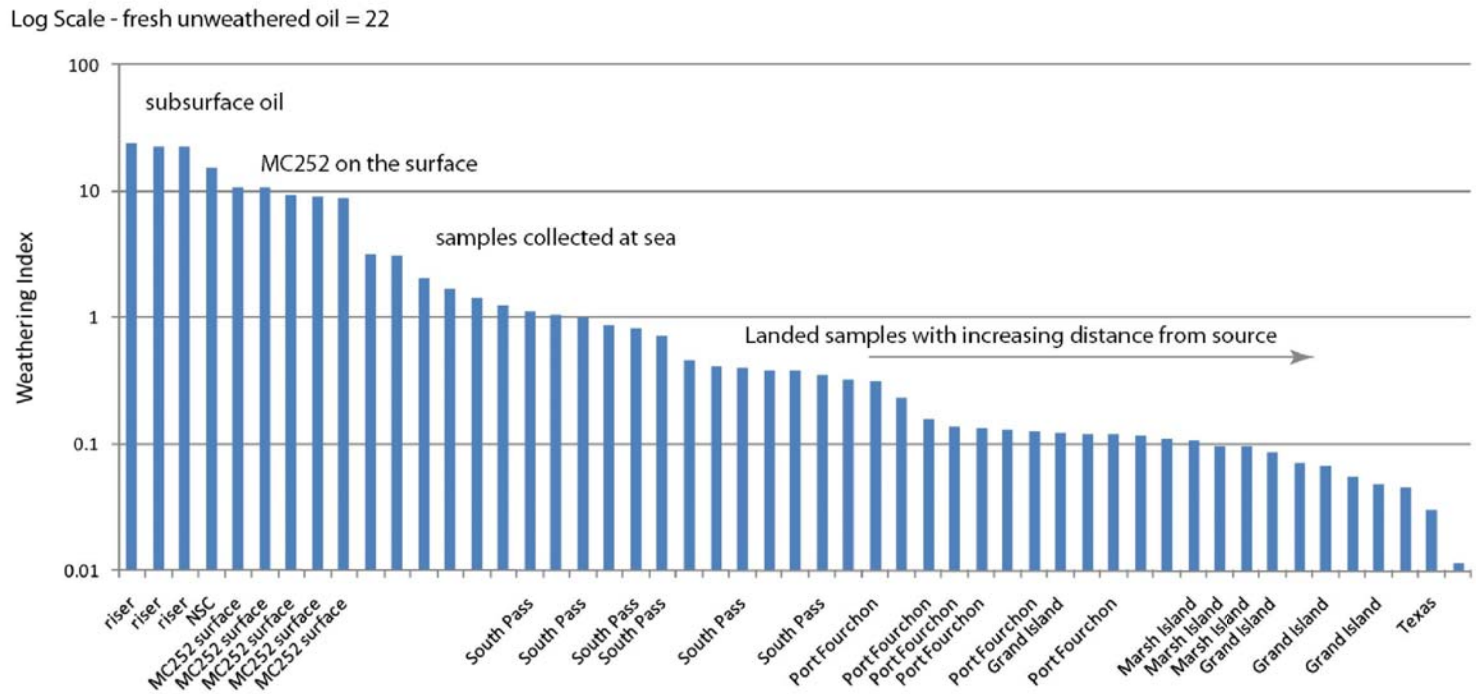


Figure 1. Example GC-FID chromatograms for fresh MC252 oil (top), weathered MC252 sampled from the shoreline (middle) and a weathered non-MC252 tar ball.



Weathering Index = Σ (naphthalenes) / Σ (chrysenes)

Figure 2. Weathering index of the MC252 source oil (collected both subsea at the riser and on the water surface at the source) compared to samples collected at increasing distance from the source.

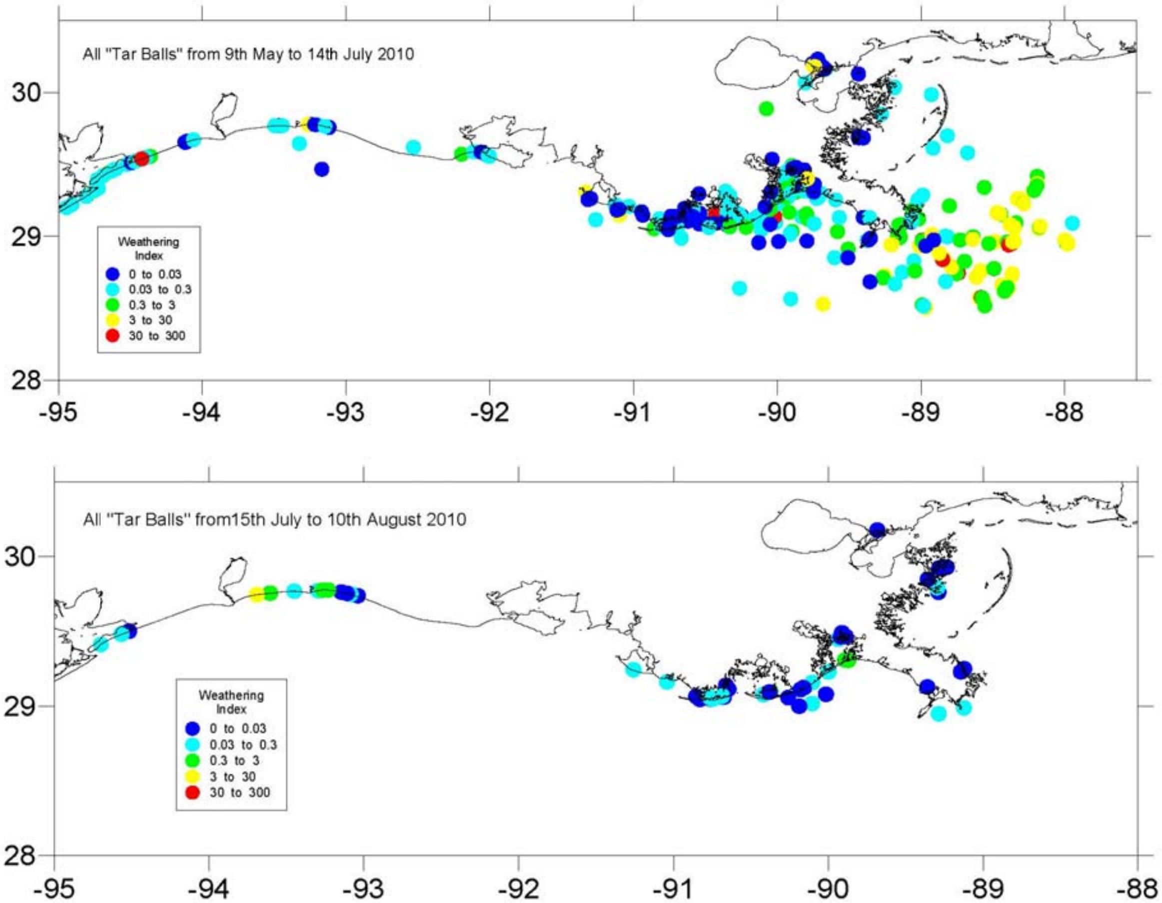


Figure 3. A spatial/temporal representation of an index of weathering. The top figure includes all samples collected before the well was closed on 15 July 2010. The bottom figure includes all samples collected after that date.