

Bio Chem Strike Team Bioremediation Product Field Trials

Introduction

The purpose of BP's Bio Chem Strike Team (BCST) is to evaluate the efficacy of bioremediation and chemical cleaning products. The team includes staff from BP, State agencies, academia, and third party technical companies. As part of the bioremediation evaluation, the BCST has to propose to test products in both the laboratory and field. After thorough review, four products listed on the National Contingency Plan (NCP) Product Schedule have been selected for field tests:

3. Oil Spill Eater (OSE) II

This document summarizes the proposed field trials. The goal is compare the reduction in concentrations of crude oil and selected compounds of interests in treated areas relative to a no treatment control. The random block protocol is based on methods developed by the US Environmental Protection Agency.¹ While described in more detail in Section 2, each "block" consists of 5 "plots" (four products + control). To test reproducibility, five blocks are proposed.

The BCST requests RRT approval to conduct this test on marsh shorelines along the western edge of Bay Jimmy in Barataria Bay, LA. Maps of the test location are presented in Appendix A. The plots are in the area between the low and high tide lines. The products will be applied using low energy manual sprayers (handheld garden sprayers). Temporary plywood paths will be deployed during application and sampling to protect the marsh. Initially samples will be collected every two weeks, and then extending with time. The length of the test will depend on initial results, but is expected to be between 2 and 6 months. Both sediment and near-shore water will be collected. Analytes include:

- Total petroleum hydrocarbons (TPH)
- Diesel range organics (DRO)
- Oil range organics (ORO)
- Louisiana RECAP TPH fractions
- Extended polycyclic aromatic hydrocarbons (PAHs).
- C12-C35 n-alkanes
- Biomarkers
- Nutrients
- Dissolved oxygen
- Bioactivity

¹ Venosa, et al., 1996. Bioremediation of an Experimental Oil Spill on the Shoreline of Delaware Bay. *Environ. Sci. Technol.* 30: 1764-1775

Product 3- Oil Spill Eater (OSE) II

1.1. Product Type (based on NCP Product Schedule):

- ☐ Dispersants
- ☐ Surface Washing Agents
- ☐ Surface Collecting Agents
- ☒ Bioremediation Agents
- ☐ Miscellaneous Oil Spill Control Agents
- ☐ Burning Agents (technical information is not required)
- ☐ Sorbents (technical information is not required)
- ☐ Other

1.1a Manufacturer's Name, Address, Telephone Number:

Oil Eater International Corp.
13127 Chandler Drive
Dallas, Texas 75243

Phone (972) 669-3390
Fax (972) 644-8359

1.1a Applicator's Name, Address, Telephone Number:

Steven R. Pedigo, Chairman
OSEI
13127 Chandler Drive
Dallas, Texas 75243
(972) 699-3390
(972) 644-8359 (Fax)

1.2. Product Name: Oil Spill Eater II

1.3. Product description (basic chemical make-up, etc.) If this is a chemical agent, please list any potentially hazardous components as well as possible breakdown products that would be of an environmental or human health concern.

This product is a combination of microbially produced biosurfactants, microbially produced enzymes and cofactors, and an oleophilic nutrient mixture.

1.4. Is this product either listed on the EPA NCP Product Schedule or Exempted: YES / NO
<http://www.epa.gov/emergencies/docs/oil/ncp/schedule.pdf>
YES

1.5. Short summary of any previous use or studies pertaining to product. A short reference list of any published documents would be of benefit as well as electronic copies of any key papers that would support the use of this product.

The company website (<http://www.osei.us/>) gives a list of application sites and histories.

The product is approved by the EPA and used by the major military services. Company literature sites numerous endorsements by state and federal agencies. The product has been used by a private land owner on Grand Isle, LA, for clean up of a sea wall on his property (video shown on OSEI website (News)).

1.6. Bioremediation agents would likely require a study plan that is outside of the scope of a small-scale study as well as extensive testing of nutrient levels, oxygen depletion, and chemical changes in oil chemistry. It has also been postulated that the Louisiana Delta is not nutrient limited nor without hydrocarbon degrading bacteria and other microorganisms. If bioremediation products are being considered, prior concurrence with RRT6 is required

Section 1a: Product Technical Information (40 CFR 300 Appendix C 6.0)

1.4a Are there any special handling and worker precautions for storage or field application?

1. Flammability – Non-flammable

2. Ventilation – Normal room ventilation

3. Skin and eye contact; Flush with clean water for 10 minutes.

Ingestion: Do not induce vomiting; drink plenty of water.

Oil Spill Eater II:

1. Product meets EPA requirements for release to the environment

2. Wear goggles for eye protection, protective clothing to avoid dermal contact, including rubber gloves when handling the product.

3. Routine hygiene should be observed;

4. Skin and eye contact: flush skin and eyes with copious amounts of water if case of contact.
5. Maximum and minimum storage temperatures; <120 °F
Optimal storage temperature; 72°F

1.4.b What is the shelf life under optimum and field storage conditions?

5 Years

1.4.c What is the recommended application procedure?

Use spray equipment to dispense product in marsh or open water (including near shore)

1.4.d What is the recommended concentration of product, application rate, and general cost for area or quantity treated? (e.g. gallons of dispersant per area or quantity of oil/water treated)

Apply as 1:1 ratio (diluted product to oil); 1 gallon of a 1:50 (product:water) dilution per gallon of crude oil (dilution water should come from location of application), approximate cost, \$2.78/gallon of diluted product.

1.4.e What are the conditions for use: water salinity, water temperature, types and ages of pollutants, amenable to land application etc.

Product can be used in fresh or salt water; works faster in warmer waters.

Higher molecular weight or weather residues require somewhat longer to solublize.

1.4.f What is the toxicity if product is a dispersant, surface washing agent, surface collecting agent, or miscellaneous oil spill control agent and has there been any synergistic affects noted when the agent is used on oil spill related compounds?

NA

1.4g If the product is a bioremediation agent which means microbiological cultures, enzyme additives, or nutrient additives, is effectiveness data available and if so what are the results?

The company sights multiple examples on its web site of successful clean up efforts.

1.4h If the product is a dispersant, surface wetting agent, surface collecting agent, or miscellaneous oil spill control agent, what are the following physical characteristics?

Note: The submitter may claim this information is confidential if the agent is a dispersant or surface wetting agent. In which case it can be provided under separate cover to the **Secretary and labeled "Confidential Information"**.

1. Flash Point (F) – NA
2. Pour Point (F) – NA
3. Viscosity: 1.30 cps at 60° F
4. Specific Gravity: 1.02 at 20°C
5. pH: (10% solution if hydrocarbon based): unknown
6. List solvents if dispersant or surface washing agent – NA
7. List additives if dispersant or surface washing agent – NA
8. Provide solubility if a surface cleaning agent - NA
9. Provide analyses for heavy metals, chlorinated hydrocarbons, and cyanide if it is a dispersant, surface washing agent, surface cleaning agent, or miscellaneous oil spill control agent
NA

Section 2: Testing Protocols and Effectiveness Criteria

2.1. Proposed Use or Method of Action (provide short description):

Bioremediation field trial in brackish marsh shoreline. Propose to compare three bioremediation products to natural attenuation and a nutrient only positive control.

2.2. Location for testing (optimum use of the product e.g. near shore, shoreline, or marsh):

Test proposed for the marsh at the NW edge of Bay Jimmy, LA.

West End 29.455681°, -89.891658°, East End 29.456608°, -89.883267°

See Appendix A for maps of the area.

2.2a Age and location of the oil that can be address (e.g. light ends floating, submerged moose near shore, tar balls on the beach, oiled marsh grass, etc.)

Weathered MC 252 oil as found at the test site. See photo of test site in Appendix.

2.3. Study plot design (there should be ample buffering between test plots and controls):

Proposed test plot design (subject to change based on pretesting assessment)

- Outline shown in Figure 1.
- A random block design is proposed (based on Venosa, et al., 1996). Each block will accommodate five treatment “plots”: 1) no amendment, 2) to 5) testing products added as per manufacturer’s instructions. The location of each test plot is randomized in each block.
- Three to five blocks proposed.

- Each test plot will be 3 m deep from shoreline by a minimum 3 m wide along shoreline.
- 10 m between each test plot within a block.
- 10 m minimum between blocks.

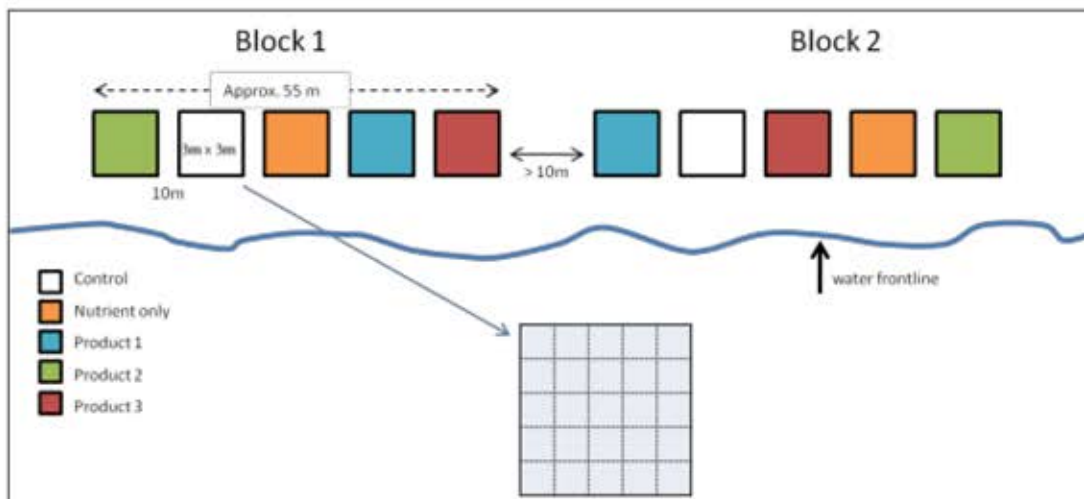


Figure 1. Layout of the test plots

2.4. Dates of testing and expected duration of field test and monitoring

September 2010 through April 2011.

2.5. Habitat type where product will be tested (describe using ESI Shoreline Type):

ESI shoreline type 10a, Salt to Brackish Marshes.

2.6. Description of how test and results will be monitored

Experimental Design

- The entire test location will be characterized prior to finalizing block numbers, spacing between blocks, and locations. This will include TPH and nutrient analyses for sediments and water quality and nutrient analyses for water.
- After blocks and randomized plot locations are finalized, samples will be collected at time zero. This will include chemical, nutrient, and microbial analyses for sediments and water quality and nutrient analyses for water.
- Products will be applied according to manufacturer's recommended procedures to the appropriate plots.
- Ongoing sampling will be conducted at 1, 2, 4, and 8 weeks, at which time, additional monitoring will be determined going forward. These will include chemical, nutrient, and microbial analyses for sediments and water quality and nutrient analyses for water.
- Sediment sampling locations will consist of three (3) randomly selected, interior nodes on a grid superimposed onto the plots (example grid shown in Figure 1). All attempts will be made to access the sampling node from outside of the plot or by traversing areas between grid lines.

- Sediment samples will consist of continuous cores collected from the base of any emergent vegetation down to three (3) inches below surface. This depth may change depending on the results of the initial site assessment. The entire core column will be vertically composited.
- Collected sediment samples will not be combined; thus, 15 samples (=3 x 5 treatments per block) per sampling event per block will be generated.
- The analytical results from the three (3) sediment sample within each treatment plot will be averaged. This average value will be used in the statistical analysis of the data collected from each block receiving the same treatment. Thus, each treatment will have one replicate data point per block per sampling event (i.e. 5 replicate data points per sampling event if 5 blocks are used).
- Water sampling locations will consist of a single sample collected in the water immediately upgradient of each plot where at least one (1) inch of standing water exists.
- The nutrient analytical results (sediment and water) obtained from each sampling event will be used to determine whether supplemental nutrients are added to all of the plots. If the initial sampling events (0, 1, and 2 weeks) show rapid depletion of nutrients, additional nutrient-only sampling events may be considered.

Analyses

A. Chemical analysis,

- The harvested samples will be subjected to extraction (using methylene chloride), clean-up (silica gel/alumina column), and GC or GC/MS analysis to measure oil degradation. The chemical compounds with potential interest are:
 - TPH
 - DRO and ORO
 - RECAP TPH fractions
 - Extended PAHs
 - C12-C35 n-alkanes
 - Biomarkers

B. Water quality analysis

- DO, pH, temperature, conductivity, salinity, and depth will be measured using standard field equipment, appropriately calibrated.

C. Microbial analysis

- Microbial activity will be measured by epifluorescent direct cell count (EDCC).
- Microbial characteristics will be measured using Phospholipid Fatty Acid Analysis (PLFA), Denaturing Gradient Gel Electrophoresis (DGGE) and/or quantitative Polymerase Chain Reaction (qPCR)

D. Nutrients

- Nitrogen and phosphorus will be measured by methods 350.1 mod for NH₄, 353.2 mod for NO₃/NO₂ and 365.4 for P (or should it be SM4500P?). TOC will be measured by method 9060

2.7. Description of how effectiveness will be measured and what criteria would be used to rate the effectiveness of the product tested.

The effectiveness will be based on a comparison of the results of each product to the natural attenuation and nutrient only controls.

- 2.8. Has the proposed test been vetted through the Safety Unit to insure that proper measures and protective clothing requirements have been met? YES / NO.

Will be completed prior to testing.

- 2.9. Will the test plot require any type of posting to warn of possible hazards? NO

Plots will be posted to minimize disruption, but not required for safety.

Section 3: Environmental and Ecological Considerations

- 3.1. Explanation of how any potential or collateral environmental injury will be mitigated during application and testing.

Operational guidelines included in the study plan are intended to minimize potential or collateral habitat impact such as limiting walking in the marsh. Sampling strategy will minimize time spent walking in the marsh. Plywood strips 2 foot by 8 foot will be used to walk on to limit foot prints. Water sampling will be conducted to monitor nutrient wash off.

- 3.2. Have any possible drinking water concerns been addressed? YES / NO

Waters are estuarine or brackish marsh. Not a drinking water source.

- 3.3. List any Federal or State of Louisiana listed Endangered/Threatened Species or Critical Habitats as defined by the Endangered Species Act (ESA) that might be present or that might be affected by this action:

Piping plover and several species of sea turtles are the federally listed species that occur in the vicinity, although they are not typically closely associated with salt marsh vegetation. Impacts to these species are not anticipated. No critical habitat occurs in the proposed test area.

- 3.4. Has the Wildlife Section within the Unified Command reviewed and evaluated the protocols and test designed and determined that there will be NO IMPACT with respects to sensitive species or species of concern.? YES/NO.

The study plan has been sent to Wildlife Operations and Section 7 for review. The Louisiana ESI maps have been reviewed with no listed species or bird nesting colonies noted within roughly 2 miles of the proposed test area.

- 3.5. Has there been a determination of NO EFFECT with respect to the Essential Fish Habitat as defined by the Magnuson-Stevens Fishery Conservation and Management Act? YES/NO

The study plan is being reviewed by Section 7 and NMFS.

- 3.6. Has there been a determine of NO EFFECT with respect to Cultural/Historical Resources as defined by the National Historic Preservation Act (NHPA) that might be affected by this action? YES/NO

The study plan has been submitted to the MC252 cultural resources lead. Section 106 consultation has been initiated for the proposed test area. Additional archeological survey has been requested and initiated by SCAT archeologists. Survey of the test area is to be conducted on September 29.

- 3.7 Has there been approval of this test by the land owner or land manager? Yes / NO

To be determined.

- 3.8. Are there any know concerns not identified in this checklist that would be of interest to the RRT: YES / NO. If yes, please provide additional clarification.

Section 4: FOSC (or FOSCR) and State Approval

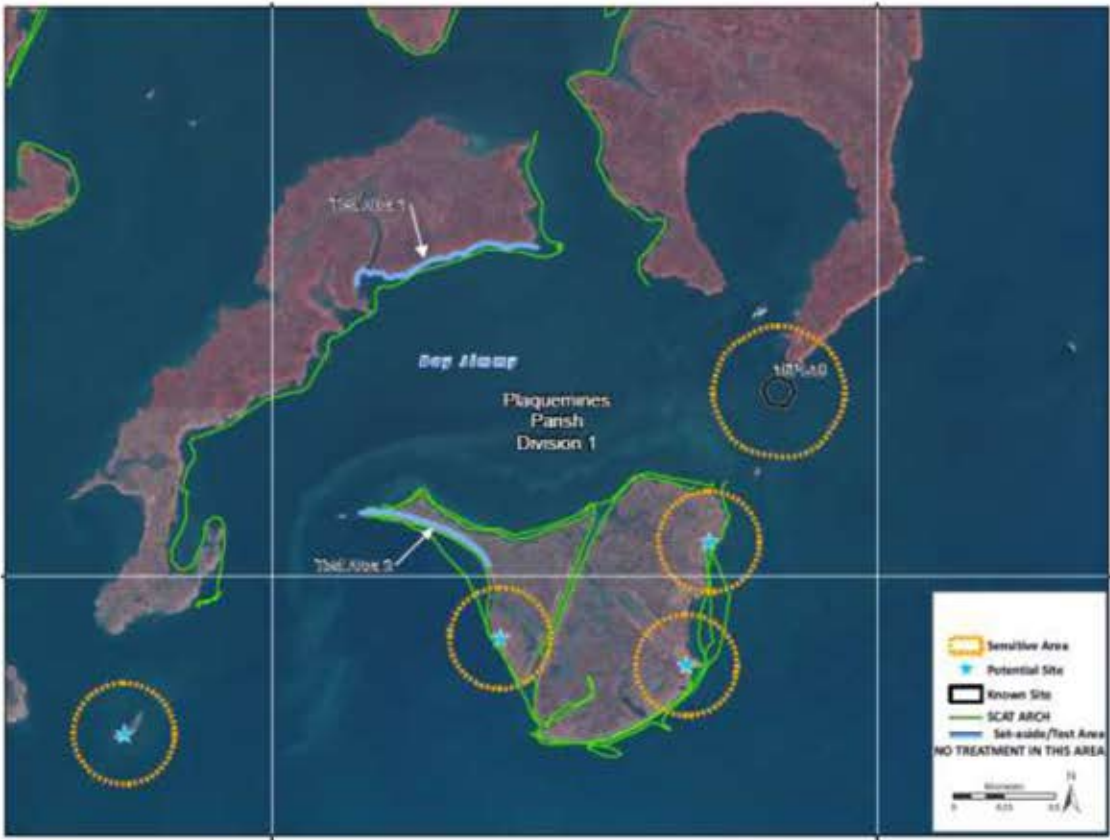
Name:
(FOSC/FOSCR)

Name:
(LDEQ Approval)

RRT preauthorization to the FOSC/FOSCR is restricted to small scale test studies for products that have been vetted through the ARTS process. The RRT has provided authorization to the FOSC/FOSCR that specific, case-by-case, testing approval by the RRT is not required if these guidelines are met. The RRT must be provided with the above information prior to testing and may decide, on a case-by-case bases, to require formal RRT approval if one of the following RRT members express concerns: EPA or USCG co-chairs, DOI representative, DOC/NOAA representative, or State of Louisiana Representative.

Appendix A:

Proposed Test Location:



Proposed Test Site:

