P.O. Box 515429
Dallas, Texas 75075
Ph: (972) 669-3390
Fax: (469) 241-0896
Email: oseicorp@msn.com
Web: www.osei.us

RRT Spilled Oil/Hydrocarbon Based Material Spill Response Plan

Oil Spill Eater II A first Response Biormediation Response

June 6, 2013

TABLE OF CONTENTS

TABLES AND DIAGRAMS

Forward/preamble to EA Plan:

The following material has been compiled based on and against *the Regional Response Team IV Bioremediation Response Plan*. The original material published on RRT IV's website as part of their Regional Response Plan, represents a comprehensive outline of assessment steps to be taken by FOSCs considering the use of NCP listed Bioremediation Agents on any given spill, environment and oil/hydrocarbon type.

The RRT IV plan below has been modified into a plan for addressing <u>one</u> of the categories of Bioremediation – Category Enzyme Additive (EA) type classified as such on the NCP Product Schedule. Having a separate EA Type plan is critical since Microbial Culture Additive (MC) based agents have restricted and limited uses while EA Type has very broad applicability and effectiveness for use on US Navigable waters. *EA Type Bioremediation* and its modes of action must be considered and assessed separately from the MC and NA listed bioremediation methods. The *EA Type Plan* below fulfills all requirements set forth in RRT IV's original plan, but for this single methodology only

I. INTRODUCTION

Bioremediation (Category EA) as a first response tool has been around since 1989 and, is a form of oil/hydrocarbon based material clean up, in which microorganisms chemically alter and breakdown organic molecules into other substances, carbon dioxide and water - in order to obtain energy and nutrients. The basis for this process is relatively simple: microorganisms require minerals and sources of carbon, as well as water and other elements, to survive and function. The most difficult part of bioremediation is getting the process started especially with light end hydrocarbons as well as fuels and solvents whose toxicity is formidable, however once the process starts there is nothing that should stop the entire spill from being used as a food source for enhanced microorganisms, converting the spill completely to CO2 and water, unless more contaminant should enter the spill area. With advances in this field, leaving any toxic compound for nature to remove carries a risk of adverse effects on living organisms, marine and other life which can be avoided. The time frames of nature's process can be anywhere form 5 – 20 years necessitating enhanced bioremediation, by category EA which accelerates natural biodegradation processes by applying specially chosen enzymes, nutrients to spilled substances

The three main types of Bioremediation identified/classified on the NCP Product Schedule, and each having very distinct differences in their mode of action and applicability in a given environment, the definitions category EA is the first response bioremediation product/process that will be discussed and utilized in this response plan

1 Example: Category Enzyme Type has been successfully utilized on numerous spills since 1989, tested by the US EPA, and BP for the Deepwater Horizon spill compared to Corexit dispersants as well as by DOI in 2010 [verify DOI DATE]

II. Purpose

The paramount purpose of this document is to define and allow all RRT members as well as all the oil spill response community to understand why spills are cleaned up.

Oil/Hydrocarbon based spills are cleaned up in order to reduce the toxicity of the spill to the environment, so that living organisms can survive, including single celled organisms. By accomplishing this task then marine species, humans, and natural resources are protected in accordance with the Clean Water Act and OPA 90

This document has a fourfold purpose:

1. To define the three Bioremediation Agent Types listed on the NCP Product Schedule
2. To outline a process by which Federal On-Scene Coordinators (OSCs) in all RRT's may request authorization or pre-approval to use category EA bioremediation in response to spills of oil or hazardous substances (the authorization procedures presented are consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP));
3. To outline the types of information necessary to show Category EA bioremediation is feasible, provide as much of this information in advance as possible, and outline a mechanism for capturing information on bioremediation use for future decision making; and,
4. To describe how to implement category EA bioremediation activity and determine show its effectiveness.

This document is to show there is a non toxic to marine species, safe for responders, means to permanently remove oil/hydrocarbon based material spills from the environment in accordance with the Clean Water act and OPA 90. This document will show there is a clean up product/process that that meets all state and federal regulations, and will allow FOSC's and all the RRT members to meet their job descriptions as well as the EPA Charter and the delegated charge from the President of the United states to protect the US natural resources and the health safety and welfare of its people.

This response plan will include all the necessary information to pre plan and adjust in emergencies response areas of priority, and to bring a spill to a clean up acceptable to the public that minimizes damages and prevents further contamination of secondary or tertiary areas, while protecting wildlife as well as all marine species.

III. CATEGORY TYPE ENZYME ADDITIVE (EA)

As covered, while NRT and RRT guidance addresses the (MC) and (NA) bioremediation types extensively in the 2001 *Guidelines for the Bioremediation of Marine Shorelines and Freshwater Wetlands*[i] it does not sufficiently detail the mode of action of *Bioremediation Type EA.*[ii] Below are data to remedy this.

ENZYMATIC AGENT DEFINITION:

Bio-catalysts designed to enhance the emulsification and/or solubilization of oil to make it more available to microorganisms as a source of food or energy (The US EPA, Coast Guard, NOAA, DOI have all stated publically this first action is acceptable and preferred). Catgory EA is a liquid concentrate, which may be mixed with surfactants and nutrients that are manufactured through fermentation. This type of agent is intended to enhance biodegradation by indigenous microorganisms.

(EA) TYPE MODE OF ACTION:

Enzyme Additive mode of action is applicable in open/moving water (fresh, salt and brackish), marsh/estuaries, shoreline and soil environments. When applied, the non-toxic converters and bio-surfactants in Bioremediation Agent (EA) Type eliminate the classic appearance of an oil spill by emulsifying and solubilizing the molecular hydrocarbon structure and eliminating the adhesion properties of crude oil. This usually takes place within the first 5 - 30 minutes (depending on temperature). The emulsified oil continues to float near the surface thereby eliminating a secondary impact to the water column and seabed.

With the toxicity and adhesion properties eliminated, wildlife that may come in contact with the broken down hydrocarbons, they will not become coated in oil and oil adherence to marsh, shorelines, sands, and manmade structures is eliminated. The flammability is eliminated in a short time (depending on temperature) protecting ports, harbors and drilling rigs from the potential explosion hazards associated with fuel spills.

A further action of bioremediation category EA, (there are numerous enzymes contained in the product's matrices) is that the enzymes then attach themselves to the hydrocarbons with the biosurfactants, developing protein binding sites, that act as a catalyst to speed up the bioremediation process by inducing enhanced indigenous bacteria to utilize the detoxified oil/hydrocarbons as a food source. The EA category also contains properties that cause all the constituents to remain in contact with the spilled oil/hydrocarbons in moving waters.

Over the next few days or weeks (again, depending on temperature), non-toxic nutrients in the Enzyme Additive type rapidly colonize indigenous bacteria to large numbers. The colonized bacteria consume the detoxified hydrocarbon emulsion, digesting the spill to CO_2 and water, thereby permanently removing the oil/hydrocarbons from the environment and resulting in final water clarification. Without category (EA) assistance, this natural process may take up to 20 years based on Ixtoc and the Valdez spill studies.

SHORELINES/MARSHES:

When a spill has already made land fall or contaminated a marsh, category EA can be applied to lift the spill off the marsh grass (or sandy beaches and shorelines), limiting the time the spill can adversely impact these areas. The use of category EA does not deplete the O2 from water since the spill is held on the surface utilizing predominantly atmospheric O2.
With category EA there are no tradeoffs or deleterious effects with this response method.

There is no limited window of opportunity for the application of category EA; it can be used in estuaries, in open (salt) water and, moving fresh water in rivers and soil. It is effective as a first response tool and/or when applied days or months after a spill. Category EA can even be applied to oil that is lying on the seabed floor as long as the product can be brought into contact with the oil which will eventually lift it to the surface returning the seabed to pre-spill conditions.
As of the date of this writing, there is only one product on the NCP list that falls under this Bioremediation Agent Type EA classification: (B53-EA-OIL SPILL EATER II), therefore all mode of action descriptions above are related to

this single EA product of its kind in existence. Any newly added EA type listings would require review and validation as fitting in this category.

IV. APPLICABLE REGULATIONS

Legislation at both the federal and state level may affect decisions to use bioremediation category EA and the states have shown the propensity to use category EA. Existing regulations and policies that govern the use of bioremediation in response to spills are different for each RRT but in actuality are similar. The current policies were based on incorrect, and or incomplete information submitted by Al Venosa of the EPA, which were then promulgated into guidance documents there were incorrect and or incomplete, this plan corrects, and fills in the incomplete information. Therefore the existing regulations and policies cannot be correct or complete and they need to be changed to conform with the truth so that correct and complete regulations and policies may exist. See link http://osei.us/technical-library-documents see pages 191-198

V. ROLES AND RESPONSIBILITIES

This section discusses issues relevant to managing the response to a spill, with particular emphasis to managing a first response bioremediation category EA activities which will show why it supercedes all other responses.

On-Scene Coordinator (OSC)

As per 40 CFR Section 300.120, USCG and EPA provide pre-designated OSCs that have overall responsibility for oil spill responses in the coastal and inland zones respectively. When using category EA bioremediation as a response tool, the OSC shall be responsible for ensuring that the requirements set forth in this plan are properly followed and implemented. This includes notification, planning, documentation and monitoring of all bioremediation activities. Thus, the OSC, in conjunction with his/her contractors or a responsible party, will be directly involved in the cleanup effort.

Federal Agencies

US Environmental Protection Agency - EPA, with their knowledge of category EA bioremediation, may lend themselves to the OSC as a technical advisor. This knowledge includes information on the ability of category EA bioremediation treatment techniques to degrade oil, its relative toxicity to a habitat and the expected rate of degradation. Typically, EPA provides the Scientific Support Coordinator for inland zone spills. In addition, EPA maintains laboratory facilities that may be used to run bioremediation related analyses.

US Coast Guard - The USCG supplies expertise in oil spill response technology and

incident command. Response support, through manpower or equipment, can be provided by the Strike Teams and the National Strike Force Coordination Center. Additionally, the USCG can assist with cost tracking and funding support from the Oil Pollution Trust Fund. 1

1 (With a working knowledge of Agent Type EA, the USCG has recommended action with this agent type numerous times and has used it at their own facilities.) see link http://www.osei.us/pdf%20files/Coast%20Guard%20BP%20spill%20approval%201.pdf

National Oceanographic and Atmospheric Administration - NOAA/HAZMAT provides Scientific Support Coordinators (SSCs) and their support teams. The SSC provides scientific advice to support the Federal OSCs in operational decisions that will protect the environment effectively, mitigate collateral harm, and facilitate environmental recovery. The NOAA/HAZMAT Scientific Support Team has extensive expertise in all scientific aspects of spill response and mitigation and limited experience with oil spill response with bioremediation in both operational and experimental use. NOAA has expertise in biology, geomorphology, chemistry, and physical and coastal processes and needs to become familiar with Category EA so they can support and assist in the use of category EA bioremediation as a response technique and in its proper application. NOAA/HAZMAT also provides the Department of Commerce RRT member. The DOC RRT member provides advice and access to NOAA and DOC resources and expertise and serves as the point of contact for DOC/NOAA trustee issues. NOAA officials from previous statements need to become more familiar with the types of bioremediation based on their assertions in regards to category EA/OSE II see link http://www.osei.us/pdf%20files/NOAA%20Charlie%20Henry%20final%201%2025%202011%20.pdf

NOAA officials have also witnessed first hand the successful testing and demonstration of OSE II at Mo Hang Port South Korea see link http://osei.us/photoalbums/south-korea-hebie-spirit-2 see specifically pictures 46, and 47 for NOAA officials.

Department of Interior - DOI has direct jurisdiction for the protection of resources on its own lands, as well as trustee responsibilities for certain natural resources, regardless of location. They can provide information concerning the lands and resources related to geology, hydrology, minerals, fish and wildlife, cultural resources and recreation resources. The DOI natural resource trusteeship also includes migratory birds, anadromous fish and endangered or threatened species and their critical habitats. The DOI performed a comparison test of OSE II as well as both Corexit 9527 and Corexit 9500, and with mechanical clean up. Their test proved that neither Corexit removed oil from the environment (per the clean water act requirement) and that mechanical clean up could only perform as it has historically with a 2 to 8% removal while OSE II removed 67% of the oil, DOI has clearly proven what the most effective response is category EA/OSE II! See link http://osei.us/pdf%20files/OSEI-Summary-of-Department-of-Interior.pdf

State and Local Agencies

State and local agencies have a distinct role and perspective during a response that impacts their own resources. Typically, these agencies can provide valuable information on the latest regulations, guidelines, water resource conditions, environmentally sensitive areas and public concerns. Therefore, any response effort should be carefully coordinated with impacted State and local agencies. See attached OSE II and RRT association for all the State requests of OSE II in appendix C below.

Responsible Parties (RP)

Since the RP has firsthand information concerning the spilled material, the RP may request OSC approval for the use of category EA bioremediation or the application of category Ea a bioremediation enhancing agent. The RP can initiate a bioremediation activity after the request is approved by the OSC following concurrence from the RRT and consultation with the impacted natural resource trustees. The OSC's request, on behalf of the RP, shall be accompanied by a completed Bioremediation Use Authorization Form. Maximum cooperation and participation should be expected from the RP throughout the entire response and category EA bioremediation activity. BP requested the use of OSE II for the BP Macondo spill see links http://osei.us/wp-content/uploads/Goetzee-BP-request-for-the-use-of-OSE-II-inclusion-statement-for-EPA-letter-of-may-2012.pdf

VI. DECISION TOOLS

All oil/hydrocarbon based material spills are candidates for first response bioremediation category EA application, for all characteristics of the spill and environmental sensitivities of the spill location. The spill itself is the problem so accessing a safe non toxic solution that permanently removes a spill from the environment is the standard that has to be met. This plan assists OSCs and the RRT in category EA's application however, pre approval is paramount in understanding before a spill occurs how to handle the spill

based on a priorities and then site assessment. All spills for first response bioremediation category EA application and the pre planning documentation should be carried out long before spills occur, since this is the responsibility of all the RRT members: A diagram outlining (1) how category EA meets the Clean Water act/OPA 90, (2) the fact that Category EA is safe and will not compromise responders or human health, (3) Category EA is non toxic to marine species, (4) Category EA has proven through testing and experience in clean ups to convert oil/hydrocarbon based material to CO2 and water. (5) and how category EA does not allow contamination of the water column/seabed, and does not deplete O2 and (6) a form for obtaining pre approval for category EA (7) a category EA first response bioremediation use form for each spill is filled out. The form is presented in Appendix B

Bioremediation Use Authorization Form

A category EA first response Bioremediation Use Authorization Form that specifies the minimum information requirements necessary to support decisions regarding the use of category EA first response bioremediation for all spills is included in Appendix B of this plan. This document as presented covers all the information in regards to utilizing category EA, **the only items to fill out during a spill, event is the details of the spill incident,** Category EA first response bioremediation details, Category EA first response bioremediation Work plan and monitoring plan. Once the form has been completed, it should provide pertinent information needed to address 100% of a spill.

A completed form should be transmitted to the RRT for notification purposes to proceed to understand the full scope of the spill and the response with category EA's first response bioremediation application. The RRT shall have pre approved the use of category EA a first response's bioremediation allowing the FOSC to address the spill immediately with Category EA OSE II.

The OSC can easily verify the fact category EA/Oil Spill Eater II is on the NCP list at B#53 on the EPA web site.

DIAGRAM 1: DECISION TREE FOR CONSIDERATION OF BIOREMEDIATION

Identify spilled pollutant

Y

Is pollutant amenable to bioremediation?
Yes to all types of oil for Category EA/OSE II

N

Consider Alternative Method

Y

There is not an alternative to category EA/OSE II, and its mode of action.

N

Do regulations permit use of bioremediation AND do hydrodynamics of spill area allow for an effective use of bioremediation?
Yes the clean water act calls fro the removal of the oi from the environment, and category EA/OSE II transcends all areas of response, and can legally be used since it is on the EPA NCP list

Y

Implement guidelines for use of bioremediation.
Determine Cleanup Endpoints and Time lines.
Already established Category EA/OSE II the end point is the oil being permanently removed by converting the spill to CO2 and water

Characterize impacted areas & identify bioremediation approach, Category EA/OSE II can be used in all response areas.

Could impacted areas accommodate active bioremediation/agent application?
(agent must be on NCP Product Schedule)
All areas cab accommodate Category EA/OSE II

N

Consider Alternate Method

Y

Infrastructure in place to perform and/or monitor?
Yes for category EA/OSE II

N

Is an alternate bioremediation method available?
There is not an alternative to category EA/OSE II, and its mode of action.

Y

N

Consider Alternate Method

N

Obtain RRT approval
Should be pre approved before a spill, you do not wait until a house is on fire to train fire fighters.
Category EA/OSE II is already approved and listed

Y

Bioremediation authorized as category EA/OSE II

I. FEASIBILITY ASSESSMENT CRITERIA

The feasibility through testing and use by RRT 's has already been accomplished for Category EA/OSE II. Category EA has been used in all the scenarios presented in this plan. The implementation is easily addressed by utilizing dispersant spray apparatus already in place.

1) BIOREMEDIATION SUB-CATEGORY EA (ENZYME ADDITIVE)
Bioremediation Sub-Category EA is the only first-response bioremediation methodology. It is effective on fuels, fresh oil, medium weight oil, heavy oils (bunker C and ANS), and weathered heavy oils. See link: http://www.osei.us/pdf%20files/RRT%20plus%20testing.pdf. It can be utilized on the full scope of hydrocarbon potential as well as hydrocarbon-based hazardous chemicals including PCB's. The effectiveness of sub-category EA is not constrained by the varying characteristics of different types of oil. It can be utilized on gasoline/fuels if they pose an explosion hazard, in a populated area, port, or harbor, including oilrigs. Sub-category EA swiftly breaks the oil up into small particles, making it difficult to see. At the same time, it changes the density of oils, preventing them from sinking into the water column and thereby preventing the contamination of secondary, tertiary, and quaternary areas. This action prevents migration of the spill to more sensitive areas. The entire extent of the hydrocarbon material is expected to remediate 100%, especially the most persistent toxic components of the hydrocarbons in the PAH range, which has been demonstrated through testing and cleanup experience.
Sub-category EA can be used along with mechanical cleanup, if desired, however, mechanical cleanup is comparatively limited and costly. The DOI proved sub-category EA to be significantly superior in results (through performing test comparisons of OSE II, mechanical cleanup, and Corexits 9500 and 9527a). See link: http://osei.us/pdf%20files/OSEI-Summary-of-Department-of-Interior.pdf
.

Incident Characteristics

Category EA OSE II has cleaned up all types of oils/hydrocarbon based materials with testing and clean ups, and has been documented as doing so by even the EPA, DOI and other RRT members. Category EA wiil provide a more effective response and allow the matrix to be upgraded to be able to provide complete more effective general guidelines regarding the use of category EA a first response bioremediation in different habitats based primarily on concerns for preserving habitats and minimizing harm to the indigenous flora and fauna.

Characteristics of Spilled Oil

The possibility and practicality of using bioremediation against the type of oil or petroleum product spilled has been evaluated. Category EA/OSE II can be used on all types of oil as shown and proven through previous testing and clean up experience, even heavy oil as EPA RRT VII has proven see link

http://www.osei.us/pdf%20files/RRT%20plus%20testing.pdf . That is, the extent to which the remaining chemical constituents of the spilled oil (which characterize that oil)

are expected to be biodegradable is now understood and realized by the RRT before a spill event occurs with this plan and its citations. The entire extent of the hydrocarbon material expected to remediate is 100% especially the most persistent toxic components of the hydrocarbons in the PAH range and has been proven through previous testing, and clean up experience with category EA.

Category EA/OSE II is a first response bioremediation and can replace historical responses that do not remove oil from the environment as the clean water act requires, and category EA/OSE II can be used along side mechanical clean up which is limited and costly if that is desired. The DOI proved category EA/OSE II is superior to dispersants and mechanical clean ups which were historically used, and proven very ineffective, see link http://osei.us/pdf%20files/OSEI-Summary-of-Department-of-Interior.pdf

When used on diesel-type and medium oils that do not have large amounts of high molecular weight, slowly degrading components, category EA a first response bioremediation is effective as well. On thick oil residues it is effective. *(to further assist in making this determination see Appendix C,* COMPILATION OF DOCUMENTATION AND USE OF OSE II WITH EPA/RRT's*.)* : Category EA/OSE II can be used on fuels/solvents if they pose a fire hazard to eliminate the fire hazard. See link with category EA/OSE II and a fire departments flammability tests http://osei.us/gas.pdf and link http://osei.us/photoalbums/690-2 Chief Shan English observed the tests.

Category EA has been utilized on fuels, fresh oil, medium weight oil heavy oils (bunker C and ANS) and weathered heavy oils, therefore it can be utilized on the full scope of hydrocarbon potential as well as hydrocarbon based hazardous chemicals including PCB's. Category EA use is not constrained by the characteristics of the oil. Category EA can be utilized on gasoline/fuels if they pose an explosion hazard, in a populated area, port, or harbor, including oil rigs. Category EA's ability to rapidly change the density of even heavy oils prevents oils from sinking into the water column preventing the oil spill from contaminating secondary, tertiary, and quaternary areas. The oil is broken into small particles, so it becomes difficult to observe, however the original area of contamination is the only area effected, preventing migration of the spill to more sensitive areas.

The information below for oil characteristics is for category EA

Group I: Very Light Refined Products *(gasoline, naptha, solvents)*

a very volatile and highly flammable
b complete removal by evaporation likely
c high acute toxicity to biota
d can cause severe impacts to water-column and intertidal resources
e specific gravity less than 0.80
f will penetrate substrate, causing subsurface contamination
g **Catefgory EA can be used on this group 1, and its use would diminish a fire hazard and protect ports/harbors, and structures near a potential fire hazard.**

Group II: Diesel-like Products and Light Crude Oils *(no.2 jet fuel oil, jet fuel, kerosene, marine diesel, West Texas Crude, Alberta Crude)*

a moderately volatile; persists in environment for an increasing period of time as Aweight@ of material increases
b light fractions will evaporate to no residue
c crude oils leave residue after evaporation
d moderate to high toxicity to biota
e can form stable emulsions
f tend to penetrate substrate; fresh spills are not adhesive
g specific gravity of 0.80-0.85; API gravity of 35-45
h **Category EA first response bioremediation is effective on lower molecular weight oils, with faster degrading components; aromatic portions less susceptible to degradation and has proven this in numerous clean ups and can be used on Group II.**

Group III: Medium-grade Crude Oils and Intermediate Products *(North Slope crude, South Louisiana crude, no. 4 fuel oil, lube oils)*

a moderately volatile
b up to one third will evaporate in the first 24 hours
c moderate to high viscosity
d specific gravity of 0.85-0.95; API gravity of 17.5-35
e variable acute toxicity, depending on amount of light fraction
f can form stable emulsions
g variable substrate penetration and adhesion
h Category EA first response **bioremediation is effective on lower molecular weight oils, with faster degrading components**

EA can remediate the entire hydrocarbon structures and has proven this in numerous clean ups and can be used for Group III clean ups.

Group IV: Heavy Crude Oils and Residual Products *(Venezuela crude, San Joaquin Valley crude, Bunker C, no. 6 fuel oil)*

a slightly volatile

b very little product loss by evaporation

c very viscous to semisolid; may become less viscous when warmed

d specific gravity of 0.95-1.00; API gravity of 10-17.5

e low acute toxicity relative to other oil types

f can form stable emulsions

g little substrate penetration; can be highly adhesive

h **higher molecular weight and fewer number of straight-chained hydrocarbons makes bioremediation more difficult, however category EA can remediate Group IV as well as the entire hydrocarbon structures and has proven this in numerous clean ups. EPA RRT VII has proven this for category EA/OSE II by performing 2 different tests in triplicate with OSE II on heavy waste oil showing an average of 73% reduction in 28 days, far exceeding any other methods ability to address this type of oil see link** http://www.osei.us/pdf%20files/RRT%20plus%20testing.pdf

Group V: Very Heavy Residual Products

a very similar to all properties of Group IV oils, except that the specific gravity of the oil is greater than 1.0 (API gravity less than 10). Thus, the oil has greater potential to sink when spilled. **Category EA II can remediate Group V as well as the entire hydrocarbon structures, and has proven this in numerous clean ups. EPA RRT VII has proven this for category EA/OSE II by performing 2 different tests in triplicate with OSE II on heavy waste oil showing an average of 73% reduction in 28 days, far exceeding any other methods ability to address this type of oil see link** http://www.osei.us/pdf%20files/RRT%20plus%20testing.pdf Category EA also changes the density of the oil preventing it from sinking as quickly as the heavy oil would otherwise.

Characteristics of Affected Habitats

The understanding that Category EA use transcends all areas of impact, and is imperative that its application proceed as soon as possible since once applied the oils density lessens, its adhesion properties diminish protecting shorelines, plants and wildlife from being coated with oil, and preventing the oil from sinking into the water column or seabed and immediately reducing the spills toxicity (the reason you clean up spills) reducing the time the spill is in a particular area/habitat is the desired response. The oil spill has created the harm, how fast can its effects be diminished to save and protect as many natural resources is the goal, therefore time to apply category EA with it overwhelming benefits should be as soon as possible. Category EA has proven bioremediation in all the areas/habitats noted in this plan. The harmful effects of the oil must be balanced be mitigated and removed from the environment as soon as possible with a non toxic effective means category EA fits the need. The listed habitats are appropriate for marine, estuarine and riverine settings.

Open Water category EA has successful experience in	Off-shore Waters, Category EA has experience in
Tidal Inlets category EA has experience in	Water Intakes Category EA is use in waste treatment plants so if the water will go through treatment it would be acceptable, however since category EA causes oil to float, by booming off the intake area category EA will prevent the oil/hydrocarbons from sinking to the level of the intake, therefore protecting the intake
Small Lakes/Ponds category EA has experience in	Small Rivers/Streams category EA has experience in
Exposed Man-made Structures category EA/OSE II has experience in	Sheltered Man-made Structures category EA has experience in
Exposed Scarps in Clay	Wave-cut Clay Platforms

Open Water category EA has successful experience in	Off-shore Waters, Category EA has experience in
category EA has experience in	category EA/ has experience in
Fine-grained Sand Beaches category EA has experience in	Sandy Banks category EA has experience in
Mixed Sand and Shell Beaches category EA has experience in	Shell Beaches or Banks category EA has experience in
Exposed Rip-rap (O) category EA has experience in	Sheltered Rip-rap (O) category EA has experience in
Exposed Tidal Flats category EA has experience in	Sheltered Tidal Flats (category EA has experience in
Salt to Brackish-water Marshes category EA has experience in	Freshwater Marshes category EA has experience in
Freshwater Swamps category EA has experience in	Mangroves category EA has experience in

Open Water, Off-shore, Tidal Inlets and Water Intakes

Bioremediation is not effective for the time-frames of concern, relative to the potential of transport of the oil to areas where it could affect more sensitive resources. Thus, bioremediation treatment is not advisable for these habitats or areas.

Category Ea/OSE II is preferable for use especially in and around water intakes, due to the fact OSE II causes oil to float. This would allow booming operations to prevent oil from getting near to the intake and keep the oil on the surface out of the direct suction area of the intake. Category Ea/OSE II when applied to oil on the open water, off-shore, tidal flats, breaks down the oils structure, reducing the oils toxicity, adhesion properties, causing the oil to float so other areas of the water column and

seabed are protected, and if the oil gets to the shoreline the oil would not adhere to the shoreline, marshes, sandy beach ect. For tidal flats the oil would be lifted off the flat and remediated on the surface of the water away from the shoreline once the tide goes out. Category Ea/OSE II has constituents that cause these matrices of the product to adhere to hydrocarbon based material so that no matter where a spilled hydrocarbon based material migrates it will float and remediate to CO2 and water. See link Dubai https://www.dropbox.com/s/0q9bl9238qqxq2g/IMG_2325-1.MOV link Arabian Gulf Dammam Saudia Arabia http://osei.us/archives/1135 link Thane Creek India http://osei.us/archives/1128

Small Ponds, Lakes, Rivers and Streams

Applicable for gasoline and light oils due to their rapid evaporation. There is information on impacts and effectiveness for other oil types, however there are no special concerns about nutrient overloading in small, restricted water bodies with category EA.

Category EA/OSE II has been used on a spill if significance (over 5,000 gallons) on fresh water where the oil was lifted off the shoreline grass and sandy areas, as well as living and dead marsh grass, the oil was held on the surface, where the enhanced indigenous bacteria spread out on the oils surface, and converted the oil to CO2 and water leaving a protected water column, and the ponds floor was never impacted by the oil. See link http://osei.us/photoalbums/crude-oil-spill-cleanup

Solid Man-Made Structures: Exposed and Sheltered

Oiling of exposed sea walls usually occurs as a band at the high-tide line. This type of oiling is amenable to category EA first response bioremediation, Category EA/OSE II has the ability to lift the oil off of man made vertical or horizontal structures, due to its ability to break down the molecular structure of the oil and lift the hydrocarbons out of the pours of the concrete, stone, rock, or lift the oil off of wooden structures.

Exposed Scarps in Clay and Wave-Cut Clay Platforms

Because of their erosional nature, removal of lightly oiled sediments may not be recommended on these habitats. Category EA Bioremediation means whereby the oil could be addressed in place.

Category EA/OSE II has the ability to lift the hydrocarbon based material off the sediment, preventing the blanketing off the area with oil choking any living organisms in these areas, and the reduction of the adhesion properties would prevent re-oiling.

Fine-grained Sand Beaches or Sandy Banks

On outer beaches with low recreational use, Category EA bioremediation is the option, particularly for light oiling or residual oil left after other countermeasures have been completed.

Category EA/OSE II, whether the beach is recreational or not, it should be utilized since the oils molecular structure is rapidly broken down and the adhesion properties reduced, therefore the oil is lifted off the sandy beach or shoreline, removing the oil, and the remediation to CO2 and water will follow with a clean protected shoreline, since the adhesion properties are reduced and re-oiling is prevented.

Fine-grained sand beaches also occur along bay margins and dredge spoil banks. Sandy banks occur along rivers. These habitats typically occur in more sheltered areas, where natural removal of residual oil by wave or current action will be slower then along exposed beaches. They are often not amenable to mechanical removal, thus category Ea is the preferred method to remove the oil from the environment.

Category EA/OSE II would preclude the manual removal of oil since mechanical manual removal disrupts the intertidal zone environment, and human removal would needlessly expose responders to toxic oil, and its gasses. whether the beach is recreational or not, it should be utilized since the oils molecular structure is rapidly broken down and the adhesion properties reduced, therefore the oil is lifted off the sandy beach on shoreline, removing the oil, and the remediation to CO2 and water will follow with a clean protected shoreline, since the adhesion properties are reduced and re-oiling is prevented.

Mixed Sand and Shell Beaches and Shell Beaches or Banks

For lightly or moderately oiled beaches and banks, particularly where mechanical cleanup may result in removal of large amounts of sediment or be logistically difficult, category EA first response bioremediation is the preferred method to return the area to pre spill conditions as quickly as possible. In a safe manner.

Whether the beach is recreational or not, Category EA/OSE II should be utilized since the oils molecular structure is rapidly broken down and the adhesion properties reduced, therefore the oils lifted off the sandy beach or shoreline, removing the oil, and the remediation to CO2 and water will follow with a clean protected shoreline, since the adhesion properties are reduced and re-oiling is prevented. There is no reason to use a no action decision since this will allow toxic hydrocarbons toxicity to impact the mixed sand, shell beach or banks and linger for a protracted period of time, when category EA can lift the oil off the beach and limit the time the toxic hydrocarbons linger on the beach.

Riprap: Exposed and Sheltered

Oil on riprap can occur as a coating on the boulders or as persistent

accumulations of oil in the void spaces between the boulders. Category EA can remove the oil and remediate it permanently removing it from the man made structures and the environment. This type of oil is amenable to effective removal by category EA bioremediation techniques under most conditions.

Thus, category EA bioremediation application would be the best option.

Category EA/OSE II should be utilized since the oils molecular structure is rapidly broken down and the adhesion properties reduced, therefore the oil is lifted off the riprap and from the crevices, removing the oil, and the remediation to CO2 and water will follow with a clean protected area, since the adhesion properties are reduced and re-oiling is prevented. If the tide is not capable of carrying the oil out of crevices and protected areas, the oil will merely remediate to CO2 and water in place, and become permanently removed from the area.

Exposed Tidal Flats and Sheltered Tidal Flats

Both of these habitats are inundated daily by high tides which would allow the oil to be lifted and partitioned from the shoreline when the tide comes in. Category EA first response bioremediation is the preferred method under these conditions. There are no significant toxicity concerns for use of category EA bioremediation agent in shallow, poorly flushed areas, such as sheltered tidal flats, or subtital habitats where there are concentrations of sensitive life stages of fish and shellfish, such as sea grass beds and oyster reefs.

Category EA/OSE II is acceptable for high tides and flushing since the product is molecularly attached to the broken down molecular hydrocarbon structure that is detoxified, and caused to lift and float, so that wherever the detoxified oil may migrate it will still remediate to CO2 and water, so dilution is not a factor. Category EA/OSE II's ability to detoxify the oil reduce its adhesion properties and cause it to float, in poorly flushed area still allows for separation from life stages of fish, shellfish, and sea grass beds, and allows the oil to be flushed out of the area with any minimal tidal movement, protecting the living organisms in these areas not initially effected by the initial invasion of the oil to the area. Any oil trapped where Category EA/OSE II has been applied will float and remediate to CO2 and

water, which prevents the lingering toxic effects of the oil in the area for an extended period of time.

Salt to Brackish-water Marshes, Freshwater Marshes, Freshwater Swamps and Mangroves

Category EA first response bioremediation cleanup does not cause significant impacts to these sensitive habitats over and above what the oil has already produced. Category EA's ability to detoxify the oil rapidly, reduce the adhesion properties, and cause the oil to float is the only way to protect natural resources and return the spill to pre spill conditions. Category EA bioremediation is the preferred method. In wetlands with shallow, poorly mixed water bodies, the potential increase in eutrophication and ammonia caused by aggressive bioremediation needs to be considered however with Category EA these issues are alleviated by causes the oils density to lessen and the oil to float.

Category EA/OSE II when compared to past methods, and understandings, does not cause significant impacts to these areas, since the application is by spray apparatus. Once the area has been invaded by oil, the toxicity of the oil will be present, therefore the adverse impact is already present. The timely reduction in toxicity and removal of the oil is needed. Category EA/OSE II's ability to breakdown the molecular structure by reducing the oil into small particles limiting the toxicity, preventing the choking of the organisms by allowing the blanketing of the oil, reducing the adhesion properties, lifting the oil to the waters surface, allowing separation from vegetation or natural land scapes lessons the time the toxic oil can effect these areas, therefore it is preferable to utilize category EA/OSE II. EA/OSE II by causing any molecular weight oil to breakdown and lift up, even in poorly mixed areas, prevents eutrophication over other response, and doing nothing. Doing nothing allows for eutrophication to occur for an extended time, category EA/OSE II limits this time and the impact of the oil to the surrounding area. Category EA/OSE II will not exacerbate the development of ammonia over doing nothing at all. Category Ea/OSE II is mixed with the water from the nearby area so whether the area has fresh, salt, or brackish water the natural bacteria are enhanced and is already acclimated to the effected environment. Category EA/OSE II limits the time and amount of toxicity of the oil to the and allows for the oil to be separated from the flora and fauna of the area.

LOGISTICAL CONCERNS

Characteristics of a spill incident, including characteristics of affected habitats and spilled hydrocarbon based pollutant, for category EA The affected habitat, or type of hydrocarbon based pollutant does not preclude the use of category EA/OSE II, it transcends almost all scenarios, and will remediate almost all types of hydrocarbon based pollutants! Based on the fact that Categroy EA a first response bioremediation product can be used, then the logistical feasibility of implementing an appropriate category EA bioremediation action plan can be activated. Implementation is easily performed utilizing current dispersant spray apparatuses, and labor that is already pre staged for spills. Most vessels contain fire fighting eductor or induction systems so almost any vessel can be used to apply category EA with minimal training. the scale of the spill is not a problem, since there are pre plans in place to apply large amounts of dispersants and it is an easy change over to apply category EA, the OSEI Corporation maintains a stock of OSE II to clean up 1,000,000 gallons of oil and can out produce what can be applied in a matter of days. the resources necessary to conduct the application as stated previously are already pre staged and in place due to plans for dispersant applications, it is an easy change over, the craft are merely loaded with category EA, and the dials slightly changed. The monitoring is easily handled since it is possible to visually observe the effects of the application of category EA in all habitats. Category EA application availability, and monitoring are already in place and easily carried out.

Scale of Bioremediation Response

The first step in assessing the logistical feasibility, is to understand the logistical feasibility is easily accomplished with pre approval and pre staging of category EA, The scale does not preclude the use of category EA bioremediation; with category EA even for spills as large as the BP Macondo spill, a plan was quickly developed to meet the requirement of addressing 4,000,000 gallons a day release as well as several hundred thousand gallons already on the seabed was presented to BP. Category EA can handle any spill more effectively than any other means available. The scale of category EA bioremediation response refers to the extent to which bioremediation will be involved in the cleanup, particularly in terms of the size of the area, Category EA is a first and only response needed for spills and has performed these types clean up singularly, and in conjunction with booming operations. Category EA precludes the needs for any other response and can be used synergistically with mechanical clean up if needed. The scale of the bioremediation response effort will determine the amount of category EA that will be utilized, the number of personnel, and the equipment resources necessary to complete the application technique and monitoring of the bioremediation response effort. Category EA/OSE II is prepared to initially respond to spills up to one million

gallons of oil and by the time this quantity is applied, a follow up batch of more Category EA/OSE II can be readied for deployment. Category EA/OSE II is more preferable than dispersants since it meets the letter of the Clean water act by actually removing oil from the environment, and does not have a limited window of opportunity for application.

Agent Availability

Once the scale of the spill has been determined then the RRT would notify the manufacture of category EA bioremediation which in turn would allow the manufacture of category EA to determine the amount of category EA that needs to be utilized. This is easily determined by dividing the total spill by 50, if it is an ongoing spill then the daily requirement would be determined. The availability of category EA for use at the spill location should be assessed, however category EA can be quickly shipped to any area in the US, however if the RRT wants category EA staged at particular locations then it will be incumbent on them to pre authorize the use of category EA to meet any of their particular site or staging requirements. Category EA can be almost any where in the US in a matter of hours, so availability is not a problem.
Category EA/OSE II contains a stock pile to initially address approximately 1 million gallons of oil and can provide more, faster than it can be deployed. Pre approval and staging category EA/OSE II would eliminate the availability concern, which is the means to how dispersants have enough on hand for spills.

Application and Monitoring Resources

Category EA is easily applied by any spray device and due to the fact dispersants spray devices are already in place it is an easy change over to category EA, and even utilizing vessels that are not typically established for spill clean up, that do however have fire fighting eductor, or induction systems can be readily utilized as well. Implementation is quite easily handled due to the pre planning and staging of current dispersant application equipment. Several application methods are generally available for bioremediation agents and each method may have unique resource requirements for its implementation. the habitat(s) where category EA bioremediation is being considered for cleanup should will determine what type of application equipment that will be required.. Category EA/OSE II can be deployed by any spray apparatus as well as from eductor or induction systems and can be deployed in the same manner by aireal spray with a slight adjustment in the pre mixing in the craft with water. Most Contractors that can be deployed for dispersant application with a minor adjustment can apply category EA/OSE II. Vessels of opportunity can be outfitted easily to apply category EA/OSE II, and most commercial vessels in ports contain some type of induction fire fighting systems that can be utilized for Category EA/OSE II application.

Next, the types and supply of available equipment and personnel adequate to implement and monitor the bioremediation response effort, as well as access to

laboratory facilities for sample analyses, is easily handled by utilizing the same equipment , personnel and facilities establish for dispersants. (Refer to the Biomonitoring Plan section for recommended monitoring activities and monitoring resource requirements.) Category EA can be utilized more simply than current dispersant responses since there is not the concern of compromising responders health, and the same visual monitoring for dispersants can be utilized for category EA since there is a visual effect to the oil when category EA is applied. For additional requested testing the same laboratories and personnel can carry these out for category EA that is carried out for dispersants.
Biomonitoring with Category EA/OSE II can be visually observed to easily discern the oil reactions to the application of category EA/OSE II Just as it is for dispersants, except the observers will not be in harms way from toxic chemical components in dispersants since OSE II has no toxic chemical components.

IMPLEMENTATION

When initiating category EA bioremediation application, several steps shall be completed. First, the OSC shall notify RRT 4 that the use of category EA bioremediation is being utilized by transmitting the pre-established Bioremediation Use Authorization Form with the spill particulars added. Second, the category EA pre established Bioremediation Work Plan and Bioremediation Monitoring Plan shall be adjusted to a spills particular type and scale to address issues necessary to ensure an efficient and effective category EA bioremediation spill response. These plans are be pre developed before a spill emergency with category EA/OSE II, so there is no guess work when a spill occurs and in fact the pre plans for implementation and monitoring is attached. This document covers most of the spill scenarios, and the work plan that is contained with this document is filled out so you are now pre readied to respond to the spills scenarios noted in this document with category EA/OSE II..

RRT Notification

After adjusting the spill plan and monitoring plan for a particular spill with category EA and the appropriate application choice has been determined for each affected habitat to receive category EA, the completed category EA Bioremediation Use Authorization Form shall be transmitted to the affected State(s), EPA and the pertinent RRT, the appropriate USCG District and the Federal Trustees so all are informed. If applicable, the appropriate Federal Land Manager (e.g., DOI) should also be notified. Category EA/OSE II's ability to transcend all scenarios, and types of oil allow category EA/OSE II as first response or any time frame response product/process, with no limited window of opportunity, places it in a unique situation for all responses.

If use of bioremediation in the spill area has been pre-approved or pre-authorized by the pertinent RRT, then concurrence is not necessary. However, the OSC must still notify the pertinent RRT personnel RRT of the decisions in regard to the use of category EA bioremediation. In the event the pertinent RRT pre-authorizes an area for the use of of category EA bioremediation, such areas will be included in the plan by addendum. Pre approval is an absolute requirement in order for contractors to have category EA/OSE II staged and readied, and should be carried out immediately.

BIOREMEDIATION WORK PLAN (Pages 63-69 below)

Work plans are important to ensure the safe, coordinated, and well documented implementation of bioremediation. Work plans are comprised of systematic procedures and guidelines that clarify and resolve issues such as worker and public safety, documentation requirements, response personnel roles and responsibilities, treatment technique agent application protocols, and application control and oversight considerations. Complete Work plans must include spill and site specific considerations. It is essential in a response that every incident or event be managed according to a plan and bioremediation is no exception. The Work plan shall provide:

- Ë A clear statement of objectives and actions.
- Ë A basis for-measuring work effectiveness and cost effectiveness.
- Ë A basis for measuring work progress and for providing accountability.

Plans should be prepared for specific time periods or operational periods. These periods can be of various segments of time. Decisions on the length of the operational period or time segments may be affected by the length of time available/needed to achieve objectives, the availability of resources, environmental considerations, and safety considerations. Essential parts of any Work plan are:

1. **Statement of objectives -** Statement of what is expected to be achieved. Objectives must be measurable.

2. **Organization -** Describes what organization will be in place. This will describe in detail the specific roles and responsibilities of the participants in a bioremediation treatment technique. This will also describe the interaction of one entity to another.

3. **Tactics and assignments -** Describes tactics and control operations and what resources will be assigned. If the application is a large one, resource assignments may be done by groups.

4. **Supporting material -** Examples include a map or sketch of the area(s) to be treated, communications, traffic plan, weather data, special precautions, and safety information.

All supervisory personnel must be familiar with the plan and any changes which develop throughout the life of the project. This can be accomplished through briefings and by distributing copies of the written plan.

The Work plan must include an avenue to provide for ongoing evaluation of the plan's effectiveness. Supervisors should regularly assess work progress against control operations called for in the plan. If deficiencies are found, improved direction or additional staffing may be required, tactical operations may need to be modified, and/or changes may need to be reflected in planning for the next segment of time.

Demobilization activities, although often overlooked, are an integral part of the Work plan. As the project begins to wind down, everyone will be anxious to leave the scene and return home. Demobilization planning helps to assure a controlled, safe, efficient, and cost effective demobilization process.

Organization

The response structure or organizational framework identifies the participants in a response, their general areas of responsibility, and the lines of authority among them. A chart illustrating the participants in a bioremediation response activity in Region 4 and their inter-relationships would be very helpful in summarizing this information. In developing this section, the following questions should be addressed:

Who will manage the overall bioremediation activity?
Who will be the likely participants (e.g. federal and state agencies) in the activity for the Region? What are the general roles?
Who will be the likely participants, if any, from outside the Region? What are the general roles?
Who will manage the monitoring portions of the activity?
Who will develop an appropriate Work plan for the bioremediation activity?
Who will perform specific treatment method or agent(s) application(s)?
Who will perform monitoring?
Who will perform public outreach?

Describe in detail the specific roles and responsibilities of the likely participants (RRT, federal and state agencies, international governments/agencies, non-governmental organizations, responsible parties, etc.) in a bioremediation activity in Region 4. The information in this section should coincide with the information presented above on the regional response structure.

Tactics and assignments

Tactical direction includes determining the tactics and operations necessary for the selected strategy and determining and assigning the appropriate resources.

Resource assignments should be made for each specific work task. Such assignments should consists of the kind, types and numbers of resources available and needed to achieve the desired outcomes.

Personnel and logistical support factors must be considered in determining tactical operations. Lack of logistical support can mean the difference between success and failure in achieving objectives.

Supporting Material

Public Safety/Information - Public safety is paramount in any bioremediation project. The following are some suggested actions which should be taken during a spill response to ensure public awareness and protection:

> Provide news releases and updates to newspapers, radio, television stations, and neighboring areas that could potentially be impacted by bioremediation activities. Be prepared to discuss details regarding the chosen treatment technique in simple layterms so the affected public will have an understanding of exactly what to expect and what the expected benefits are.

Site/Worker Safety - Worker health and safety is always the foremost concern during any spill response action. Since all oil spill response actions require a health and safety plan and the bioremediation application is merely a facet of the total spill response effort, the existing heath and safety plan should be used for the bioremediation application and augmented with the specific safety hazards associated with the bioremediation treatment method or agent application. A section referred to as biological hazards should be included in all health and safety plans associated with oil spill responses where biological agents are used as a response tool. This section should discuss the specific health and safety concerns associated with possible exposure to biological agents and include material safety data sheets (MSDS) for all agents being used. At a minimum, the health and safety plan should address the following aspects of the bioremediation treatment method/monitoring program:

1. minimum health and safety concerns,
2. potential hazards during application and monitoring,
3. evaluations of those identified hazards,
4. actions described to minimize the potential hazards, and
5. response(s) needed if hazard does effect worker(s).

The following documents contain guidance on the preparation of health and safety plans:

1. OSHA 1910.120 and EPA 40 CFR 311,
2. USEPA, OERR ERT Standard Operating Procedures,
3. NIOSH/OSHA/USCG/EPA Occupational Health and Safety Guidelines,
4. ACGIH Threshold Limit Values, and
5. existing local and area contingency plans.

To avoid disturbances to the treated area after treatment, all treated and control

sites should be secured by the best achievable means. To avoid possible injury, post warning signs or secure the treated area to differentiate the site from surrounding localities.

BIOMONITORING PLAN

Category EA a first response bioremediation is a proven to enhance the biodegradation of oil or hazardous substances without increasing adverse impacts to human or ecological health. The EPA, , EPA RRT VII, and DOI have all proven through testing and actual filed use category EA enhances the bioremediation of weatherd crude oil, heavy in emulsion oil, as well as refined dielectric oil therefore there is no need for a research and development program during an emergency event for this proven safe effective product., The EPA has also already tested OSE II for toxicity on several species see 18 toxicity test document below, and the EPA has already tested category EA on a simulated open mesocosm spill where the absolute effluent of OSE II and oil was measured in a controlled situation where the EPA proved there is no increase in toxicity at all, in fact the EPA proved the toxicity was reduced. The EPA';s defensible document proving virtually no toxicity for category EA exists and this document for Category EA/OSE II where an EPA contract measured toxicity of category EA/OSE II and found category EA/OSE II to be non toxic and stated category EA did not create any toxicity, see link http://www.nbiap.vt.edu/brarg/brasym95/kavanaugh95.htm Category EA/OSE II has had over 18 toxicity tests on fresh and salt water species, and a number of these tests were performed by the EPA or under EPA contract see link http://www.nbiap.vt.edu/brarg/brasym95/kavanaugh95.htm and link http://osei.us/wp-content/uploads/18-Toxicity-test-with-4-2012-Log0.pdf also see 2 years of OSE II application on private fish pond to remove oil without adversely effecting the exotic fish or the surrounding plants http://osei.us/archives/1150 In most of the OSEI Corporation videos you will see OSE II being directly sprayed on human hands legs and feet to show there are no adverse chemical effects from directly handling OSE II also see OSHA letter in regards to OSE II at link http://osei.us/tech-library-pdfs/2011/9-OSEI%20Manual_OSHA.pdf and the OSE II MSDS at link http://osei.us/tech-library-pdfs/2011/8-OSEI%20Manual_MSDS.pdf

Biomonitoring for Category EA is easily carried out since visual observations can determine the response effect. There is no need to monitor efficacy since there is a preponderance of tests and successful clean ups that have been previously performed, the utilization of category EA is not a research project it is a proven effective response.

Therefore, an associated biomonitoring program can be conducted when category EA bioremediation application is utilized, however there is more than enough supporting tests to prove there is no toxicity concerns. (either natural or enhanced) The EPA/RRT plan outlining the biomonitoring program will be referred to as the biomonitoring plan.

Objectives

The principal objectives of the monitoring program and the elements of each objective are listed below.

1. Determine the efficacy of the selected bioremediation treatment method as it relates to the degradation of the spilled material. This is not necessary since category EA is already a proven technology for over 23 years and with over 23,000 spill clean ups.

> To continue to use biological degradation, the response community must compile data which shows that the use of bioremediation accelerates the breakdown of oil in the environment at a faster rate than if the oil was left to breakdown and degrade naturally. If there is no proven acceleration of the breakdown, then the risks and costs associated with the use of biological methods may outweigh the advantages.

2. Measure the environmental impact, if any, resulting from the biotreatment of an area, throughout the response activity to ensure against the harmful effects from the response. Especially, monitor any increases in eutrophication or ammonia caused by bioremediation. Category EA has already proven to be virtually non toxic and the reduce toxicity by the EPA, therefore the outcome from the utilization of category EA is already known and it is positive for the restoration of the environment from an oil spill.

> The monitoring of water quality parameters throughout the bioapplication is essential due to the potential for algae blooms, dissolved oxygen depletions, elevated available toxins in the water column, all of which may result in a critical impact to aquatic and vegetative life. Category EA does not create any O2 depletion over and above what the oil itself creates through its carbon loading of any ecology, category EA causes oil/hydrocarbon based material to float and allows the oil to flush even in slow flushing areas since the oils adhesion properties are diminished so the oil cannot remain adhered to vegetation and this prevents the oil from lingering in any are.

3. Determine if the bioremediation end points have been reached.

> With the use of all response tools it is important to determine at what point the tool is no longer effective or at what point it has achieved its objective. Thus biomonitoring end points must be developed prior to the initiation of the application, keeping in mind that these end points may need to be modified as the program progresses. The end points with category EA have been fully substantiated by the EPA, RRT VII, DOI and use by the EPA see appendix C below.

4. Ensure the comparability of data collected from all bioremediation response efforts conducted within Region 4 through compliance with USEPA Region IV=s Sampling Standard Operating Procedures.

.

This is done in order that the data may be used to enhance our understanding of bioremediation as an oil spill response tool. Properly collected, validated and interpreted data will provide critical information to assess the efficacy and environmental impact of bioremediation treatment and related response activities. Such documentation is needed to identify and correct problems in the biological treatment process, to determine whether bioremediation endpoints have been reached, to ensure that biotreatment is less environmentally harmful than the spilled pollutant and to support cost recovery and other legal actions.

Secondarily, the data can be used for developing regional and national data bases, interfacing with natural resource trustees, preparing interim and final reports, and revising this biomonitoring plan.

Quality Assurance

The quality of environmental data used to support OSC decision-making is critical to a spill response that considers or uses bioremediation. The primary goal of the quality assurance (QA) program is to ensure the accuracy of the environmental data considered by the OSC and RRT 4. It is the QA policy of RRT 4 that all activities associated with data collection and derivation are to be documented thoroughly. A monitoring program manager should be selected to specify procedures for ensuring the quality of data generated through the monitoring program and for providing sufficient resources for QA of collected data.

Biomonitoring Plan Design

Each biomonitoring program, in large part, will be event/site specific; however, pre-event planning and standardization of collection/analysis methods is encouraged. The design of the biomonitoring program is two-fold: (1) to document any impact to water quality which might result from the treatment or application and (2) to provide for the evaluation of the effectiveness of the treatment method or applied agent(s).

Conducting biomonitoring does not preclude the OSC/RP from conducting any other required monitoring associated with the spill event.

Project planning and site reconnaissance are essential activities conducted prior to the design of the biomonitoring plan. The OSC/RP may wish to refer to the area contingency plan (ACP) for existing shoreline or site assessment procedures developed by the area committees. The purpose of site reconnaissance activities are to gather

information sufficient to:

- Ë Determine that the objectives of the biomonitoring plan are consistent with the features of the site selected for application;
- Ë Identify the type and quantity of existing historical water quality data for the area selected for the application, such as nutrient loading trends and physical water parameters;
- Ë Define the geographic area of the spill targeted for application, for physical and chemical characteristics important to the design and execution of the biomonitoring plan;
- Ë Determine the distribution, abundance, and seasonality of habitats, in the area to be considered for application;
- Ë Project weather forecasts, meteorological and hydrogeological trends in the potential application area, for the proposed application time period;
- Ë Determine equipment needs based on operational logistics; and
- Ë Develop procedures designed to document sample collection methods and procedures.

The extent of the biomonitoring program should be directly proportional to the complexity and sensitivity of the area(s) chosen for biological degradation. The more diverse and sensitive the effected environment, the more complex and extensive the biomonitoring program should be. The volume of material spilled is not the driving factor in determining the extensiveness of the biomonitoring program; however, the larger the spill, in general, the more area affected and the greater the potential for affecting sensitive ecosystems. Thus, large spills generally will require a more extensive biomonitoring program. The OSC/RP should refer to the ACP and incorporate any and all required monitoring as directed by the ACP.

Because one spill event may affect several different morphological environments or habitats, bioremediation treatment techniques may be applied in several different habitats. The supporting biomonitoring program must be designed to accommodate inherent differences which are present in each habitat. Thus, each discrete habitat, within an application area, may require its own monitoring program.

Monitoring Activities

Biomonitoring plans should ensure that observations and samples be collected and analyzed from the following areas - within each discrete habitat(s):

Untreated areas
uncontaminated, untreated source areas (this will serve as background information and may not require the same intensity of sampling as the other areas),
2. contaminated, untreated source areas, and

Treated area

3. contaminated, treated areas

In order to evaluate the effectiveness of the bioremediation treatment technique the biomonitoring plan should provide for the comparison of replicate data from treated and untreated areas for the duration of a project.

Within each discrete habitat which is a part of the bio application project, treated and untreated sites that exhibit similar chemical and physical characteristics should be chosen. Their similarity will support the comparability of the data generated. During their selection the following criteria should be considered, (1) environmental parameters, (2) physical habitat and geomorphology, and (3) oil loading and the probability of further oiling. Site variability should be limited as much as possible in order to generate data which is comparable.

Other physical variances which may effect the integrity of the data collected are wave action, tidal flushing, currents, boat traffic, and exposure to wind or other external forces.

Because efficacy analyses focus on evaluating relative changes in the concentration of the constituents of oil between treated and untreated sites, it is important to ensure that uncontaminated source areas remain uncontaminated for the duration of the monitoring program and contaminated areas are not reoiled for the duration of the monitoring program.

Monitoring should take in place in two forms:

1. Qualitative - serves as real time feedback for response decision and is usually in the form of visual observations, supported by photo documentation.

2. Quantitative - serves as the basis for longer term analysis of the success of the project and is in the form of sample collection and analysis.

Although visual observation is considered subjective, there is no substitute for this type of "real time" or fast feedback. Observers must be assigned to the project and trained to monitor morphological changes which may occur to the oil as it breaks down and any changes in organism behavior, such as the occurrence of algae blooms and fish kills.

All sample collection and analysis begins with a sampling plan. The sampling plans should include, at a minimum, the following:

Implementation schedule (monitoring should be expected to take place over 3-4 months or until end points are reached)

List of objectives

Tasks to be conducted
Description of project management

- Identification of sensitive areas included in/adjacent to the sample location areas
- Identification of sample locations, frequency, and collection methods
- Description of sample chain of custody procedures and QA/QC procedures
  Description of water quality history (if available) of the affected area or procedure for determining background values for the affected area if historical data does not exist

The environmental characteristics and measurements that should be assessed and the samples that should be taken as part of the biomonitoring are presented in Table 2, along with a schedule for performing these activities. Sampling at each site, water depth (as appropriate), and time, should be performed in *duplicate for 10% of the samples collected*. Although the mix of samples collected should be based on the requirements of the analytical methods, minimum sample sizes are recommended as 1 liter for water samples and 4 - 16 oz for sediment or shoreline materials. All samples should be placed in precleaned jars or bottles with Teflon lined caps, as appropriate.

The monitoring parameters should involve a tiered approach which utilizes relatively inexpensive techniques such as total petroleum hydrocarbons (TPH) for screening and more sophisticated methods that target individual petroleum constituents to confirm biodegradation efficacy in *at least 25% of the sample*s *analyzed*. The latter would include GC/MS analysis of target aliphatic and aromatic hydrocarbons which have been identified as marker compounds for tracking oil degradation and weathering, such as the normal alkanes, the isoprenoids, pristane and phytane, and the conservative biomarker hopane. Water quality measurements should include nutrients, dissolved oxygen, biological oxygen demand (BOD), TOC and COD. Refer to Appendix E for methodologies and recommended procedures.

All data is subject to review by the OSC or a delegate and will be made available upon request. This data will support further response decisions and to provide the response community with a better understanding about the use of bioremediation as an oil spill response tool.

DOCUMENTATION AND REPORTING

During the course of a bioremediation activity and accompanying monitoring effort, the following reports shall be prepared and submitted to the OSC:

Activity reports -- provide descriptions of the bioremediation activity area, weather, unique observations, and activities undertaken, as well as the names and affiliations of persons on site. Activity reports should be prepared whenever activities on a site are undertaken.

Analytical reports -- provide laboratory analysis results of environmental and control samples. Lab results should be analyzed, interpreted and a brief summary report prepared within a reasonable time agreed to by all parties.

After action report -- provide a description of the overall bioremediation activity and accompanying monitoring effort, including results of both field and laboratory activities. A draft should be submitted within 30 days after the end of the monitoring effort. A final report, (incorporating comments from those the draft was submitted to, as well as photos) should be submitted within 60 days after submission of the draft.

In addition, at the time the final after action report is submitted, all field notes, including those of contractors, should be submitted to the OSC.

To facilitate information transfer and the development of a data base on bioremediation use and bioremediation agents, the Bioremediation Use Follow-Up Form in Appendix F should be completed at the end of the bioremediation activity.

PLAN REVISION

The monitoring plan and suggested procedures outlined in this section should be implemented and modified, as necessary, based on the cumulative experience and knowledge gained from conducting bioremediation field activities and associated laboratory activities. Recommendations for revisions should be submitted to the Region 4 RRT for approval or pertinent RRT.

TABLE 1
FIELD-MONITORING PARAMETERS

Parameter	Sample Size[1]	Assessment/ Collection Location	Assessment/ Collection Frequency[2]
Visual observations (mortality, behavioral effects, appearance changes, oil distribution)	N/A	All test sites	Daily to the extent possible; at least each day that water, sediment, and/or shoreline material sampling is performed
Temperature (air, water)	N/A	All test sites	Days 0, 1, 7, 14 and every week thereafter
Salinity	N/A	All test sites	Days 0, 1, 7, 14 and every week thereafter
Dissolved oxygen	N/A	All test sites	Days 0, 1, 7, 14 and every week thereafter
Sea state	N/A	Activity area	Days 0, 1, 7, 14 and every week thereafter
Current	N/A	Activity area	Days 0, 1, 7, 10 and 20
Wind velocity	N/A	Activity area	Days 0, 1, 7, 14 and every week thereafter
Efficacy (water, sediment, and/or shoreline material)	1 liter water; 20 grams sediment or shoreline material	All test sites and, as appropriate, all water depths	Days 0, 1, 7, 14 and every week thereafter
Toxicity[3] (water, sediment, and/or shoreline material)	8 liters water; 20 grams sediment or shoreline material	All test sites and, as appropriate, all water depths	Days 0, 1, 7 for Microtox and at same intervals for every reapplication of

			agent, for long term amphipod days, 0, 1, 7, 14 and every week thereafter

[1]N/A means "Not Applicable".
[2]Frequency is relative to the time of agent application.
[3]Sample size, location and frequency for toxicity testing are recommendations. Actual parameters shall be determined based upon conditions of the spill event.

APPENDIX A

APPLICABLE FEDERAL AND STATE REGULATIONS

Legislation at both the federal and state level may affect decisions to use bioremediation. Existing regulations and policies that govern the use of bioremediation treatment techniques and agents in responses to spills in Region 4 are summarized below.

Federal Regulations

At the Federal level, Subpart J of the NCP governs the use of chemical and biological agents -- which include bioremediation agents -- in responding to oil spills. Specifically, the Subpart:

Restricts the use of chemical and biological agents that may affect US waters to those listed on the NCP Product Schedule;

Specifies technical product information that must be submitted to EPA for an agent to be added to the Schedule; and

Establishes conditions for obtaining authorization to use chemical or biological agents in a response action.

If EPA determines that the required data were submitted, EPA will add the agent to the Schedule. Note, however, that listing of an agent on the NCP Product Schedule does not constitute approval of that agent for use or confirmation of any claims regarding the agent's safety or effectiveness.

Data on agents listed on the NCP Product Schedule are available through EPA's Emergency Response Division in Washington, DC.

The OSC, with concurrence of RRT 4, including the RRT representative from the State

with jurisdiction over the waters threatened by the spill, may authorize the use of any agent listed on the Product Schedule. In addition, when practicable, the OSC should consult with the Department of Commerce (DOC) and Department of Interior (DOI) representatives to the RRT before making a decision to bioremediate a spill. If the use of particular products under certain specified circumstances is approved in advance by the State, DOC, and DOI representatives to the RRT, **and** such preapproval is specified in the Regional Contingency Plan, the OSC may authorize bioremediation without consulting the RRT.

Category EA meets and exceeds all federal and State and local requirements. Category EA will allow the EPA/Coast Guard and RRT to meet the federal requirements by pre authorizing and utilizing a response category EA that actually removes the oil from the environment per the Clean Water act and OPAH 90.

APPENDIX B

THIS IS A SAMPLE BIOREMEDIATION USE AUTHORIZATION FORM
WHICH HAS BEEN FILLED OUT AS IT WOULD and SHOUL BE ON A PRE SPILL BASIS AS MUCH AS POSSIBLEBE FOR BIOREMEDIATION
SUB-CATEGORY EA TYPE – OSE II
BIOREMEDIATION USE AUTHORIZATION FORM

_____

The following questions should be answered, if known, and presented to the OSC who will review them and present them to the RRT. EVERY effort should be made to present accurate and timely information. The RRT will use the information provided below to assist in making sure the implementation of category EA starts as soon as possible bioremediation.
The form consists of two parts, incident characteristics and feasibility assessment criteria for category EA the feasibility has been determined on a pre spill basis as category EA is applicable for all scenarios and all the types of oil in this plan. Additionally, a Bioremediation Work plan and Biomonitoring Plan have been pre prepared and submitted to the RRT and should be forward to all OSC for the Coast Guard and EPA on a pre spill basis so ll the OSC's or his designee for review. (Note: Many of the items requested in the feasibility assessment criteria section can and should be included in the bioremediation Work plan.) The is no need for feasibility assessment for an already proven experienced product in category EA.

Incident Characteristics
Time and date of release: (TO BE FILLED IN WITH SPECIFICS OF INCIDENT)
Product spilled: (this is not a determining factor regarding the use of OSE II since sub-category EA/ OSE II handles all hydrocarbon-based materials. However, the product spilled should be noted.
Quantity spilled: (TO BE FILLED IN WITH SPECIFICS OF INCIDENT)
Status of spill: whether the oil is fresh or fully weathered, or is a continuing leak, or one that has been contained, sub-category EA/ OSE II can be applied effectively at any point, there is no limiting window of opportunity for implementation and application.
Location of incident: (TO BE FILLED IN WITH SPECIFICS OF INCIDENT – SUB-CATEGORY EA/OSEII CAN BE USED IN ANY LOCATION)
Description of incident: (TO BE FILLED IN WITH SPECIFICS OF INCIDENT)
Properties of spilled product: THIS TYPE OF OIL SPILL DOES NOT IMPACT THE EFFECTIVENESS OF OSE II – OSE II WORKS ON ANY TYPE OF HYDROCARBON-BASED SPILLED PRODUCT

specific or API gravity
viscosity, cp
pour point, at temp, F
sulfur content, %w
Responsible party information: (to be filled in with specifics of incident)
company
address
telephone

contact person
telephone
Feasibility Assessment Criteria
Specific location proposed for treatment: SUB-CATEGORY EA CAN BE USED IN ALL OF THE CATEGORIES LISTED BELOW
* What are the characteristics of the spill environment?
* type of environment, habitat
* marine, brackish, freshwater
* past spill history
Amount of weathering spilled product has undergone: THIS IS NOT RELEVANT WITH SUB CATEGORY EA / OSE II – OSE II CAN BE UTILIZED ON FRESH, LIGHT, HEAVY OIL, AND WEATHERED OIL/ HYDROCARBON-BASED MATERIAL EQUALLY EFFECTIVELY
Description of impact(s):
* Has ownership of land been determined: (TO BE FILLED IN)
* Has written permission from landowner been obtained: (TO BE FILLED IN)
* Bioremediation agent proposed for use: SUB-CATEGORY ENZYME ADDITIVE
* Name of product. OSE II
* Type of agent (microbial, nutrient, microbial + nutrient, etc.). ENZYME ADDITIVE
* Is agent listed on NCP? YES. It is B-53 ON THE NCP LIST PRODUCT SCHEDULE UNDER CATEGORY BIOREMEDIATION, SUB-CATEGORY ENZYME ADDITIVE TYPE (EA)
* Has EPA data been reviewed by the SSC? YES
* To what tier has the agent been formally evaluated? TIER III
* Does the agent or responsible party have any previous first hand experience with the use of the proposed bioremediation agent, or have any corroborated (laboratory or field) data indicating it enhances biodegradation and is not toxic to affected spill environment? YES – EPA HAS SUFFICIENTLY TESTED IT FOR TOXICITY AND PROVEN IT TO BE COMPLETELY NON-TOXIC. THE EPA HAS SUFFICIENTLY TESTED IT FOR EFFICACY AND PROVEN IT WORKS ON WEATHERED OIL AS WELL AS HEAVY AND EMULSION OIL. THE DOI HAS SUFFICIENTLY TESTED IT FOR EFFICACY AND PROVEN IT IS MORE EFFECTIVE THAN DISPERSANTS AND MECHANICAL. DOE
HAS USED IT TO CLEAN UP SPILLS EFFECTIVELY. DOC/NOAA HAS WITNESSED A SUCCESSFUL DEMONSTRATION OF OSE II REMEDIATING BUNKER C OIL IN SOUTH KOREA. IN EACH CASE ABOVE THEY WERE TESTED OR USED ON FRESH/MEDIUM/HEAVY/WEATHERED TYPES OF OIL.
* Has this agent been used on previous oil spills? AS OF MAY 17TH, 2013, IT HAS BEEN USED TO EFFECTIVELY CLEAN UP 23,600 OIL SPILLS ONFRESH/MEDIUM/HEAVY/WEATHERED TYPES OF OIL.
* What were the characteristics of the oil and the spill environment in each case? FRESH/MEDIUM/HEAVY/WEATHERED TYPES OF OIL ON ROCKY SHORELINE, SANDY BEACH, MARSH, ESTUARINE, RIVERINE, FRESH AND SALT WATER, OPEN OCEAN.
* Are degradation results (based on oil chemistry and microbial tests) available for review? YES, THEY ARE ALL AVAILABLE – A NUMBER OF KEY TESTS ARE CITED IN THE

ATTACHED COMPILATION OF DOCUMENTATION OF TEST AND USE RESULTS OF OSE II WITH THE RRT.
* Is a reference available? SEE DOI TEST CITED IN ATTACHED COMPILATION OF DOCUMENTATION OF TEST AND USE RESULTS OF OSE II WITH THE RRT
Supply:
* source of supply OSEI CORPORATION
* amount available – Enough to clean up a million gallons initially, with costed resupply every 5 days.
* ETA to site – (estimated 2-8 hours depending on location of site in Alaska)
Application:
* estimated amount of agent(s) needed (one gallon of OSE II for every 50 gallons of oil or hydrocarbon-based material)
* who will apply the agent (vendor personnel, response contractor personnel, or other contractor) vendor personnel or any response contractor capable of applying dispersants
* method to be used in applying agent any type of spray apparatus can be used, including aerial.
* impacts of proposed application method – 1) immediate reduction of the toxicity to the environment; 2) causes oil to float protecting the water column and seabed; 3) within 30 minutes, reduces adhesion properties so if oil reaches manmade structures or intertidal zone, or birds and other marine life or wildlife, it will not adhere; 4) diminishes fire hazard in a matter of minutes; 5) permanent removal of the oil/hydrocarbon-based material within a matter of a few days to a few weeks.
* time to prepare agent for application – ready to apply on delivery
* has application equipment been calibrated for this particular application – yes, with most eductor systems. However, if it needs to be changed it is simply a matter of changing the spray dial to 2%.
* planned rate of application – enough to address 500 thousand to a million gallons of oil per day.
* how long will application take – (this depends on the amount of oil spilled. For example, if it is 10,000 gallons, it's less than 30 minutes – if it is a million gallons, it would take several hours
* will product have to be reapplied - NO
- how frequently (not applicable)
Bioremediation Work plan
* Has a bioremediation Work plan been prepared? YES – SEE ATTACHED
* Has the plan been reviewed? (IT CAN BE REVIEWED QUICKLY)
Biomonitoring Plan
* Has a biomonitoring plan been prepared? YES
* Has it been reviewed? ABSOLUTELY – IT WAS WRITTEN BY THE EPA.
Project Management
Bioremediation application project manger: (TO BE FILLED IN PER INCIDENT)
contact number:
address:
This bioremediation application has been approved:

__ _____
Federal On-Scene State On-Scene Environmental Protection
Coordinator Coordinator Agency

_____

Department of Department of
Commerce Interior

This document fills in the wide information gap (incomplete and misgudance) that exists for oil spill response in the United States of America. This response plan shows there is a safe for responders, non toxic means to permanently remove oil/hydrocarbon based spilled material from the environment, fulfilling the US Clean Water Act, and OPAH 90. The RRT is now fully aware and has absolute documentation meets and or exceeds any and all federal, state and local requirements.
This response plan will now allow the EPA to meet its charter, as well as allow the President of the United states to meet his oath of office, and fulfill the requirements of the RRT, and its members. This response plan is the common sense approach the public demands and expects it elected officials, and the personnel working for the various US Federal departments to carry out.

APPENDIX C

COMPILATION OF DOCUMENTATION AND USE OF OSE II WITH EPA/RRT'S

US federal government and RRT groups that have associated with the OSEI Corporations product Oil Spill eater II.

OSE II is on the US EPA National contingency Plan for Oil Spills List.

Link http://www.epa.gov/oem/content/ncp/products/oseater.htm

This was the **5th time OSE II** had been successfully tested with this same method EPA method to get bioremediation products listed on the EPA NCP list.

EPA contractor utilizing OSE II on US navigable waters, on the Osage Indian Reservation in Oklahoma

The US EPA also spent millions testing OSE II through NETAC for bioremediation protocol development. OSE II's successful efficacy tests on Tier II which were peer reviewed by 31 scientist established the fact that OSE II should be tested in Tier II open water mesocosm tests. Tier III initial efficacy tests showed OSE II working well, Tier III also included toxicity testing on two separate marine species, which showed OSE II was practically non toxic. Link http://osei.us/technical-library-documents efficacy tests pages 25-28 and toxicity tests pages 99-101

EPA/NETAC testing performed by the University of Western Florida under contract from the US EPA Hap Prichard Gulf Breeze Florida performed toxicity testing with OSE II where in a simulated open water test OSE II was applied to oil and the effluent was tested on two different species and the average LC 50 was

Video proof OSE II is not toxic to fresh water marine species or plants, OSE II being applied directly to the waters surface with Koi fish swimming through the OSE II being applied to oil on the waters surface. This body of water with exotic p[lants and fish has had OSE II applied to it for over 2 years with no adverse effects to the fish or the plants see video at link http://osei.us/archives/1150

Video proof OSE II is non toxic to salt water marine species, this video also shows OSE II is non toxic to responders, and once OSE II has been applied to oil the oil will not adversely effect humans or adhere to humans as well. The end of the video shows how effective OSE II is at decontaminating equipment made of hydrocarbons and you can see how well OSE II cleans up shorelines as well, See link http://osei.us/archives/1135 see the frames on the video at time 9 minutes and 12 seconds, which shows a small fish swimming under the oil that has OSE II applied with no adverse effects!

EPA RRT VII tested OSE II on heavy waste oil in nine aquariums with pictures of the successful testing of OSE II in triplicate on heavy waste oil with water from a lake, Spring Lake, and from the Missouri River. The NRT/RRTIV guidance documents had stated bioremediation would not remediate heavy oils, the EPA/RRT VII has proven this is not the case.

EPA/RRT VII See Link:
http://www.osei.us/pdf%20files/RRT%20plus%20testing.pdf

EPA Al Venosa literature review of Bioremediation/OSE II see link
http://www.osei.us/pdf%20files/EPA%20peer%20review%20of%20OSE%20II.pdf

EPA RRT VI phone conversation with OSEI CEO Steven Pedigo, Jim Staves, Ragan Broyles, and Steve Mason, Jim Staves stated the EPA could not find a scientific reason why not to use OSE II April 16, 2012!

EPA RRT IV personnel viewed a successful demonstration of OSE II on sandy beach and marsh grass contaminated with BP Macondo well oil with Corexit attached. http://osei.us/archives/819

Oil Spill Eater II demonstrated for members of the Mississippi DEQ and EPA RRT IV members.

The US Navy used OSE II on US navigable waters spills in San Diego Bay on hundreds of spills, with whales and dolphins around without any adverse effects to any marine species while reducing their clean up cost over 87%. The US EPA Debra Dietrich and Nich Nichols met with the Navy officials with the OSEI Corporation in San Diego where EPA officials learned about the 100's of clean ups performed by the US Navy for 3 and ½ years.

Opening link to OSEI home page http://osei.us/

US Coast Guard Grotten, Conneticut sent a letter during the BP spill requesting the FOSC to take action with OSE II. The US Coast Guard has purchased and utilized OSE II since 1990 themselves.

Coast Guard link
http://www.osei.us/pdf%20files/Coast%20Guard%20BP%20spill%20approval%201.pdf

Coast Guard Commandent Paul Yost Class mate of Coast Guard (Ret) Admiral Lively of the OSEI Corporation requested the responsible party of the Valdez spill to test OSE II. Exxon tested OSE II in the winter of 1990 in Florham Park New Jersey along with at least 10 other products Exxon thought were the best

products in the world. Dr. Brown of the University of Alaska witnessed the test and relayed to us OSE II was 92% more effective than the next best product which included the toxic Inipol product Exxon had purchased the rights for. Exxon understood in the winter of 1990 what product would be the most effective product to clean up the Valdez spill, and because they were not going to make money on it they did not use it.

The US Department of Interior performed a test comparing OSE II to dispersants (Corexit 9527A and 9500A), and mechanical clean up. OSE II cleaned up 67% of the oil while the dispersants were not successful at being effective (sinking oil into the water column) and the mechanical clean up was able to clean up its normal 2 to 8%. OSE II was proven by DOI to be the superior clean up method. **This RRT trustee's test proves what is the most effective clean up response that meets the Clean water act requirements of permanently removing oil from the environment.** See test summary at link http://osei.us/brochures click on US Department of Interior study, this will allow you to read the summary of the test as well. http://www.google.com/search?client=safari&rls=en&q=OSEI+summary+of+Department+of+interior+test&ie=UTF-8&oe=UTF-8

US DOI link

//www.bsee.gov/uploadedFiles/BSEE/Research_and_Training/Technology_Assessment_and_Research/aa(3).pdf

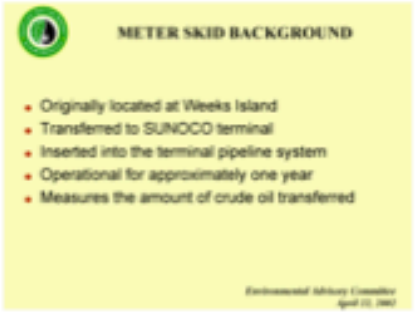
US NOAA officials visited a demonstration of OSE II, in Mo Hang Port South Korea, where the gentleman in the yellow jacket the head of the South Korean Coast Guard explained the great successful testing of OSE II, which led to a successful demonstration on the shoreline with South Korean government officials and the approval of OSE II for South Korea as well. These are pictures of NOAA officials wearing NOAA caps at the successful demonstration.

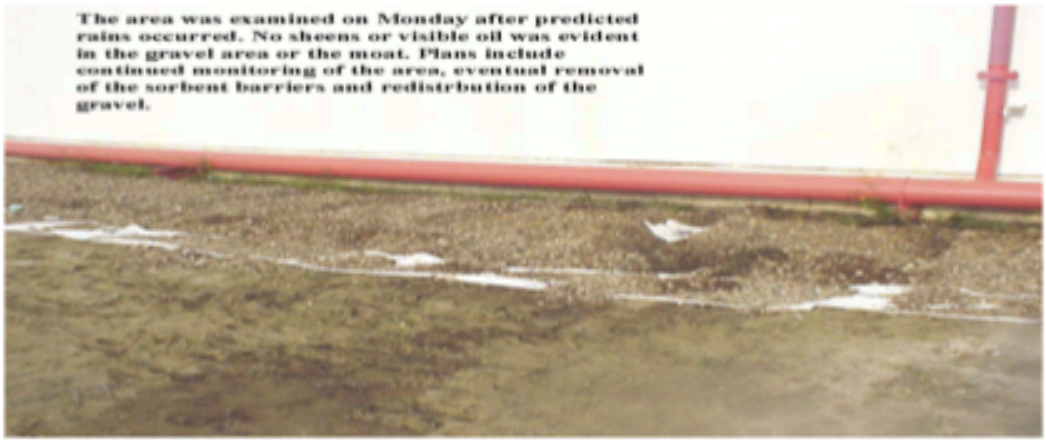


The conclusion of the successful test showed OSE II remediating the Bunker C oil to CO 2 and water, and showed there were small crabs that were living in the water for the duration of the test unharmed. See link http://osei.us/photoalbums/south-korea-hebie-spirit-2 scroll to the bottom of this picture set to see NOAA officials.

NOAA official Charlie Henry letter. See link
http://www.osei.us/pdf%20files/NOAA%20Charlie%20Henry%20final%201%2025%202011%20.pdf

US Department of Energy use of OSE II at their Sunoco Terminal





Oil Spill Eater II was used to successfully finish the Clean up of the storage tank mixer failing that produced this spill. The gravel around the storage tank did not have to be removed since OSE remediated the oil from site to CO2 and water.

SEE Department of Energy link at http://osei.us/photoalbums/department-of-energy-use-of-ose-ii-2

States that have requested the use of OSE II.

Valdez Spill

Alaska spring of 1990 Alex Viteri of Alaska department of environment quality, requested the EPA and Exxon to do a small demonstration test with OSE II on the Valdez spill, EPA never responded.

BP spill

State Of Louisiana

- A letter from the Office of A.G. Crowe requesting the use of OSE II

Louisiana Department of Environmental quality Sanford Phillips requested to demonstrate OSE II at least two times, Sam Coleman EPA RRT VI stated no and Sanford Phillips stated after the last request for the demonstration of OSE II for Sam Coleman to put his response in writing and Sam Coleman refused.

State of Mississippi

- A letter from Senator Gollot of Mississippi requesting the use of OSE II.

State of Alabama

- A letter from Senator Hank Erwin to RRT4 Alabama State Senator support for OSE II

This letter was sent to Unified command after ADAM viewed a demonstration of OSE II and tried OSE II themselves on tar balls from the BP Macondo spill see link http://osei.us/archives/858

City of Destin after seeing a demonstration of OSE II

http://osei.us/archives/1005 **The minutes of the special session to view the OSE II demonstration, as well as the minutes from 8/2/2010 where the city council unanimously voted to request to unified command the use of OSE II are under the video.**

- A certified letter from the Office of A.G. Crowe to Barack Obama at The White House demanding the use of OSE II

Governor Jindal of Louisiana attempted to have OSE II demonstrated on the BP Macondo spill on May 6, 2010, and RRT VI EPA stopped the Governor from utilizing OSE II to protect his states natural resources.

The preponderance of the evidence, demonstrations, videos, tests, and clean ups on US Navigable waters, as well as all the members of the RRT's that have tested and or utilized OSE II, has proven OSE II is the safer for responders, non toxic to marine species as well as plants, and permanently removes oil from the environment shows OSE II is the means to protect natural resources and return spills sites to pre spill conditions while protecting the environment.

APPENDIX D

LABORATORY ANALYSIS PARAMETERS5

Parameter	Sample Matrix	Methodology	Recommended Methods
Oil hydrocarbons (C17, pristane, C18; ne)	Water, Sediment or shore ial	GC + GC/MS	ASTM Method D3328
NH_3	horeline material	Spectrophotometric	EPA Method 350.1, 350.2 c
NO_3	Water, Sediment or shore rial	Spectrophotometric	EPA Method 353.2 or 353.3
NO_2	Water, Sediment or shore rial	Spectrophotometric	EPA Method 354.1
PO_4	Water, Sediment or shore rial	Spectrophotometric	EPA Method 365.1, 365.2 c
Toxicity	Water, Sediment or shore rial		

Sampling is to be conducted in accordance with an approved sampling plan and should utilize a justified random approach where the individual sites are selected based on appropriate habitat-types within treated and untreated zones. Within a site, individual sampling stations should be randomly chosen. Dependent on habitat-type, the site may be further divided such that specific zones within the site are monitored such as the upper and lower intertidal zones or stream-side and back marsh areas. Sediment grab samples may be collected using a variety of standard techniques. Core sampling is preferred for most intertidal and subtidal areas since it consistently allows for a highly reproducible volume of sample to be collected. Typically the core depth should exceed the depth of contamination if applicable and the core should be sectioned by 5 cm increments. Scoop-type grab sampling is applicable but great care is required to ensure that consistency is maintained. The sampling plan should provide exact guidance as to the width and depth of each sample.

Adjacent subsurface water samples may be collected using standard grab techniques. Caution should be exercised to prevent surface oil from contaminating the collection vessel as it is lowered to the specified sampling depth. Water grab sample will typically be collected at 1-3'depth.

Analytical methods used for bioremediation monitoring should be consistent with standard methods utilized for oil weathering and degradation studies. Analytical

guidance being developed by the EPA and NETAC for laboratory testing of bioremediation agents should be adopted for field monitoring studies.

Field and laboratory blanks should be specified in the monitoring plan and should represent at least 10% of the samples analyzed. To assess environmental variability, 10% of the sample stations should be sampled and analyzed in triplicate. Since no certified reference material is currently available for oil bioremediation monitoring, a reference sample of the spilled oil should be analyzed periodically to verify laboratory consistency. Quantitative values for the reference oil should not vary by more than 20% for selected analytes. Good laboratory practices should be employed that are consistent with the objectives of the biomonitoring plan.

Accurate sample identification and proper control of samples is essential. A chain of custody procedure will be established and implemented which will ensure integrity of the samples and proper handling of the samples.

APPENDIX E

INFORMATION FEEDBACK:
BIOREMEDIATION USE FOLLOW-UP FORM

Lessons learned from a spill cleanup operation are most useful when others, particularly those not personally involved in the original cleanup operation, can benefit from them by drawing upon the original responders' experiences. Region 4 has established a program to facilitate the collection and transfer of information on uses of bioremediation that is intended to provide decision makers with case data upon which future decisions regarding bioremediation may be based. Particularly because response officials have very limited experience with bioremediation in uncontrolled environments, such as open water and other marine areas, this program is expected to be a valuable resource for supporting informed decisions regarding bioremediation.

The principal objective of this bioremediation information feedback program in Region 4 are as follows:

To gather relevant, accurate, descriptive, and complete information from sites - where bioremediation has been used for spill response; and

To provide that information via an accessible network to future decision makers who are considering the use of bioremediation.

The Bioremediation Use Follow-Up Form on the following pages has been provided to guide information collection efforts in support of this program. A separate form should be completed for each unique bioremediation activity. Because certain information may not have been anticipated when the form was developed, feel free to provide any other information deemed appropriate regarding the use of bioremediation in a particular response action.

BIOREMEDIATION USE FOLLOW-UP FORM

A. SPILL INFORMATION

1. Spill event
2. Date
3. Location (e.g., offshore, wetlands, coastal)
4. Product(s) spilled
5. Amount of spill
6. Reason(s) for using bioremediation
7. Age of oil when bioremediation agents applied

B. BIOREMEDIATION AGENT INFORMATION

1 . First Treatment or Application:
   a. Type of agent applied (e.g., nutrient, microbial, enzyme)
   b. Name of agent
   c. Agent listed on the NCP Product Schedule?
   d. Vendor
   e. Vendor address and phone number
   f. Rate effectiveness (compared to control site) on a scale of 1 to 10, 10 being the highest score
      Visual observation
      Oil chemistry
      Method used (e.g., GC, GC/MS, TPH)

2. Second Treatment or Application (complete if different from above):
   a. Type of agent applied (e.g., nutrient, microbial, enzyme)
   b. Name of agent
   c. Agent listed on the NCP Product Schedule?
   d. Vendor
   e. Vendor address and phone number
   f. Rate effectiveness (compared to control site) on a scale of 1 to 10, 10 being the highest score
      Visual observation
      Oil chemistry
      Method used (e.g., GC, GC/MS, TPH)

3. Third Treatment or Application (complete if different from above):
   a. Type of agent applied (e.g., nutrient, microbial, enzyme)
   b. Name of agent
   C. Agent listed on the NCP Product Schedule?
   d. Vendor
   e. Vendor address and phone number
   f. Rate effectiveness (compared to control site) on a scale of 1 to 10, 10 being the highest score
      Visual observation
      Oil chemistry
      Method used (e.g., GC, GC/MS, TPH)

C. SITE CONTROLS

1. Size and number of test site(s)
2. Size and number of control site(s)
3. Site security measures taken

D. TREATMENT AREA LOCATION

1 . On water (latitude and longitude)

2. Shoreline (latitude and longitude)
   Shoreline type (e.g., sand, shell, cobble)
   Shoreline zone (e.g., intertidal, surge, storm/overwash) Depth of shoreline oiling

E. APPLICATION INFORMATION

1. Microbial counts before application
2. Microbial counts after application
3. Applications performed by (names and titles)
4. Application method(s) used
5. Application date(s)
6. Application conditions (e.g., winds, waves)
7. Agent concentration and rates (e.g., gal/acre)
8. Additional information on re-applications

F. MONITORING

1 . Schedule and duration (e.g., weekly for 3 months)
2. Method (e.g., foot, by air, boat)
3. Monitoring performed by (names and titles)
4. Toxicity noted

G. PROBLEMS ENCOUNTERED (e.g., weather, site security, application)

H. LESSONS LEARNED

1. CONTACTS
   1. OSC (name, address, and phone)
   2. SSC (name, address, and phone)
   3. Form completed by (name, title, and agency)

APPENDIX F

REFERENCES

Anderson, J.P.E. "Principles of and Assay Systems for Biodegradation." *Biotechnology and Biodegradation,* vol. 4, Advances in Applied Biotechnology Series. Texas: The Portfolio Publishing Company, 1990, pp. 129-146.

Atlas, R.M. "Biodegradation of Hydrocarbons in the Environment," *Environmental Biotechnology.* New York: Plenum Press, 1988.

Atlas, Ronald M. "Microbial Degradation of Petroleum Hydrocarbons: an Environmental Perspective." *Microbiological Reviews.* March 1981, pp. 180-209.

Leahy, J.G. and R.R. Colwell. "Microbial Degradation of Hydrocarbons in the Environment." *Microbiological Reviews.* September 1990.

Ponier, Ralph J. "Bioremediation Using Adapted Bacterial Cultures, Topic 1: Examination of Site Data and Discussion of Microbial Physiology With Regard to Site Remediation." *Proceedings of the Hazardous Materials Control Research Institute's First National Conference on Bioremediation.* 1990, pp. 321-361.

US Environmental Protection Agency. *Guide for Preparation of Quality Assurance Project Plans for the National Estuarine Program.* EPA 556/2-88-001. Office of Marine and Estuarine Protection, Washington, DC June 1988.

ADDITIONAL SOURCES OF INFORMATION ON BIOREMEDIATION

Ahearn, D.G. "Microbial Degradation of Oil Pollutants." Workshop, Georgia State University, December 4-6, 1972. Proceedings: Louisiana State University Center for Wetland Resources, Publication LSU-SG-73-01, 1973.

Chianelli, R.R., *et al.* "Bioremediation Technology Development and Application to the Alaskan Spill." *Proceedings: 1991 Oil Spill Conference.* March 4-7, 1991, San Diego, California, pp. 549-558.

Congress of the United States. *Bioremediation for Marine O# Spills.* OTA-BP-0-70. Office of Technology Assessment, Washington, D.C. May 1991.

DeLune, R.D., R.P. Gambrell, J.H.Pardue and W.H.Patrick, Jr. "Fate of Petroleum
Hydrocarbons and Toxic Organics in Louisiana Coastal Environments." *Estuaries. 13(1),* 1990, pp. 72-80.

Jordan, Randolph and James R. Payne. *Fate and Weathering of Petroleum Spills in the Marine Environment.* Michigan: Ann Arbor Science Publishers, Inc., 1980.

Lee, Richard F. "Metabolism of Petroleum Hydrocarbons in Marine Sediments." *Proceedings of a Symposium on Sources, Effects and Sinks of Hydrocarbons in the Aquatic Environment.* AIBS Publication, 1976.

Mearns, Alan J. *Observations of an Oil Spill Bioremediation Activity in Galveston Bay, Texas.* NOAA Technical Memorandum NOS OMA 57. June 1991.

Owen, D. "Bioremediation of Marine Oil Spills: Scientific and Operational Constraints," Proceedings of the Fourteenth Arctic and Marine Oil Spill Program Technical Seminar. Vancouver, British Columbia, June 12-14, 1991, pp. 119-130.

Pitter, Pavel and Jan Chudoba. *Biodegradability of Organic Substances in the Aquatic Environment.* Boca Raton, Florida: CRC Press, 1990.

Pritchard, P. Hap and Charles F. Costa. "EPA's Alaska Oil Spill Bioremediation Project." *Environmental Science & Technology.* 25 (3), 1991, pp. 372-382.

Sauer, Ted and Paul Boehm. "The Use of Defensible Analytical Chemical Measurements for Oil Spill Natural Resource Damage Assessment." *Proceedings: 1991 Oil Spill Conference.* pp. 363-369.

Venosa, A.D. and J.R. Haines. "Screening of Commercial Innocula for Efficacy in Stimulating Oil Biodegradation in a Closed Laboratory System." *Journal of Hazardous Materials.* 28: 131-144, 1991.

[1] Bioremediation [Types MC and NA] for open water spills is not considered to be appropriate or achievable because of the above two requirements. When nutrients are added to a floating slick, they immediately disperse into the water column, essentially diluting to background levels. [with the exception of NCP Listed Type EA based on extensive field use and testing on fresh and weathered hydrocarbons/oil. It recently demonstrated an 80% rate of PAH degradation on Macondo Block La. sweet crude containing Corexit per March 3 2011- BP BCST D.Tsao , LSU R..J. Portier, L. M. Basirico *Laboratory Screening of Commercial Bioremediation Agents for the Deepwater Horizon Spill Response.]*

[1] 2001 *Guidelines for the Bioremediation of Marine Shorelines and Freshwater Wetlands* (http://www.epa.gov/osweroe1/docs/oil/edu/bioremed.pdf)

[1] This description of the EA Type mode of action is based on the NCP listed sole sourced product Oil Spill Eater II's field use and test documentation on fresh and weathered hydrocarbons/oil in ocean, fresh water and shoreline environments. If another EA Type product is added to the NCP List, these descriptions may not apply and should be validated in field tests with that product.
[1] As per NRT Science and Technology Committee Bioremediation Fact Sheet: "Added bacteria seem to compete poorly with the indigenous population." … "and has not been shown to have any long-term beneficial effects in shoreline cleanup"

References:

EPA: *NRT SCIENCE AND TECHNOLOGY COMMITTEE Fact Sheet: Bioremediation in Oil Spill Response An information update on the use of bioremediation. May, 2000*

Zhu X., Venosa A.D., Suidan M.T., (Sept 2001) *Guidelines for the Bioremediation of Marine Shorelines and Freshwater Wetlands*, U.S. EPA.

U.S. EPA (2012) NCP Product Schedule, http://www.epa.gov/oilspill
http://www.epa.gov/oem/content/ncp/products/oseater.htm
BP BCST D.Tsao, LSU R.J. Portier, L. M. Basirico, March 3 2011, *Laboratory Screening of Commercial Bioremediation Agents for the Deepwater Horizon Spill Response.*

Zhu X., Venosa A.D., Suidan M.T., (2004) EPA/600/R-04/075 Literature Review on the use of Commercial Bioremediation Agents for Cleanup of Oil-Contaminated Estuarine Environments.
http://www.epa.gov/oem/docs/oil/edu/litreviewbiormd.pdf
Alleman, B.C., and E.A. Foote. 1997. Evaluation of Amendments for Enhancing Microbial Activity in Soils from Site 18 at MCAGCC Twentynine Palms, California. Battelle, Columbus, OH. Performing Organization Report Number D.O. 1795. Sponsoring Agency Report Number TCN 96-026. Feb. 7, 1997.

Zwick, T.C., Foote, E.A., Pollack, A.J., Boone J. L., Alleman, B.C., Hoeppel, R.E., Bowling L. (1997) Effects of nutrient addition during bioventing of fuel contaminated soils in an arid environment. In: *In-Situ and On-Site Bioremediation*: Volume 1, Battelle Press, Columbus, OH, pp. 403-409.

Bonner J.S., Autenrieth R.L., *Microbial Petroleum Degradation Enhancement By Oil Spill Bioremediation Products*, (Oct 1995) Report Submitted to Texas General Land Office (Comparative analysis of 13 NCP Listed Bioremediation Products, EA Type PAH reduction efficacy exceeded MC and NA.Types)
U.S. Environmental Protection Agency Office of Research and Development National Risk Management Research Laboratory Land Remediation and Pollution Control Division 26 W. Martin Luther King Drive Cincinnati, OH--added bacteria seem to compete poorly with the indigenous population (Tagger et al., 1983;

Lee and Levy, 1989; Venosa et al., 1992)--biostimulation alone had a greater effect on oil biodegradation than the microbial seeding (Jobson et al., 1974; Lee and Levy, 1987; Lee et al., 1997b, Venosa et al., 1996)

EA Type References:

LSU: Characteristics, Behavior, & Response Effectiveness of Spilled Dielectric Insulating Oil in the Marine Environment, June 2011
For U.S. Department of the Interior Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) Herndon, VA; By Louisiana State University
Department of Environmental Sciences
http://www.bsee.gov/uploadedFiles/BSEE/Research_and_Training/Technology_Assessment_and_Research/aa%283%29.pdf
A.T. Merski, (1993)-NETAC *Oil Spill Response Bioremediation Agents, Evaluation Methods Validation Testing, Discussion of Results.*

Dr. E. Brown, University of Alaska, Fairbanks (1990) Bioremediation performed on PAH's shows extreme or great reduction in the target analytes using EA Type. Report of Exxon tested Bioremediation EA Type in 1989 at Florham Park, New Jersey showing effective by a factor of better than 90% on the North Slope Alaskan Crude oil from the Valdez spill.
Galen Bartman, *Oil Spill Eater Respirocity Evaluation CAI Lab. No. 3265* (July 1990) additive [EA] has a meaningful and significant effect on decreasing the oil concentration and increasing the oxygen take up.

US Marine Corps at 29 Palms utilizing EA remediated tank wash out and several types of fuels (including tretra ethal lead) to State of California acceptable levels, DOD Environmental Award *Testing and Evaluation of Enzymatic Catalysis for the Remediation of Petroleum Contaminated Soils*
(Oct 93) pg 66 http://osei.us/tech-library-pdfs/2011/OSEI%20Manual_FINAL-2011.pdf
State of Alaska, Legal Closure Letter: pg75- 80 http://osei.us/tech-library-pdfs/2011/OSEI%20Manual_FINAL-2011.pdf The soils have been remediated to the most stringent cleanup levels-ADEC
State of New York, Groundwater remediation of heating oil by Alpha Geo Science with complete sampling and testing certified by NYSDEC, Summary and Results of In Situ Soil Remediation; No. 95-16786 pg. 80-86
http://osei.us/tech-library-pdfs/2011/OSEI%20Manual_FINAL-2011.pdf

R.H. Ward, SRI San Antonio Texas (1999)-EA Type does not sink oil into water column or sediments - Swirl Flask Dispersant Effectiveness Test SwRI Project Number: 08-2326-088 Workorder: 8783

Resource Analysts, Inc. Subsidiary of MILLIPORE (June 1990) References: 1) EPA SW 846, 3RD Edition Determination of no Trace Elements and Chlorinated hydrocarbons in EA Product.

M.en C. Gabriel Peneda Flores, Q.B.P. Norma Pescador Elizondo, (2002) Ecologia microbian Lab, University of Mexico-Instituto Politecnico Nacional, Escuela Nacional De Ciencias Biologicas – Efficacy test of EA Type on heavy (Maya Crude) and medium weight crude oil demonstrates significant reduction of PAH's (54% reduction in 30 days on the Maya crude, and medium crude reduced 80% in 30 days.)

Environmental Protection Authority New Zealand, Hazardous Substances Division, Benjamin Sowman, (16 July 2012); SOS # 1001797; Determination of the Status of Oil Spill Eater II-Non Hazardous

[1] 2001 *Guidelines for the Bioremediation of Marine Shorelines and Freshwater Wetlands* (http://www.epa.gov/osweroe1/docs/oil/edu/bioremed.pdf)

[1] This description of the EA Type mode of action is based on the NCP listed sole sourced product Oil Spill Eater II's field use and test documentation on fresh and weathered hydrocarbons/oil in ocean, fresh water and shoreline environments. If another EA Type product is added to the NCP List, these descriptions may not apply and should be validated in field tests with that product.

[i] 2001 *Guidelines for the Bioremediation of Marine Shorelines and Freshwater Wetlands* (http://www.epa.gov/osweroe1/docs/oil/edu/bioremed.pdf)

[ii] This description of the EA Type mode of action is based on the NCP listed sole sourced product Oil Spill Eater II's field use and test documentation on fresh and weathered hydrocarbons/oil in ocean, fresh water and shoreline environments. If another EA Type product is added to the NCP List, these descriptions may not apply and should be validated in field tests with that product.

http://www.osei.us/pdf%20files/NOAA%20Charlie%20Henry%20final%201%2025%202011%20.pdf

NOAA officials have also witnessed first hand the successful testing and demonstration of OSE II at Mo Hang Port South Korea see link http://osei.us/photoalbums/south-korea-hebie-spirit-2 see specifically pictures 46, and 47 for NOAA officials.

See link http://osei.us/pdf%20files/OSEI-Summary-of-Department-of-Interior.pdf

BP requested the use of OSE II for the BP Macondo spill see links http://osei.us/wp-content/uploads/Goetzee-BP-request-for-the-use-of-OSE-II-inclusion-statement-for-EPA-letter-of-may-2012.pdf

EPA RRT VII has proven see link
http://www.osei.us/pdf%20files/RRT%20plus%20testing.pdf

The DOI proved category EA/OSE II is superior to dispersants and mechanical clean ups which were historically used, and proven very ineffective,see link
http://osei.us/pdf%20files/OSEI-Summary-of-Department-of-Interior.pdf

See link with category EA/OSE II and a fire departments flammability tests http://osei.us/gas.pdf and link http://osei.us/photoalbums/690-2 Chief Shan English observed the tests.

See link Dubai https://www.dropbox.com/s/0q9bl9238qqxq2g/IMG_2325-1.MOV
link Arabian Gulf Dammam Saudia Arabia http://osei.us/archives/1135 link Thane Creek India http://osei.us/archives/1128

Texaco fresh water spill http://osei.us/photoalbums/crude-oil-spill-cleanup

EPA contract measured toxicity of category EA/OSE II and found category EA/OSE II to be non toxic and stated category EA did not create any toxicity, see link
http://www.nbiap.vt.edu/brarg/brasym95/kavanaugh95.htm

18 toxicity tests http://osei.us/wp-content/uploads/18-Toxicity-test-with-4-2012-Log0.pdf

exotic fish or the surrounding plants http://osei.us/archives/1150

OSHA letter in regards to OSE II at link http://osei.us/tech-library-pdfs/2011/9-OSEI%20Manual_OSHA.pdf

MSDS at link http://osei.us/tech-library-pdfs/2011/8-OSEI%20Manual_MSDS.pdf

Al Venosa fact sheet and the OSEI Corporation reply May of 2000 See link http://osei.us/technical-library-documents see pages 191-198

RRT IV/NRT BIOREMEDIATION WORK PLAN
UTILIZING BIOREMEDIATION SUB-CATEGORY
TYPE ENZYME ADDITIVE – OSE II

(applicable for all RRT's)

Work plans are important to ensure the safe, coordinated, and well documented implementation of bioremediation. Work plans are comprised of systematic procedures and guidelines that clarify and resolve issues such as worker and public safety, documentation requirements, response personnel roles and responsibilities, treatment technique agent application protocols, and application control and oversight considerations. Complete Work plans must include spill and site specific considerations. It is essential in a response that every incident or event be managed according to a plan and bioremediation is no exception. The Work plan shall provide:

- A clear statement of objectives and actions.

Category EA/ OIL SPILL Eater II's objective in every spill scenario is to address as close to 100% of the spill as possible remediating the spilled hydrocarbon based pollutant to CO2 and water permanently removing the spill from the environment as per the Clean Water Act requirement.

- A basis for-measuring work effectiveness and cost effectiveness.

Category EA/OSE II requires $2.00 of OSE II for each gallon spilled that Oil Spill Eater II is applied to as of 5/15/2013. The work effectiveness will be readily observable since areas where OSE II has been applied correctly, the oil will be breaking up and separating from the shoreline marsh grass, etc, or in the case of open water spills the oil droplets become so small they become difficult to visually see. An area where the oil would not be breaking up would stand out and could be easily addressed by spraying OSE II to the oil that has not been addressed.

- A basis for measuring work progress and for providing accountability.

The visual observations of the oil breaking down and lifting from shorelines or disappearing into small droplets in the open waters could be readily viewed. If the oil is not breaking down, then redirecting crews to address these areas with OSE II is easily accomplished.

Plans should be prepared for specific time periods or operational periods. These periods can be of various segments of time. Decisions on the length of the operational period or time segments may be affected by the length of time available/needed to achieve objectives, the availability of resources, environmental considerations, and safety considerations.

Essential parts of any Work plan:

1. Statement of objectives - Statement of what is expected to be achieved. Objectives must be measurable.

Category EA/ OIL SPILL Eater II's objective in every spill scenario

is to address as close to 100% of the spill as possible remediating the spilled hydrocarbon based pollutant to CO2 and water permanently removing the spill from the environment as per the Clean Water Act, this can be readily viewed or GC/MS can be carried out if needed.

2. Organization - Describes what organization will be in place. This will describe in detail the specific roles and responsibilities of the participants in a bioremediation application technique. This will also describe the interaction of one entity to another.

The OSEI Corporation will provide a project supervisor, and one consultant for each area polluted by a spill, areas being shoreline, open areas, marshes, estuaries, and special areas. These consultants will oversee each section of the spill (such as the ongoing source of the well blow out for the BP Deepwater Horizon spill). There will be a consultant (deployment manager) that will also make sure, the logistics of staging and supplying application vessels water based or land based are supplied with OSE II in a timely manner. For larger spills this could require two consultants, and for larger spills over 10,000,000 gallons the number of consultants supplied by the OSEI corporation would be roughly one per 10,000,000 gallons of oil spilled.

3. Tactics and assignments - Describes tactics and control operations and what resources will be assigned. If the application is a large one, resource assignments may be done by groups.

There will be water based vessels for open water spills as well as aerial application, for shorelines land based, and shallow water craft with induction systems will be utilized, marsh and estuaries, shallow water craft with minimal pressure spray application will be utilized. The leading edge of a spill nearest to the shoreline will be address first since it is closest to land fall to prevent the spill from impacting the shoreline.

4. Supporting material - Examples include a map or sketch of the area(s) to be treated, communications, traffic plan, weather data, special precautions, and safety information.

Satellite mapping with average depth of oil analysis will be carried out as well to determine the amount of oil in any given acre, open water shoreline, or marshes, or tidal flats. Communications covering the most sensitive areas to be protected first from application of category EA/OSE II will be determined and where to place floating curtain booms since the oil will be caused to float allowing booms to actually protect inlets, bays, ports, and harbors, as well as sensate marshes and estuaries.

All supervisory personnel must be familiar with the plan and any changes which develop throughout the life of the project. This can be accomplished through briefings and by distributing copies of the written plan. As well as through cell phone and satellite phone communications.

The Work plan must include an avenue to provide for ongoing evaluation of the plan's effectiveness.

Supervisors should regularly assess work progress

against control operations called for in the plan. If deficiencies are found, improved direction or additional staffing may be required, tactical operations may need to be modified, and/or changes may need to be reflected in planning for the next segment of time. Tactical operations could change from wind or a change in current from an incoming storm, otherwise the plan will be consistent with addressing the shoreline and most sensitive areas first.
Demobilization activities, although often overlooked, are an integral part of the Work plan. As the project begins to wind down, everyone will be anxious to leave the scene and return home. Demobilization planning helps to assure a controlled, safe, efficient, and cost effective demobilization process.

Demobilization will follow from last vessels and personnel to first vessels and personnel until the site is closed.

Organization

The response structure or organizational framework identifies the participants in a response, their general areas of responsibility, and the lines of authority among them. A chart illustrating the participants in a bioremediation response activity in Region 4 and their inter-relationships would be very helpful in summarizing this information. In developing this section, the following questions should be addressed:

* Who will manage the overall bioremediation activity?
With Category EA/OSE II you would need an overall response manager, and open water official, for large spills this would be by areas, and may require more than one official, shoreline, official, ports, and harbor official, marsh and or intake official, official for man made structures, and the OSEI Corporation would present a counter personnel for the same areas.

- Who will be the likely participants (e.g. federal and state agencies) in the activity for the Region? What are the general roles?
- Who will be the likely participants, if any, from outside the Region? What are the general roles?

OSEI Corporation counter part personnel to help direct application areas and actions in concert with federal, state and local officials.

* Who will manage the monitoring portions of the activity?
The official for each of the affected areas will also be able to monitor through observation the oil that has been addressed and is breaking down.

- Who will develop an appropriate Work plan for the category EA first response bioremediation activity?
-
- The OSEI Corporation will present a plan for each area after satellite

- information has been obtained; however since category EA/OSE II is safe and has no down sides or trade offs, the immediate application of 1 gallon of OSE II mixed with 50 gallons of non polluted water from near the spill source and then the 1 gallon of mixed OSE II and water application to each spilled gallon can start while the plan is being developed for the particular case/area. The plan will include materials needed, OSE II and water needed, the entire scope of equipment required, which is minimal and readily available, support vessels and craft, or based on availability, the areas to be addressed first to last, and the step by step process for each area, the maintenance if any needed for each area, and testing requested by officials, therefore extraction of samples and the ice chest, sampling jars, labeling, and chain of custody forms and courier for samples to be taken to a designated lab. Sample plan attached.
-
- * Who will perform specific treatment method or agent(s) application(s)?
- Certified contractors that can already apply dispersants, except shoreline, sensitive areas, and marsh application will be added at the direction of the OSEI Corporation in concert with an RRT official or designate. These vessels and personnel are already in place for dispersants and the transition to utilizing OSE II is easily carried out.
-
- * Who will perform monitoring?
- *
- The federal, state, local official or designate to work with the OSEI consultant established for each area of the spill. The same officials overseeing the application of OSE II will be able to carry out a duel role, since you can easily observe the effects of applying OSE II to open water, shorelines, marshes/estuaries, and man made structures.
-
- * Who will perform public outreach?
- The OSEI Corporation will present information every 8 hours of the response, the reactions of the oil/hazardous substance to the application of OSE II and the areas protected, and estimated time to finish addressing an area.
- Describe in detail the specific roles and responsibilities of the likely
- participants (RRT, federal and state agencies, international
- governments/agencies, non-governmental organizations, responsible parties,
- etc.) in a bioremediation activity in Region 4. The information in this section should coincide with the information presented above on the regional response structure.
-
- The role of the designate to work with each OSEI consultant will be to oversee the application of OSE II in each segmented spill area. If there is a specific area of concern in a given area, special attention will be given to address it, so the safest most effective outcome of removing the oil from the environment can be obtained. The designate will be able to oversee application and to revisit application areas to monitor the effectiveness of the application and the oil response to the application. If a given area or spot is not reacting accordingly then a further application will need to be performed in order to make sure 1 gallon of the OSE II and water mixture is making contact with each gallon of oil spilled. OSHA has reviewed the contents of OSE II and has stated there are no concerns with exposure for humans, so responders and officials will be safe without the need for

hot chemical suits and respirators. Respirators may be needed initially to protect responders from the oil itself, and the need for this precaution can be gauged by the smell of the oil. Once the smell of the oil is lessened after the application of OSE II has occurred, there is no further need for protecitive respirators.

-
- **Tactics and assignments**
-
- Tactical direction includes determining the tactics and operations
- necessary for the selected strategy and determining and assigning the
- appropriate resources.
-
- Once the spill volume is determined, and the areas it covers, the decision to use aerial spray will be determined. The need for resupply vessels for fuel, food, water and OSE II, etc, the number of aerial spray craft, the number of vessels equipped with spray apparatus similar to dispersant spray apparatus, the number of shallow water vessels and land based application vessels will be determined. The number of vessels will be determined so as to give the spill complete coverage without producing a traffic problem in a given area. A staging area for supplies and OSE II will be established. For large spills this may be numerous areas. An OSEI consultant will be assigned to each area, with an official designate to work with them for application and monitoring, and test extractions if required, and area maintenance, if needed. They will report back every 4 hours, and adjustments can be made by the OSEI Corporation consultant, with agreement from the official designate, or the request for a change in procedure can be requested to the OSEI Corporation spill overseer, and then this can be agreed upon with the official designate. Based on the type of oil, and if the spill event is singular and not ongoing once the oil has had OSE II applied to it with a one to one application of OSE II and water mixture, the oil will start to break up in minutes in the Gulf, and reduce to small particles in open water becoming difficult to see. The oil with OSE II applied in the environment, where OSE II's ability is exponentially more effective than in closed laboratory tests, should have the oil toxicity reducing quickly, and the adhesion properties eliminated in 20 to 30 minutes. This may take a bit longer if it is Bunker C or a very heavy type oil. (In the case of a very heavy oil, 30 minutes after applying OSE II a second application may be needed to force the further breakdown of oil faster, if needed to protect sensitive areas). The importance of adhesion properties reduction is to prevent migratory wildlife from becoming coated in oil. The fact the oil is caused to float prevents the oil from impacting marine species, the water column, the seabed, and its sediments or flora. All during these steps the oil is being converted to CO2 and water, exactly following mother nature's own process - just speeding it up.
-
- The plan will be to protect the most sensitive areas, first by applying OSE II to the oil closest to the most sensitive area, along with booming and absorbent barrier strategies, to cut off oil all together from reaching certain areas; then, from an order of first to last of areas that need to be addressed and the vessels, and equipment needed to fulfill a complete removal of the oil from the environment.
-

- Resource assignments should be made for each specific work task. Such
- assignments should consist of the kind, types and numbers of resources available and needed to achieve the desired outcomes. The resources for the actual application will be in the various areas response plan developed by the OSEI Corporation once the scope and type of spill has been determined.
-
- Personnel and logistical support factors must be considered in determining tactical operations. Lack of logistical support can mean the difference between success and failure in achieving objectives. There will need to be staging areas for supply, and the personnel to handle the transfer of supply, as well as vessels and their intended use and area. The development of this part of the plan will be derived from the scope and type of oil spilled. The plan can be developed very quickly by the OSEI Corporation based on the facts surrounding the specific spill and will include required materials and equipment.
-
- **Supporting Material**
-
- Public Safety/Information - Public safety is paramount in any
- bioremediation project. The following are some suggested actions that should
- be taken during a spill response to ensure public awareness and protection:
-
- Provide news releases and updates to newspapers, radio, television stations,
- and neighboring areas that could potentially be impacted by bioremediation activities. Be prepared to discuss details regarding the chosen treatment technique in simple lay terms so the affected public will have an understanding of exactly what to expect and what the expected benefits are.
-
- Category EA/Oil Spill eater II does not contain any hazardous chemicals
- as per the country of New Zealand's review, and per the MSDS sheet. This
- means OSE II itself is not a concern; however, direct contact and inhalation of the
- oil is of concern and the non responders should be asked to stay away from spill areas, or at least warned of the potential risk with oil spills. Once the application of OSE II is complete in any given area at temperatures above 40°F the oil should be remediated to CO2 and water within 14 to 30 days. At that point the waters would be safe once again for recreational purposes and there would be no residual oil on the sediment to come ashore later. The fish and seabed species would all be safe to harvest since the oil would have never encroached their living areas, and or they would have been able to escape the oil's toxicity since it would be held on the surface and prevented from entering the water column or seabed.
-
- Site/Worker Safety - Worker health and safety is always the foremost concern during any spill response action. Since all oil spill response actions require a health and safety plan and the bioremediation application is merely a facet of the total spill response effort, the existing heath and safety plan should be used for the bioremediation application and augmented with the specific safety hazards associated with the bioremediation treatment method or agent application. A section referred to as biological hazards should be

included in all health and safety plans associated with oil spill responses where biological agents are used as a response tool. This section should discuss the specific health and safety concerns associated with possible exposure to biological agents and include material safety data sheets (MSDS) for all agents being used.

-
- At a minimum, the health and safety plan should address the following aspects of
- the bioremediation treatment method/monitoring program:
-
- 1. Minimum health and safety concerns:
- Any concerns regarding health and safety would be because of the oil, not OSE II. OSE II is completely non-toxic - you can wash your hands with it and handle OSE II with no harmful effects whatsoever.
- 2. Potential hazards during application and monitoring:
- There are no potential hazards from OSE II itself. There are,
- however, from the oil, and direct contact with the oil should be avoided.
- 3. Evaluations of those identified hazards:
- Any hazards related to oil spill cleanup with OSE II are solely from the oil itself and not OSE II. Direct contact with the oil should be avoided.
- 4. Actions described to minimize the potential hazards:
- Goggles to avoid gaseous oil vapors should be worn to avoid irritation of the eyes.
- A mask should be worn to prevent inhalation of oil vapors. Gloves should be worn to avoid any direct contact with oil.
- For those responders only dealing with the supply line of OSE II to the site, etc., no Haz Mat equipment of any kind is required because OSE II is totally non-toxic and safe for responders.
- 5. Response(s) needed if hazard does affect worker(s).
- Category EA/OSE II, in and of itself, is not a hazardous material and it does not contain any hazardous chemicals. After reviewing OSE II's matrices, OSHA has stated that OSE II does not pose any potential harm to humans.
-
- However, when around an oil spill, we suggest gloves in case of contact with the oil, goggles to protect from oil/gas vapors, and a mask to protect from oil vapors. Neither Chemical respirators nor chemical suits are required. Normal hygienic practices should be carried out. Any gloves or clothing, shoes or boots that come into contact with the oil can be safely cleaned off with OSE II. The oil is the hazard of concern, not OSE II.
-
- The following documents contain guidance on the preparation of health
- and safety plans:
- 1. OSHA 1910.120 and EPA 40 CFR 311,
- 2. USEPA, OERR ERT Standard Operating Procedures,
- 3. NIOSH/OSHA/USCG/EPA Occupational Health and
- Safety Guidelines,
- 4. ACGIH Threshold Limit Values, and this would be
- needed for the oil not OSE II.
- 5. existing local and area contingency plans.

- To avoid disturbances to the treated area after treatment, all treated and
- control sites should be secured by the best achievable means. To avoid possible
- injury, post warning signs or secure the treated area to differentiate the site from
- surrounding localities.

Appendix G

Bioremediation Monitoring Plan for Bioremediation, Sub-category EA Enzyme Additive - OSE II

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JAN 16 1992

OFFICE OF
SOLID WASTE AND EMERGENCY RESPONSE

MEMORANDUM

SUBJECT: Region 6 Bioremediation Spill Response Plan

FROM: Karen Sahatjian, Chair
Implementation Subgroup, Subcommittee on National Bioremediation Spill Response

TO: Members of the Implementation Subgroup

Again, I would like to thank those members of the Implementation Subgroup who attended our meeting on Thursday, December 5, and Friday, December 6, 1991, in New Orleans, Louisiana. We have made great strides over the past few months in developing the Region 6 Plan and I sincerely thank everyone for their participation.

Attached for your review is the latest draft of the Plan. I would appreciate your careful attention in reviewing the draft, as I would like to present the Plan on behalf of the Subgroup in final form to the Regional Response Team next month. As we discussed at the New Orleans meeting, I have set up a conference call on January 28 to discuss any comments or concerns you may have regarding the Plan. Please call (202) 269-4246 at 2 p.m. Eastern time to be connected into the conference. The conference call has been scheduled for 2 to 3:30 p.m.

Please feel free to call me at (202) 260-1354 if you have comments or questions. Once again, thank you very much for contributing your time and effort to this important project.

Attachment

SECTION 6

MONITORING

Bioremediation is often assumed to enhance the biodegradation of oil or hazardous substances without increasing adverse impacts to human or ecological health. Until there is evidence to confirm this assumption, however, bioremediation effectiveness and safety need to be monitored through a sound program of applied science.

This section presents a general plan that provides Federal On-Scene Coordinators (FOSCs) with the information needed to prepare for, implement, and oversee monitoring activities designed to enable the objective evaluation of bioremediation in the response to a spill. (Please note that these activities should be coordinated with the activities of the Shoreline Cleanup Assessment Team.) The plan is intended primarily for monitoring oil spill bioremediation activities conducted in coastal areas and estuaries. Preparing for monitoring in advance of a spill is stressed in order to reduce the number of decisions that must be made during an actual response, increase the effectiveness of monitoring efforts, and promote the use of standard, accepted protocols.

The plan presented in this section is intended to be implemented primarily through the responsible party's or the FOSC's contractor. The contractor will use this plan as a minimum scope of work to develop a detailed, site-specific workplan (the specific elements of the workplan will be developed through negotiation with the monitoring Project Manager). If an agency of the Regional Response Team (RRT) decides to implement a bioremediation monitoring plan with its own resources, that agency will also need to develop such a workplan.

6.1 OBJECTIVES

The principal objectives of the monitoring program and the major elements of each objective are listed below.

Objective 1: Determine the efficacy of the selected bioremediation agent in enhancing the degradation of spilled contaminants.

- Certify the viability of microorganisms and/or nutrient composition of the bioremediation agent in a laboratory setting before or concurrent with the initial application; Done → this has been accomplished repeatedly
- Certify the ability of the bioremediation agent to degrade or enhance the degradation of spilled contaminants in a laboratory setting before or concurrent with the initial application; and Done → this has been accomplished repeatedly
- Determine the extent to which the bioremediation agent has enhanced the rate of contaminant biodegradation as compared to an untreated, contaminated site.

Objective 2: Measure the environmental impact of bioremediation treatment for the duration of the monitoring activity. Dispersant toxicity tests with OSEI for the EPA show the oils toxicity is reduced by 1000 in 24 hours

- Determine the extent to which the bioremediation agent increases or decreases the toxicity of spilled contaminants; OSEI reduces
- Document adverse physical effects attributable to bioremediation agent application and monitoring activities; and in over 16,000 spill cleanups over 22 years there has never been ANY advese effect with the use of OSEI
- Determine the extent to which the bioremediation agent alters the nutrient dynamics of the treated habitat. OSEI by causing oil to floot prevents the depletion of O2 in the water column & keeps the oil to OSEI on the surface.

Objective 3: Ensure the comparability of data collected from all monitoring projects in the Region for use in a Region 6 bioremediation data base. OSEI really doesnot effect nutrient levels as tests have proven

- Employ standard methods and operating procedures at all monitoring projects; and
- Conduct sampling both at replicate treated and untreated (control) sites for all bioremediation activities, unless replication is specifically ruled out on the basis of informed judgement by the FOSC or the monitoring Project Manager. Sampling from replicate sites is needed to establish variance of means among sites.

6.2 USES OF COLLECTED DATA

The primary use of monitoring data will be for response management decision-making by the FOSC. Properly collected, validated, and interpreted data provide critical information to assess the efficacy and environmental impact of bioremediation treatment and related response activities. Such documentation is needed to identify and correct problems in the biological treatment process, to determine whether bioremediation end-points have been reached, to ensure that biotreatment is less environmentally harmful than the spilled pollutant, and to support cost recovery and other legal actions.

Secondarily, the data can also be used for developing regional and national data bases, interfacing with natural resource trustees, preparing interim and final reports, and revising this monitoring plan.

6.3 MONITORING PLAN DESIGN

OSEI was successfully tested & monitored through EPA/NETAC Tiers III & IV

The monitoring plan described in this section is designed to be implemented in various levels of response based nominally on spill volume. The rationale for this design is that increasingly more comprehensive monitoring will be necessary and should be undertaken as the volume of a spill increases (assuming that the size of any bioremediation activity also increases), or as the potential for damage to sensitive resources attributable to the spilled oil or bioremediation activity increases, regardless of spill volume. (Weather conditions, the location of a spill, and the particular location of any ensuing bioremediation activity also need to be considered when determining the appropriate monitoring response level.) In addition, the design provides flexibility to tailor monitoring activities to best fit the conditions associated with a particular bioremediation activity.

Because a principal goal of monitoring is to establish whether the addition of bioremediation agents accelerates contaminant degradation without contributing significant adverse environmental impacts, the monitoring plan design provides for the comparison of data from replicate treated and untreated areas throughout the duration of a bioremediation activity. That is, the plan proposes that observations be made and samples collected and analyzed for: (1) uncontaminated, untreated source areas; (2) contaminated, untreated source areas; and (3) contaminated, treated source areas. This approach should be followed for each bioremediation activity and monitoring response level to the extent possible. after 16,000 spill cleanups, and numerous efficacy studies that by EPA & other governments OSE# has proven beyond

Details of each monitoring response level and the criteria for selecting treated and untreated sites are provided below. a shadow of a doubt that OSE# accelerates contamination degradation without adverse effects to the environment or responders

6.3.1 Monitoring Intensity Levels

Monitoring intensity levels describe the scale of field and laboratory activities that should be performed as part of the monitoring effort of a bioremediation activity. Monitoring intensity levels vary primarily with the size of the monitoring effort, rather than the specific types of activities to be performed. In this context, the "size" of the monitoring effort refers to the number of samples to be taken and the sampling density, as well as resource requirements needed to accommodate increased sampling and analysis activity.

The activities proposed for monitoring intensity levels assume that any bioremediation agent used is both listed on the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) Product Schedule and has undergone controlled laboratory testing that at least demonstrates its ability to degrade oil. Generally, it is assumed that bioremediation agents have not undergone adequate field testing to demonstrate their efficacy and safety.

Intensity I Monitoring Response -- Spill <240 Barrels

Historically, oil spills smaller than 240 barrels (or 10,000 gallons) have been the most common. Bioremediation activities following a spill of less than 240 barrels could be undertaken, for example, to clean up habitats, such as sensitive marshes, where mechanical methods would be inaccessible or too disturbing to be practical, or to hasten cleanup of lightly-oiled shorelines outside of public-use areas. Monitoring of a bioremediation activity following an Intensity I spill should, at a minimum, incorporate the following activities:

Field Activities

Reconnaissance -- collection of screening and qualitative information through a preliminary survey of the spill area. Information collected will be used to assist in designating treatment and control sites, evaluating logistics of monitoring, and determining resource needs. Reconnaissance activities should include performing visual observation from aircraft or boat; tracking oil distribution and movement; assessing the presence, location, and abundance of spilled material; and evaluating potential logistical problems posed by the physical habitat. Generally, this type of information will be collected by the Shoreline Cleanup Assessment Team as part of the monitoring for the overall response to a spill. Therefore, reconnaissance for bioremediation monitoring should be coordinated

with these other information collection activities to minimize any unnecessary duplication of effort.

Environmental parameters assessment -- collection of information on weather conditions and measurement of field conditions or water quality, where applicable, to assist in selecting treatment and control sites and, later, in evaluating effects of bioremediation agent applications.

Sampling -- collection of water, sediment, and/or shoreline-material samples on which to perform laboratory efficacy and toxicity tests to evaluate effects of bioremediation agent applications, as well as nutrient balance analyses. Samples should be collected in triplicate at each sampling site, water depth (as appropriate), and time. For applications in marshes or shallow waters, surface water and the top two centimeters of sediment should be collected. For applications on beaches or shorelines, only shoreline material (e.g., sand, shell) needs to be collected. For applications on enclosed open water (such as bays), surface and bottom water samples should be collected to the extent practical; at a minimum, where water is less than 20 to 30 feet deep, pretreatment surface water samples and sediments should be collected.

Other visual observation and documentation -- collection of qualitative information on environmental characteristics to help evaluate the effects of bioremediation agent applications and ensure that the spill situation and ensuing response are documented thoroughly and completely. Visual observations and measurements should focus on assessing readily discernable effects of oil and oil plus bioremediation agent on indigenous biota; physical effects associated specifically with agent applications and monitoring activities; presence, location, and abundance of spilled material; appearance changes (such as percent change in color, stickiness, and consistency) in spilled contaminants and bioremediation agent materials; and distribution and movement of spilled contaminants and bioremediation agent materials. Documentation shall be collected and assembled over the period of the response.

Laboratory Activities

Efficacy testing -- use standard EPA-approved laboratory protocols or other validated and accepted methods to analyze collected samples to measure relative changes in the: (1) composition and amount of spilled oil to assess the effectiveness of bioremediation agent applications; and (2) nutrient concentration to assess effects of agent applications on ambient concentrations and the adequacy of the application strategy to maintain microbial growth and degradative activity.

Toxicity testing -- use standard EPA-approved laboratory protocols to analyze collected samples to assess and confirm the presence or absence of toxicological effects associated with bioremediation agent applications relative to those associated only with the spilled oil.

Intensity II Monitoring Response -- Spill 240 to 2,400 Barrels

As the size of a spill increases, the likelihood of adverse effects that are attributable to the spilled oil also increases. Consequently, it is possible that several distinct habitats or sensitive

resources may be threatened or affected by spilled oil and that bioremediation may be considered for treating more than one of them. The number of unique bioremediation activities and, particularly, the scale of any bioremediation activities that may follow a spill of 240 to 2,400 barrels (or 10,000 to 100,000 gallons) are likely to exceed those that may follow an Intensity I spill. The approach to monitoring should more carefully consider the potential merit of applying bioremediation agents in particular environments or of applying particular agents as part of the overall spill cleanup strategy. A two-phased approach is proposed.

Phase I Activities

This phase provides for a pilot or small-scale field test to be conducted with each unique bioremediation agent or for each distinct habitat proposed for treatment (depending on the scale of application planned and its potential effects). For example, a bioremediation activity to treat the entire area of a 500-barrel spill should be preceded by a small-scale field test. Alternatively, a bioremediation activity to treat only a one acre area of a 500-barrel spill that does not encroach on any sensitive resources would probably not require an initial field test.

Specific monitoring activities to be performed include the following, as defined above:

- Reconnaissance, results of which will be used to designate both the location and size of test plots (one-fifteenth the area proposed for full-scale treatment is suggested; however, the area may be larger depending on the overall size of the proposed treatment area);
- Sampling; and
- Efficacy and toxicity laboratory testing, focusing on analysis of trends over the test period.

Phase II Activities

Based on results of Phase I field applications and monitoring, bioremediation agents may be applied on a larger scale and to several oiled habitats. The types of monitoring activities conducted under this phase should be the same as those conducted for an Intensity I Monitoring Response. The monitoring regime should be repeated for each distinct habitat that is treated.

Intensity III Monitoring Response -- Spill >2,400 Barrels

A spill of this size may require a multiplication of the level of effort outlined for an Intensity II spill (i.e., several small-scale field tests -- one for each habitat considered for treatment or each bioremediation agent considered for use -- and several monitoring teams with appropriate equipment and supplies to collect samples and make observations). If the FOSC recommends and the RRT concurs that equipment, personnel, and financial resources needed to conduct recommended monitoring cannot be obtained, monitoring could be performed on fewer sites as long as these sites are representative of treated habitats and allow for appropriate controls. The same types of field and laboratory activities described for Intensity II monitoring should still be performed.

6.3.2 Selection of Treated and Untreated Sites

Treated and untreated (or control) sites should exhibit similar chemical and physical characteristics to support their comparability. Preferably, a number of unique treated and untreated sites should be selected for each significantly different habitat intended for bioremediation treatment. To select treatment and control sites, the following are among the criteria that should be considered: (1) environmental parameters; (2) physical habitat and geological morphology; and (3) oil loading and the probability of further oiling.

Chemical characteristics of the spill environment as well as temperature may influence the effectiveness of bioremediation treatment. For aquatic spills, whether in enclosed open water, coastal areas, or estuaries, try to ensure that the variability in the following environmental parameters between sites is no greater than indicated below:[12]

- Dissolved O_2 concentration -- ±2 to 3 ppm (should be ±1 ppm);
- Salinity -- ±3 to 5 ppt (should be ±1 to 3 ppt); and
- Temperature -- ±3 to 5°C (should be ±1 to 3°C).

The physical habitat and geological morphology of the spill area can affect: (1) the extent of contact between contaminants and potential microbial degraders; (2) the potential for contaminant or bioremediation agent migration from or into test areas; (3) the ease and success of agent application and sampling efforts; and (4) the potential for unexplainable variances in observation and sample analysis results. Potential variances between test areas attributable to wave action, tidal flushing, currents, boat traffic, and exposure to wind or other external forces also should be considered and minimized, where possible, in selecting test sites.

Because efficacy analyses focus on evaluating relative changes in the concentration of the constituents of oil between treated and untreated sites, it is important to ensure that: (1) uncontaminated source areas remain uncontaminated for the duration of the monitoring program; and (2) contaminated areas, upon selection, are similarly oiled, and are not re-oiled for the duration of the monitoring program (otherwise, monitoring will need to be re-initiated). Uncontaminated control areas should be carefully selected to minimize the potential of contamination. Booming of control areas may be helpful. The selection of contaminated areas should be restricted to those with uniform oiling (i.e., ±10 to 20% difference). To lessen the probability of further oiling of treatment or control areas, the selection of treatment and control source areas proximate to any of the following should be avoided if possible:

- Inflows of water or runoff;
- Petroleum discharge sources; and
- Marinas and fish camps.

[12] Suggested maximum variations for these environmental parameters were recommend by Jim Clark of EPA's environmental laboratory in Gulf Breeze, Florida, with concurrence of the Monitoring Workgroup of the Subcommittee on National Bioremediation Spill Response's Implementation Subgroup.

6.4 MONITORING PARAMETERS AND COLLECTION FREQUENCY

The environmental characteristics and measurements that should be assessed and the samples that should be taken as part of the field monitoring activities are presented in Exhibit 6-1, along with a schedule for performing these activities. Sampling at each site, water depth (as appropriate), and time should be performed in triplicate. Although the size of samples collected should be based on the requirements of the analytical methods to be used for their analysis, the sizes of 1 liter for water samples and 20 grams (or 20 milliliters) for sediment or shoreline-material samples are recommended minimums. All samples should be collected in methylene chloride-rinsed jars or bottles with teflon-lined caps, as appropriate.

Parameters and methods for performing laboratory analyses of samples collected are presented in Exhibit 6-2. Copies of analytical methods are provided in Appendix F. Other methods are currently being developed by the National Environmental Technology Applications Corporation in coordination with EPA.

6.5 DATA QUALITY REQUIREMENTS AND ASSESSMENTS

All data collection activities must be planned and conducted to produce data of known and acceptable quality. To help ensure that these objectives are meet, all contractors performing work as part of the monitoring effort must submit to EPA and the lead agency from the affected state a quality assurance plan. Parameters for defining data quality include precision, accuracy, representativeness, comparability, and completeness.

Representativeness and comparability have been designed into this monitoring plan through provisions for replicate sampling from treated and untreated areas and the use of standard, approved methods for sampling and laboratory analyses.

[DATA QUALITY REQUIREMENTS FOR EACH TYPE OF MEASUREMENT MADE DURING A BIOREMEDIATION ACTIVITY DEFINED BY PRECISION, ACCURACY, AND COMPLETENESS ARE TO BE DEVELOPED BY THE REGION]

6.6 SAMPLE CUSTODY PROCEDURES

Accurate identification and proper control of samples is important to help ensure the acceptability and usability of the resulting analytical data. Having standard sample custody procedures is particularly important where the individuals performing sample collection may vary and where individuals collecting samples will not be the ones analyzing the samples. Where the monitoring program is conducted by a contractor, the contractor should designate a sample custodian who will ensure that custody procedures are properly followed.

[SAMPLE CUSTODY PROCEDURES OUTLINING THE METHODS FOR IDENTIFYING AND TRACKING SAMPLES, VERIFYING PROPER LABELING OF SAMPLES, AND ARCHIVING SAMPLES ARE TO BE DEVELOPED BY THE REGION]

EXHIBIT 6-1

FIELD MONITORING PARAMETERS

Parameter	Sample Size[1]	Assessment/Collection Location	Assessment/Collection Frequency[2]
Visual observations (mortality, behavioral effects, appearance changes, oil distribution)	N/A	All test sites	Daily to the extent possible; at least each day that water, sediment, and/or shoreline material sampling is performed
Temperature (air, water)	N/A	All test sites	Days 0, 1, 4, 10, and 20
Salinity	N/A	All test sites	Days 0, 1, 4, 10, and 20
Dissolved oxygen	N/A	All test sites	Days 0, 1, 4, 10, and 20
Sea state	N/A	Activity area	Days 0, 1, 4, 10, and 20
Current	N/A	Activity area	Days 0, 1, 4, 10, and 20
Wind velocity	N/A	Activity area	Days 0, 1, 4, 10, and 20
Efficacy (water, sediment, and/or shoreline material)	1 liter water; 20 grams sediment or shoreline material	All test sites and, as appropriate, all water depths	Days 0, 4, 10, and 20
Toxicity (water, sediment, and/or shoreline material)	8 liters water; 20 grams sediment or shoreline material	All test sites and, as appropriate, all water depths	Days 0, 1, and 4

[1] N/A means "Not Applicable."
[2] Frequency is relative to the time of agent application.

EXHIBIT 6-2

LABORATORY ANALYSIS PARAMETERS

Parameter	Sample Matrix	Methodology	Recommended Methods
Oil hydrocarbons (C17, pristane, C18, phytane)	Water	GC + GC/MS	ASTM Method D3328
	Sediment/shoreline material	GC + GC/MS	ASTM Method D3328
NH_3	Water	Spectrophotometric	
	Sediment/shoreline material	Spectrophotometric	
NO_3	Water	Spectrophotometric	
	Sediment/shoreline material	Spectrophotometric	
NO_2	Water	Spectrophotometric	
	Sediment/shoreline material	Spectrophotometric	
PO_4	Water	Spectrophotometric	
	Sediment/shoreline material	Spectrophotometric	
Toxicity	Water	4-day acute or 7-day chronic	
	Sediment/shoreline material	4-day acute or 7-day chronic	

6.7 SAMPLING AND ANALYTICAL METHODS

All sampling and laboratory analyses should follow EPA or other approved methods, unless otherwise stipulated or requested by the FOSC.

[RECOMMENDED SAMPLING AND ANALYTICAL METHODS WILL BE PROPOSED AT A LATER DATE]

6.8 RESPONSE ORGANIZATION AND RESOURCE REQUIREMENTS

For federalized spills, the decision to use bioremediation is made in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and the Region 6 Regional Contingency Plan (RCP). Once the decision and approval to bioremediate are final, the monitoring plan should be implemented. The RRT member agency that proposes the use of bioremediation on a particular spill will provide a Project Manager to implement the monitoring plan, subject to the approval of the FOSC. Personnel comprising monitoring teams and equipment resources to conduct monitoring will be provided by the RRT member agencies and contractors, as appropriate.

Specific responsibilities of the monitoring Project Manager include the following:

- Obtain approval from the FOSC for the monitoring plan;
- Assemble monitoring teams to perform observations and sampling, as appropriate, to successfully meet monitoring objectives;
- Coordinate all activities with the FOSC to ensure that monitoring does not interfere with other on-going or planned response operations;
- Name a sample custodian to coordinate all sample transfers and chain of custody;
- Ensure that monitoring teams have representation from each RRT member agency that wishes to participate;
- Provide a continuous communication link with the FOSC to ensure timely transfer of monitoring data and results that are relevant to response operations;
- Act as a liaison with natural resource trustees;
- Ensure that the quality of environmental data is known, documented, and sufficient to meet the requirements of the data users and decision makers; and
- Ensure the preparation and submission to the FOSC of all required reports on the monitoring effort.

Monitoring team members will be responsible for implementing this monitoring plan and any other bioremediation activity-specific procedures as directed by the Project Manager, ensuring

the quality of samples and data collected, and participating in the preparation and review of all required reports on the monitoring effort.

6.8.1 Personnel Requirements

The suggested minimum number of qualified personnel (in addition to the Project Manager) for carrying out the field activities associated with each monitoring response intensity level are listed below. Specific qualification requirements shall be provided by the RRT. In general, personnel responsible for making visual observations and measurements need to be trained or experienced in conducting physical observations in the field. Personnel responsible for collecting samples need to be properly trained and experienced in the collection of water, sediment, and shoreline material, as appropriate. Wherever possible, the same crews should conduct observations and sampling throughout the monitoring effort.

Intensity I Monitoring Response -- Spill <240 Barrels

- 2 people to conduct visual observations and appropriate documentation.
- 2 to 3 people to conduct land-based sample collection, as appropriate.
- 4 people to conduct water-based sample collection (2 boat operators and 2 sample collectors), as appropriate.

Intensity II and III Monitoring Responses -- Spills ≥240 Barrels

Personnel requirements for these levels of response will depend on the number and scale of each unique bioremediation activity undertaken simultaneously following a spill. The personnel requirements proposed for an Intensity I response should be used as a baseline and scaled-up as appropriate.

6.8.2 Minimum Equipment Requirements

RRT member agencies, other state agencies, and/or contractors that may oversee or participate in the monitoring for a bioremediation activity should be prepared to provide equipment resources necessary to conduct monitoring. The following equipment and supplies at a minimum should be assembled and be made ready for transport to the field to support a monitoring effort:

- Anemometers;
- Binoculars;
- Buckets (five-gallon size);
- Calculator;
- Camera (35 mm SLR) with film and appropriate filters;
- Cassette recorder (portable) with appropriate accessories;
- Cellular telephones and/or portable radios;
- Chain-of-custody forms;
- Chain-of-custody seals;

- Clipboard;
- Compass;
- Current meter;
- Field notebook;
- First-aid kit;
- Flashlight with batteries and spare bulb;
- Ice chest and ready access to ice;
- Kemmerer sampler or Van Dorn bottle, preferably stainless steel;
- Mercury thermometer (-5° to 45°C);
- Paper towels;
- Pens, pencils, and markers;
- Personnel safety equipment;
- Plastic sheeting and rubber bands;
- Polyvinyl chloride pipe, large diameter;
- Portable CTD or DO meter (or Winkler kit), pH meter, and conductivity meter (or refractometer));
- Resealable plastic bags;
- Sample containers (cubitainers, VOA vials, methylene chloride-rinsed one-liter jars, and methylene chloride-rinsed five-liter jars with silicone rubber "O" rings, silicone drain tubes, and teflon-lined lids);
- Sample preservatives;
- Shipping labels;
- Tape;
- Towels or rags;
- Video camera with tape, batteries, etc.;
- Vessels complete with communication and navigation equipment as appropriate for offshore motoring; and
- Watch.

6.9 DATA VALIDATION

All data will be subject to a thorough check by the FOSC and the monitoring Project Manager, or their designated representative, for errors in transcription, calculation, or computer input. In addition, the Project Manager will review all incident logs, sample logs, and data forms to ensure that requirements for documentation and data quality assessment have been met.

6.10 PERFORMANCE AND SYSTEM AUDITS

To help ensure that work being performed -- whether by contractor, EPA, or state personnel -- is progressing in accordance with the monitoring plan and any specified objectives or procedures, the FOSC, through the designated monitoring Project Manager, maintains the right to conduct performance or system audits of field and laboratory data collection activities. The category of audits are described below:

Management System Reviews -- evaluate the Quality Assurance Program of an organization, such as a firm contracted to conduct a monitoring project or laboratory sample analyses. The purpose of this review is to verify whether the quality assurance management procedures stated by contractor are in place, prior to a contract award.

Data Quality Audits -- evaluate a data set, or all data sets, of a particular project, by comparing the data set against specified data quality requirements for that data set.

Technical System Audits -- evaluate the actual environmental measurement data-collection systems and their associated quality control systems. These audits involve on-site auditing of field sampling activities, field measurement activities, and laboratory analytical procedures.

Performance Audits -- evaluate analytical methods and procedures of a laboratory. These audits are conducted by submitting performance evaluation samples to a laboratory for analysis. The samples contain specific pollutants in known matrices whose concentration and identity are unknown to the testing laboratory (the identity and concentration of pollutants is known to the submitter, however).

[PROVISIONS FOR PERFORMANCE AUDITS AND INTERNAL SYSTEM REVIEWS TO BE CONDUCTED BY THE MONITORING PROJECT MANAGER OR OTHER QUALITY ASSURANCE PERSONNEL ARE TO BE DEVELOPED BY THE REGION]

6.11 DOCUMENTATION AND REPORTING

During the course of a bioremediation activity and accompanying monitoring effort, the following reports should be prepared and submitted to the FOSC:

Activity reports -- provide descriptions of the bioremediation activity area, weather, unique observations, and activities undertaken, as well as the names, affiliations and signatures of persons on site. Activity reports should be prepared whenever activities on a site are undertaken.

Analytical reports -- provide laboratory analysis results of environmental and control samples. Analytical reports should be prepared and submitted by the analytical lab within 10 days after receipt of environmental samples for analysis.

After action report -- provides a description of the overall bioremediation activity and accompanying monitoring effort, including results of both field and laboratory activities. An interim draft should be submitted within 30 days after the end of the monitoring effort. A final draft (incorporating comments from the FOSC, RRT members, and other entities involved in the monitoring effort as well as photos) should be submitted within 60 days after submission of the interim draft. As to the discretion of the FOSC and the monitoring Project Manager, however, the time for submitting the final draft may vary depending on whether comments on the interim draft are received in a timely manner.

In addition, at the time the final after action report is submitted, all field notes, including those of contractors, should be submitted to the FOSC.

To facilitate information transfer and the development of a data base on bioremediation use and bioremediation agents, the Bioremediation Use Follow-up Form in Appendix G should be completed at the end of a bioremediation activity.

6.12 REVISING PLANS AND PROCEDURES

The monitoring plan and suggested procedures outlined in this section should be implemented and modified, as necessary, based on the cumulative experience and knowledge gained from conducting bioremediation field activities and associated laboratory activities. Recommendations for revisions should be submitted to the Region 6 RRT for approval. Upon approval by the RRT, revisions should be incorporated into the Region 6 RCP and other local contingency plans, as appropriate.

For Open water monitoring and testing the dispersant monitoring protocol can be used for category EA/OSE II as well.