Selection Guide for Oil Spill Applied Technologies

Volume I - Decision-Making

RRT III

RRT IV

****ATTENTION****

Disclaimer:

The information provided in this document by Region III and IV Regional Response Teams is for guidance purposes only. Specific information on countermeasure categories and products used for oil spill response listed in this document does not supersede the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), Subpart J, Product Schedule rule. 40 CFR Part 300.900 addresses specific authorization for use of spill countermeasures. Part 300.905 explains, in detail, the categories and specific requirements of how a product is classified under one of the following categories: dispersants, surface washing agents, bioremediation agents, surface collecting agents, and miscellaneous oil spill control agents. Products that consist of materials that meet the definitions of more than one of the product categories will be listed under one category to be determined by the USEPA. A manufacturer who claims to have more than one defined use for a product <u>must</u> provide data to the USEPA to substantiate such claims. However, it is the discretion of RRTs and OSCs to use the product as appropriate and within a manner consistent with the NCP during a specific spill.

For clarification of this disclaimer, or to obtain a copy of a current Product Schedule, please contact the USEPA Oil Program Center at (703) 603-9918.

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Selection Guide for Oil Spill Applied Technologies

Volume I – Decision Making

NOTE: This revision of Volume I of the "Selection Guide for Oil Spill Applied Technologies" reflects many changes from the previous versions.

Authors:
Ann Hayward Walker, Jacqueline Michel, Brad Benggio, Brad McKetrick, Debra Scholz, John Boyd, William Walker

Scientific and Environmental Associates, Incorporated and the Members of the 2002 Selection Guide Development Committee.

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Scientific and Environmental Associates, Inc.
325 Mason Avenue
Cape Charles, Virginia 23310
Tel. 757-331-1787, fax –1788, email **ahwalker@seaconsulting.com**

SELECTION GUIDE REFERENCE MATERIALS

The information contained within this selection guide was primarily developed from data supplied to the authors by the product vendors, as well as from the following sources:

USEPA, National Contingency Plan Product Schedule Notebook, October 1998, December 1998, February 1999, May 1999, August 1999, December 1999, April 2000, September 2002, and December 2002 revisions. Accessible from the USEPA website **www.epa.gov/oilspill/** or by calling (202) 260-2342 or (703) 603-9918.

Walker, A.H., J. Michel, G. Canevari, J. Kucklick, D. Scholz, C.A. Benson, E. Overton, and B. Shane. 1993. Chemical Oil Spill Treating Agents. Marine Spill Response Corporation,Washington, DC. MSRC Technical Report Series 93-015. 328 p.

Harless Performance Guild, Inc. 1995. Human Performance Technology. Newnan, GA.

Any additional reference materials specific to a product/technology category are provided at the conclusion of the Category summaries within Part 2 of this Selection Guide: Review/Selection of Options.

ACKNOWLEDGEMENTS

The authors would also like to gratefully acknowledge the assistance of the many individuals for the development and refinement of this Selection Guide. The editors made every effort to respond to all comments received. Individuals who participated in the initial development and this subsequent update of this document are detailed in Appendix L.

FRONT COVER PHOTO CREDITS

National Oceanic and Atmospheric Administration Web Page Photo Gallery
US Coast Guard Web Page Photo Gallery
Hyattsville, MD, Volunteer Fire Department Web Page Photo Gallery
Boise, ID Fire Department Web Page Photo Gallery

Selection Guide Overview

Context

The first line of oil spill cleanup operations on surface waters has been, and will continue to be, mechanical countermeasures such as booms and skimmers. However, when the limitations of mechanical countermeasures are met and oil threatens or continues to threaten the public interest or the environment, other response countermeasures and technologies should be considered. The effective and timely evaluation of these countermeasures may play a critical role in a successful oil spill response.

This Selection Guide is a compilation of information and guidance on the use of oil spill response technologies and actions that may be unfamiliar to Federal or state on-scene coordinators or local incident commanders. This lack of familiarity should not be equated with inexperience. Rather, experience with vendors in the field may leave decision-makers with the impression that these products and technologies don't work, aren't worth the trouble, or could jeopardize natural resource protection. Instead, once better understood, many of the technologies or products included in this Guide can be beneficial to removal actions and public safety, and provide additional protection to threatened resources and environmentally sensitive areas.

While many aspects of oil spill response operations are predictable, each incident is different because of the type and amount of product spilled, the location of the spill, the weather, or sea conditions, and what resources are threatened. Because of the potential complexities of effective oil spill response management, this Guide has been designed to simplify the evaluation of options for real-time response to actual oil spills.

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Shortcut to Table of Contents

About The Selection Guide

The primary objective of this guide is to provide information and guidance to responders for the timely evaluation of non-conventional or "applied" and infrequently-used technologies, i.e., ***chemical and biological products*** and ***response strategies,*** for a wide range of oil spill conditions and circumstances. The Guide contains information on ***12 types of products*** and ***5 types of strategies contained within 2 separate volumes:***

- The first volume includes ***decision-making information***, which includes information to conduct proactive evaluations by response decision-makers of a preliminary technology category, individual product, or technology during planning or incident-specific use. This information has been designed to be applicable nationwide.
- The second volume contains guidance ***procedures to implement and monitor their use,*** as well as document lessons learned. Volume 2 is region-specific and should be further developed by each Regional to address their specific needs and requirements for the use of applied technologies.

Scope

The Selection Guide includes information on applied technologies to counter the effects of spilled oil on land, on inland waters (fresh and estuarine), and coastal waters.

Updates And Website Access

The development of new or improved products or technologies for oil spill cleanup is ongoing. Unfortunately, much of the new information concerning the efficacy of products (or technologies) in particular situations is not immediately available to responders and when it becomes available, may be "too little, too late" to have a positive impact on the operation. Similarly, the successes (or failures) of products or technologies in actual field use and under varying circumstances should be accessible to the spill response community as a whole. This Selection Guide seeks to be a source of "best available" information to responders, as well as a repository for incident feedback to keep this information and guidance as up to date as possible.

The Selection Guide will be updated as new information or new emerging technologies become available. The goal is to post the Selection Guide on a Website to facilitate easy access and information exchange among regions, and regularly update it as new information and lessons learned become available.

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Intended Users

The intended users for this guide are ***all oil spill decision-makers***, both experienced and less experienced. They include members of the Unified Command, e.g., FOSC, SOSC, Industry, Incident Commander, and resource trustees, among others.

When to Use

The guide should be used:

- During spill ***response*** by the Planning Section.
- During pre-spill ***planning*** in developing Area Contingency Plans and Facility Response Plans.
- To assist decision-makers in evaluating ***vendor requests*** to use their product(s) at ***any time***.

Components of this document were developed as a job aid, i.e., sections were designed with sufficient detail to enable the decision-maker to make informed judgments for small spills without requiring outside technical support, e.g., ERT or SSC.

Development Background

This Selection Guide was initially developed under the Work Plan of the Region III Regional Response Team Spill Response Countermeasures Work Group in cooperation with the Region IV Regional Response Team. This revision was sponsored by USCG District 7.

Comments from USEPA, USCG, and State OSCs and resource trustees representing Regions III, IV, and IX have guided the development of this Selection Guide, along with the input of the Selection Guide Development Committees.

For more information on the Selection Guide development, refer to Appendix L

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Basic Reasoning

EPA and USCG OSCs in Region III indicated how they would consider using applied response technologies. Their basic ***sequence of logic to consider*** using applied technologies during an incident is as follows:

- Decide if applied technology(s) might provide value?
- Decide if the OSC has the authority to use it within its useful timeframe?
- If so, can it be here in time?
- If so, does it have application requirements that exceed the window of opportunity?
- If not, does it have unacceptable environmental, health and safety risks associated with its use?
- If it has special operational requirements, is there an identified specialist (technical contact) who can provide timely advice on its effective use?

Using Applied Countermeasures

Once a decision has been made to use an applied countermeasure, then the ***next actions*** required to use them in the "right" way include the development of:

- A testing plan to determine the applicability of the applied technology for the current incident conditions;
- An operations plan to effectively implement their use;
- A monitoring plan to document their effectiveness; and
- A report on the lessons learned from using them.

How To Proceed

The step action table below describes how to proceed within this Selection Guide:

IF you have:	AND:	THEN:
Used this guide and job aid in the past	Do not require any background information	Proceed to Part A: Screen Incident.
	Need a refresher on policy and guidance	Read the Decision Process and FAQs and then begin with Part A: Screen Incident.
NOT used this guide before	→	It is recommended you read the background information, beginning with Decision Process.

HOW TO USE THIS SELECTION GUIDE

Follow The Sequence

The Selection Guide provides a step-by-step process for determining which categories of technologies, and specific products and strategies, might be useful in various oil spill situations, during pre-spill planning or response. To document the rationale in making a technology selection, we strongly recommend that users complete the Selection Guide Worksheets as you proceed through the sequence of steps.

To evaluate requests for consideration by specific vendors, users can also go directly to Part B, the Review/Select Options section of the Guide to review information on specific products and strategies.

First Step

Table 1 contains an overview of basic information for each technology category, which orients the user on the specific technologies that are included in the Selection Guide, to give you a starting point on terminology and meaning.

Now – Screen The Incident (Environmental Matrices)

To consider the applicability of the technologies to a scenario or situation, matrices are provided to screen the incident by various characteristics. Three matrices are prepared to evaluate situations where the oil to be treated is on Inland Waters, Adjacent Lands, or Coastal Waters. Using the matrices facilitates a first-cut evaluation of the potential applicability of a technology category based on incident-specific characteristics including: a) the response phase, b) oil type, c) treatment volume, d) weather conditions, e) decision authorities, f) identification of a response problem or "consideration," and g) monitoring considerations. Assuming a potential applied technology or strategy may provide value, proceed to Part B.

Note: The user may need to conduct an individual evaluation using more than one environmental matrix if the incident specific conditions warrant.

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Next – Part B, Review Types of Strategies and Products (Concise Text Descriptions)

For each strategy or product category, a 2 to 3 page summary provides concise information to better define the strategy or product category, and identify potential concerns associated with its use. This section defines how these types of strategies or products work, that is, their mechanism of action. This section also describes their availability, application requirements, health and safety issues, operational constraints, environmental concerns, waste generation and disposal issues, what kind of decision authority is required when considering the use of a particular technology class, and where to look or go for technical assistance. Tables that contain specific information on each product or strategy in that category immediately follow these descriptions.

Then – Select a Specific Product or Strategy (Detailed Comparisons in Tables)

When a specific type of strategy or product is identified as potentially beneficial for a situation, the tables in Part B: Review-Select Option section allow a detailed comparison of other products or strategies within that category. The information compiled in these tables allow for easy comparisons of individual product information such as: toxicity data, efficacy test results, operational considerations, availability, whether it can be used in fresh or salt water, and several other specific types information, including photos and cost information (when provided) that assists in making a well-reasoned decision.

For More Information…

See Tab 5, the Appendices

The appendices in the last section (Tab 5) provide additional information, including a detailed glossary of terminology, an overview on toxicity and how to interpret toxicity data, the history, and status of the various technology categories. Case study information is being added, as it becomes available. Draft Press Release forms for media information are also included.

DECISION PROCESS

Who And How

The ***decision flow chart*** at the end of this section visually describes how decisions are made for applied technologies in the US.

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) gives the Federal On-Scene Coordinator (FOSC) primary responsibility for directing response efforts and coordinating all other efforts at the scene of a discharge or release (40 CFR § 300.105). This includes directing response efforts and coordinating all other efforts at the scene of a discharge or release.

FOSC Duties

The FOSC is charged with initiating defensive actions as soon as possible to prevent, minimize, or mitigate threat(s) to the public health, welfare or the environment of the United States. This includes the use of chemicals and other materials to restrain the spread of the oil and mitigate its effects (40 CFR § 300.310). As part of the national response priorities, all necessary containment and removal tactics are to be used in a coordinated manner to ensure a timely, effective response that minimizes adverse impacts to the environment (40 CFR § 300.317). This may include the use of products listed on the NCP Product Schedule and in this Selection Guide.

Decision Input And Concurrence

The FOSC is not the sole decision-maker regarding a product's use for mitigating a spill. The FOSC must first obtain concurrence of the incident-specific EPA representative to the RRT and, as appropriate, the RRT representatives from the state(s) with jurisdiction over the navigable waters threatened by the release or discharge, and, as practicable, in consultation with the DOC and DOI natural resource trustees.

There can be a pre-authorization or pre-approval agreement in place for a product or technology regulated by the NCP Product Schedule. In this case, the FOSC can proceed with the product's use according to the pre-authorization policy.

What About Local Government Incident Commanders?

Decisions for public safety issues for fires are under the purview of the lead public emergency response agency. Fire Departments and HAZMAT teams have the authority to "hose down" a spill using a chemical countermeasure if they determine that the spilled oil could cause an explosion and/or threaten human health. However, the use of an applied product, even in a situation designed to prevent or reduce the threat to human health and safety, requires that the lead emergency response agency notify the FOSC of this use.

One Exception … For Hazard To Human Life

"The Federal OSC may authorize the use of any dispersant … other chemical agent, including products not listed on the NCP Product Schedule, without obtaining the concurrence of the EPA representative to the RRT and, as appropriate, the RRT representatives from the states with jurisdiction over the navigable waters threatened by the discharge or release, when, in the judgment of the OSC, the use of the product is necessary to substantially reduce a hazard to human life. *Please note that, although* ***non-listed products can*** *be used,* ***listed products should*** *be used whenever possible.*

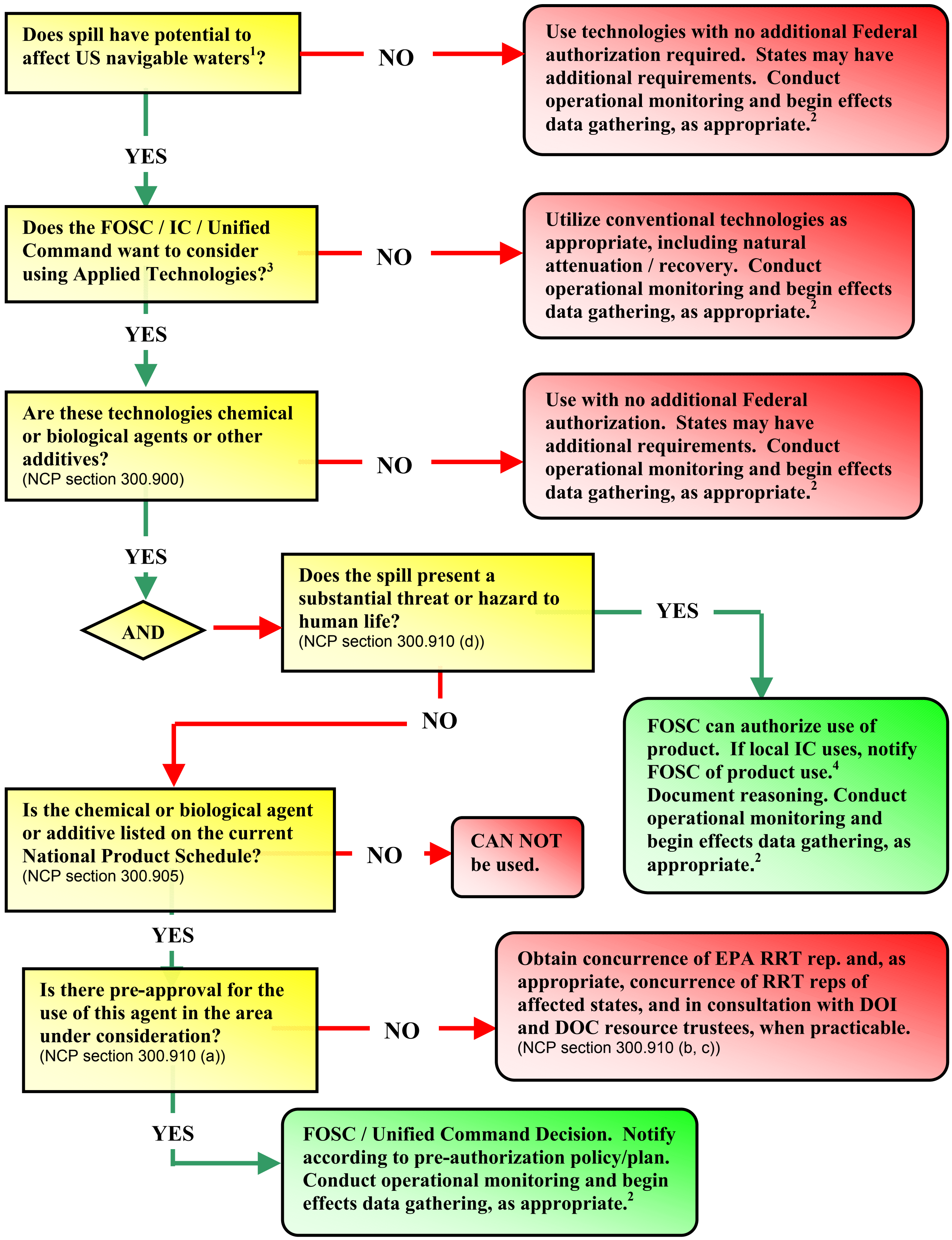
OSC Notifications

Whenever the FOSC authorizes the use of a product pursuant to the exception language in the regulations (see paragraph above), the FOSC is to inform the EPA RRT representative, and as appropriate, the RRT representatives from the affected sates, and, when practicable, the DOI/DOC resource trustees of the use of a product, including products not on the Schedule, as soon as possible.

Once the threat to human life has subsided, the continued use of a product shall be in accordance with paragraphs 300.910 (a, b, and c)." (NCP section 300.910 (d)).

Decision Process
for Using Applied Technologies During Response

Start Here: (Definitions on next 4 pages)



DECISION PROCESS FLOW CHART DEFINITIONS

#1 US Navigable Waters

[Taken from 40 CFR part 300 as defined by 40 CFR 110.1] means the waters of the US including the territorial seas. This term includes, but is not limited to:

A. all waters that are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters at are subject to the ebb and flow of the tide;
B. interstate waters, including interstate wetlands;
C. all other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, and wetlands, the use degradation, or destruction of which would affect or could affect interstate or foreign commerce including any such waters:
   1. that are or could be used by interstate or foreign travelers for recreational or other purposes;
   2. from which fish or shellfish are or could be taken and sold in interstate or foreign commerce;
   3. that are used or could be used for industrial purposes by industries in interstate commerce;
D. all impoundments of waters otherwise defined as navigable waters under this section;
E. tributaries of waters identified in paragraphs (a) through (d) of this definition, including adjacent wetlands; and
F. wetlands adjacent to waters identified in paragraphs (a) through (e) of this definition; provided, that waste treatment systems (other than cooling ponds meeting the criteria of this paragraph) are not waters of the US.

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#2 Operational Monitoring (a.k.a. effectiveness monitoring) is defined by Pond *et al*., (1997) as monitoring that "provides qualitative information, through visual observations [or other specified method] by trained personnel in real-time, during the actual response, to influence operational decision-making."

Effects monitoring (a.k.a. long-term data gathering) is defined as data that "provides quantitative information on the use of [a product] and the real effects following a spill to influence planning and future research" (Pond *et al.,* 1997). The longer time (weeks, or even months) involved with obtaining results from effects monitoring dictates that sampling should not be used to influence incident-specific decision-making. However, response and trustee agencies should begin gathering effects monitoring data as soon as practicable. Effects monitoring information collection is a long-term process and the results are typically not available in real-time to affect decision-making.

During a response, operational personnel need to be able to ensure the success of a response technique, and in particular, be able to direct, redirect, or discontinue the use of the response technique. Operational monitoring could be as simple as visually monitoring the effectiveness of a particular boom. Is it placed correctly? Is it functioning as expected? Is there any oil remaining to be captured with the particular boom? Or as complete as using Tier 3 Special Monitoring of Applied Response Technologies (SMART) protocols for dispersant use or *in situ* burn monitoring.

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#3 Applied Technologies

Are defined in this Selection Guide as:

Products	Strategies
• Bioremediation agents • Dispersants • Elasticity Modifiers** • Emulsion Treating Agents • Fire-fighting Foams* • *In situ* Burning on Land • *In situ* Burning in Inland Waters • Shoreline Pre-treatment Agents** • Solidifiers • Sorbents • Surface Collecting Agents** • Surface Washing Agents	• Fast-water Booming Strategies • Non-floating Oil Strategies • Oil-and-ice Response Strategies • Pyrolytic Oil Response Strategies • Water Intake Monitoring Strategies

* Not required to be listed on the NCP Product Schedule.
** As of this publication, there were no products listed on the NCP Product Schedule for these product categories.

#4 OSC

Decisions for public safety issues for fires are under the purview of the lead public emergency response agency. Fire Departments and HAZMAT teams have the authority to "hose down" a spill using a chemical countermeasure if they determine that the spilled oil could cause an explosion and/or threaten human health. However, the use of an applied product, even in a situation designed to prevent or reduce the threat to human health and safety, requires that the lead emergency response agency notify the FOSC of this use.

DECISION FLOW CHART DEFINITIONS (CONTINUED)

References

USEPA. 1994. 40 CFR Part 300, National Oil and Hazardous Substances Pollution Contingency Plan; Final Rule. In: Federal Register, Vol. 59, No. 178, Thursday, September 15, 1994. pp. 47, 384-47, 495.

Pond, R., J.H. Kucklick, and A.H. Walker. 1997. Dispersant Use: Real-time Operational Monitoring and Long-term Data Gathering. Prepared by Scientific and Environmental Associates, Inc., Alexandria, VA. Prepared for Marine Preservation Association, Scottsdale, AZ. 23 p.

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USING A PRODUCT DURING A RESPONSE

Concurrence	The Federal OSC may authorize the use of chemical or biological control agents listed on the NCP Product Schedule with the concurrence of the incident-specific EPA representative to the RRT and, as appropriate, the RRT representatives from the state(s) with jurisdiction over the navigable waters threatened by the release or discharge, and, as practicable, in consultation with the DOC and DOI natural resource trustees.
Incident-Specific	RRTs or Area Committees are encouraged to address the desirability of using agents listed on the Product Schedule and develop pre-authorization or pre-approval plans, as appropriate. The EPA representative to the RRT and the RRT representatives from the state(s) with jurisdiction over the navigable waters to which the pre-authorization plan applies and the DOC and DOI natural resource trustees shall review and either approve, disapprove or approve with modification these pre-authorization plans. When a pre-authorization plan exists, the FOSC can proceed with the product's use according to the pre-authorization policy.
Pre-Authorized	Prior to seeking this concurrence, the OSC must determine what, if any countermeasures from the Product Schedule would be applicable for the incident-specific spill conditions. Decision support guidance for choosing appropriate spill countermeasure technologies begins with several basic questions. These questions lead to the systematic approach for the Spill Countermeasure Technologies developed in the Selection Guide.

Pre-Approval Policies	In many cases, RRTs have developed pre-approval policies for use of certain countermeasures. Refer to the region-specific policies and/or plans that can be collected and stored in your region-specific Tabs in Volume II of this Selection Guide. This is especially true in the case of dispersants and *in-situ* burning for many regions around the country. These pre-approval policies facilitate rapid use of appropriate spill countermeasure technologies under specific circumstances.
Incident-Specific Authorization	If there is no pre-approval, the incident-specific RRT members must be convened for an incident-specific authorization. Concurrence must be obtained from USEPA and the state(s) in consultation with DOI and DOC. This approval process is often carried out in a phone conference with the incident-specific RRT members.

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LIST OF TABLES

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List of Products and Their Location Within This Selection Guide*.

The following table provides the decision-maker with a quick reference guide to the products currently listed on the NCP Product Schedule (Column 1 and 2 in **bold faced type**). In several instances, products are included in this document that are not currently listed on the Product Schedule (shaded lines). These products (primarily solidifiers) have had an extensive body of research conducted on them in recent years, and most of these products are readily available and being used by spill communities outside the US. However, under the rules established by the NCP (40 CFR Subpart § 300.915), these products would be considered chemical agents, and require listing on the NCP Product Schedule prior to their use in the US. The information for these non-listed products is contained in Appendix K unless otherwise stated in the last column.

Some products on the NCP Product Schedule are listed in a Miscellaneous category, which doesn't convey the function of the product to the reader. In those cases, the authors re-evaluated the products in terms of their mechanism of action and assigned them into functional countermeasure categories [e.g., Miscellaneous products ⇒ Surface Washing Agents (PES 51)]. The classification system for all products as evaluated in this Selection Guide is presented in Column 3.

#	PRODUCT NAME	PRODUCT CLASSIFICATION ON THE NCP PRODUCT SCHEDULE	PRODUCT CLASSIFICATION WITHIN THIS SELECTION GUIDE	CATEGORY REFERENCE PAGES	PAGE(S) FOR PRODUCT-SPECIFIC INFO
1	**Alsocup**	**Miscellaneous**	Solidifier	135 to 137	139 to 140
2	**Aquaclean**	**Surface Washing Agent**	Surface Washing Agent	157 to 159	161 to 162
3	**BET BIOPETRO**	**Bioremediation Agent**	Bioremediation Agent	87 to 90	91 to 92
4	**Biogee-HC (Microbes HC)**	**Bioremediation Agent**	Bioremediation Agent	87 to 90	91 to 92
5	**Biosolve®**	**Surface Washing Agent**	Surface Washing Agent	157 to 159	161 to 162
6	**BR (Biota Earth)****	**Not listed on NCP**	Bioremediation Agent	87 to 90	Appendix K
7	**CI Agent or Cheap Insurance**	**Miscellaneous**	Solidifier	135 to 137	139 to 140
8	**CN-110**	**Surface Washing Agent**	Surface Washing Agent	157 to 159	161 to 162
9	**Corexit 7664**	**Surface Washing Agent**	Surface Washing Agent	157 to 159	161 to 162
10	**Corexit 9500**	**Dispersant**	Dispersant	97 to 100	101 to 102
11	**Corexit 9527**	**Dispersant**	Dispersant	97 to 100	101 to 102

* **Warning**: Ensure that the revision date of this Guide is consistent with the most recent version of the NCP Product Schedule. If dates are not consistent, the information could be outdated. **Note**: As of this publication, there are only five product categories on the NCP Product Schedule: Dispersants, Bioremediation Agents, Surface Collecting Agents, Surface Washing Agents, and Miscellaneous Oil Spill Control Agents.

** Not currently listed or required to be listed for use in the US.

*** EPA has determined that this product is a Sorbent. therefore, this product does not need to be listed on the NCP Product Schedule.

#	PRODUCT NAME	PRODUCT CLASSIFICATION ON THE NCP PRODUCT SCHEDULE	PRODUCT CLASSIFICATION WITHIN THIS SELECTION GUIDE	CATEGORY REFERENCE PAGES	PAGE(S) FOR PRODUCT-SPECIFIC INFO
12	**Corexit 9580 Shoreline Cleaner**	**Surface Washing Agent**	Surface Washing Agent	157 to 159	161 to 162
13	**CytoSol**	**Surface Washing Agent**	Surface Washing Agent	157 to 159	163 to 164
14	**Dispersit SPC 1000™**	**Dispersant**	Dispersant	97 to 100	101 to 102
15	**Do-All #18**	**Surface Washing Agent**	Surface Washing Agent	157 to 159	163 to 164
16	**Elastol****	**Not listed on NCP**	Elasticity Modifier	105 to 107	107 to 109
17	**Enviro-Bond 403****	**SORBENT; Not required to be listed on NCP**	Solidifier	135 to 137	139-140
18	**Enzyt (Liquid/Crystal)****	**Not listed on NCP**	Bioremediation Agent	87 to 90	Appendix K
19	**F-500**	**Surface Washing Agent**	Surface Washing Agent	157 to 159	163 to 164
20	**FM-186-2**	**Surface Washing Agent**	Surface Washing Agent	157 to 159	163 to 164
21	**Gold Crew SW (ECP Responders SW)**	**Surface Washing Agent**	Surface Washing Agent	157 to 159	163 to 164
22	**Imbiber Beads****	**SORBENT; Not required to be listed on NCP**	Sorbents	143 to 145	147
23	**Inipol EAP 22**	**Bioremediation Agent**	Bioremediation Agent	87 to 90	91 to 92
24	**JD-109**	**Dispersant**	Dispersant	97 to 100	101 to 102
25	**JD-2000™**	**Dispersant**	Dispersant	97 to 100	101 to 102
26	**Land and Sea Restoration Product 001**	**Bioremediation Agent**	Bioremediation Agent	87 to 90	91 to 92
27	**Mare Clean 200**	**Dispersant**	Dispersant	97 to 100	103 to 104
28	**Micro-Blaze®**	**Bioremediation Agent**	Bioremediation Agent	87 to 90	91 to 92
29	**Nale-it**	**Surface Washing Agent**	Surface Washing Agent	157 to 159	165 to 166
30	**Nature's Way HS (Micro Clean)**	**Surface Washing Agent**	Surface Washing Agent	157 to 159	165 to 166
31	**NEOS AB 3000**	**Dispersant**	Dispersant	97 to 100	103 to 104

* **Warning**: Ensure that the revision date of this Guide is consistent with the most recent version of the NCP Product Schedule. If dates are not consistent, the information could be outdated. **Note**: As of this publication, there are only five product categories on the NCP Product Schedule: Dispersants, Bioremediation Agents, Surface Collecting Agents, Surface Washing Agents, and Miscellaneous Oil Spill Control Agents.

** Not currently listed or required to be listed for use in the US.

*** EPA has determined that this product is a Sorbent. therefore, this product does not need to be listed on the NCP Product Schedule.

Note: As of this publication, there were no elasticity modifiers listed on the USEPA NCP Product Schedule. In the US, any chemical agent or other additive (excluding sorbents) that may be considered for use during an oil spill response must be listed on the NCP Product Schedule. For definitions, refer to glossary.

#	PRODUCT NAME	PRODUCT CLASSIFICATION ON THE NCP PRODUCT SCHEDULE	PRODUCT CLASSIFICATION WITHIN THIS SELECTION GUIDE	CATEGORY REFERENCE PAGES	PAGE(S) FOR PRODUCT-SPECIFIC INFO
32	**Nochar A610**	**Not listed on NCP**	Solidifier	135 to 137	Appendix K
33	**Nochar A650**	**Not Listed on NCP**	Solidifier	135 to 137	Appendix K
34	**Nokomis 3-F4**	**Dispersant**	Dispersant	97 to 100	103 to 104
35	**Oil Herder**	**Not Listed on NCP**	Surface Collecting Agent	153 to 154	Appendix K
36	**Oil Spill Eater II**	**Bioremediation Agent**	Bioremediation Agent	87 to 90	93 to 94
37	**Oppenheimer Formula**	**Bioremediation Agent**	Bioremediation Agent	87 to 90	93 to 94
38	**PES-51**	**Miscellaneous**	Surface Washing Agent	157 to 159	165 to 166
39	**PRP (WAPED)**	**Bioremediation Agent**	Bioremediation Agent	87 to 90	93 to 94
40	**PX-700**	**Miscellaneous**	Surface Washing Agent	157 to 159	165 to 166
41	**Petrobiodispers**	**Dispersant**	Dispersant	97 to 100	103 to 104
42	**Petro-Clean**	**Surface Washing Agent**	Surface Washing Agent	157 to 159	167 to 168
43	**Petro-Green ADP-7**	**Surface Washing Agent**	Surface Washing Agent	157 to 159	167 to 168
44	**Petrotech 25**	**Surface Washing Agent**	Surface Washing Agent	157 to 159	167 to 168
45	**Premier 99**	**Surface Washing Agent**	Surface Washing Agent	157 to 159	167 to 168
46	**Pristine SEA I**	**SORBENT; Not required to be listed on NCP**	Sorbent	143 to 145	147
47	**Pristine Sea II**	**Bioremediation Agent (Biological Additive)**	Bioremediation Agent	87 to 90	93 to 94
48	**RapidGrab 2000™**	**Miscellaneous**	Surface Collecting Agent	153 to 154	155
49	**Rubberizer*** **	**SORBENT; Not required to be listed on NCP**	Solidifier	135 to 137	139 to 140
50	**S-200**	**Bioremediation Agent**	Bioremediation Agent	87 to 90	93 to 94

* **Warning**: Ensure that the revision date of this Guide is consistent with the most recent version of the NCP Product Schedule. If dates are not consistent, the information could be outdated. **Note**: As of this publication, there are only five product categories on the NCP Product Schedule: Dispersants, Bioremediation Agents, Surface Collecting Agents, Surface Washing Agents, and Miscellaneous Oil Spill Control Agents.

** Not currently listed or required to be listed for use in the US.

*** EPA has determined that this product is a Sorbent. therefore, this product does not need to be listed on the NCP Product Schedule.

Note: As of this publication, there were no elasticity modifiers listed on the USEPA NCP Product Schedule. In the US, any chemical agent or other additive (excluding sorbents) that may be considered for use during an oil spill response must be listed on the NCP Product Schedule. For definitions, refer to glossary.

#	PRODUCT NAME	PRODUCT CLASSIFICATION ON THE NCP PRODUCT SCHEDULE	PRODUCT CLASSIFICATION WITHIN THIS SELECTION GUIDE	CATEGORY REFERENCE PAGES	PAGE(S) FOR PRODUCT-SPECIFIC INFO
51	**SC-1000™**	**Surface Washing Agent**	Surface Washing Agent	157 to 159	167 to 168
52	**SPI Solidification Particulate** **	**Not listed on NCP**	Solidifier	135 to 137	Appendix K
53	**SX-100®**	**Surface Washing Agent**	Surface Washing Agent	157 to 159	169 to 170
54	**Sea Brat #4**	**Dispersant**	Dispersant	97 to 100	103 to 104
55	**Simple Green**	**Surface Washing Agent**	Surface Washing Agent	157 to 159	169 to 170
56	**Sorbents** **	**May be required to be listed; Check Appendix G**	Sorbents	143 to 145	147 to 150
57	**Split Decision SC**	**Surface Washing Agent**	Surface Washing Agent	157 to 159	169 to 170
58	**Step One (B&S Industrial)**	**Bioremediation Agent**	Bioremediation Agent	87 to 90	95 to 96
59	**System E.T. 20**	**Bioremediation Agent**	Bioremediation Agent	87 to 90	95 to 96
60	**Topsall #30**	**Surface Washing Agent**	Surface Washing Agent	157 to 159	169 to 170
61	**VB591 Water**	**Bioremediation Agent**	Bioremediation Agent	87 to 90	95 to 96
62	**Waste Set PS #3200**	**Miscellaneous**	Solidifier	135 to 137	139 to 140
63	**Waste Set PS #3400**	**Miscellaneous**	Solidifier	135 to 137	139 to 140
64	**WMI-2000**	**Bioremediation Agent**	Bioremediation Agent	87 to 90	95 to 96
65	**Zyme-Flow (Mari-Zyme, Petro-Zyme, Zyme-Treat)**	**Miscellaneous**	Emulsion Treating Agent	109 to 111	112

* **Warning**: Ensure that the revision date of this Guide is consistent with the most recent version of the NCP Product Schedule. If dates are not consistent, the information could be outdated. **Note**: As of this publication, there are only five product categories on the NCP Product Schedule: Dispersants, Bioremediation Agents, Surface Collecting Agents, Surface Washing Agents, and Miscellaneous Oil Spill Control Agents.

** Not currently listed or required to be listed for use in the US.

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Note: As of this publication, there were no elasticity modifiers listed on the USEPA NCP Product Schedule. In the US, any chemical agent or other additive (excluding sorbents) that may be considered for use during an oil spill response must be listed on the NCP Product Schedule. For definitions, refer to glossary

FAQs - National Contingency Plan (NCP) Product Schedule and Policies

What Is The National Product Schedule?

Section 311(d)(2)(G) of the CWA requires that USEPA prepare a schedule of dispersants, other chemicals, and other spill mitigating devices and substances, if any, that may be used in carrying out the NCP (40 CFR § 300.900; a.k.a. Subpart J).

What Does It Contain?

It contains a list of dispersants and other chemical or biological products that have met the data requirements set forth by § 300.915 of the NCP. Inclusion of a product on the NCP Product Schedule indicates only that the technical product data requirements have been satisfied.

Caution

Being listed on the National Product Schedule does **NOT** mean that the product is recommended or endorsed by the USEPA for use on an oil spill.

The Unified Command while managing a response determines whether there is a need for a product listed on the NCP Product Schedule to control a particular spill. **In most cases, the FOSC must gain incident-specific approval to use the product.** However, some states, e.g., California, also have an acceptance list. For further clarification and details, refer to the Decision Process section and Subpart J (40 CFR § 300.900), which is included in full as Appendix F in this volume.

How Are Products Listed?

To list a product on the NCP Product Schedule, a manufacturer must submit technical data (e.g., effectiveness and toxicity data) on the product to the USEPA. Specific guidelines for vendors are contained in 40 CFR, Subpart J, "Use of Dispersants and Other Chemicals § 300.915". Following data submission, the USEPA reviews the data to confirm completeness and that the procedures specified were followed.

Schedule Updates

The Product Schedule is updated every two months or as needed.

Continued on Next Page

Schedule Access

To access the NCP Product Schedule, contact the NCP information line: (703) 603-9918, or www.epa.gov/oilspill/ During a spill response, decision-makers may not have immediate access to the Internet; it is advisable that decision makers have backup in their office, that can access the necessary information in a timely manner.

What Products Must Be Listed?

Any chemical or biological agent that would be used in the environment and which cannot be completely contained and recovered is required to be listed on the NCP Product Schedule.

Who Decides What Must Be Listed?

It is the job of the USEPA Oil Program (headquarters) to determine whether products must be listed on the NCP Product Schedule in order to be used during a response.

When Can Non-Listed Products Be Used?

If use of a product will be confined to primary or secondary containment areas that can be cleaned and the material fully recovered, such as in a concrete berm or isolated sewage system with no access to other waterways, then non-listed products may be used to respond to the incident.

Continued on Next Page

Examples Of Inappropriate Product Use

Fire departments and HAZMAT teams are authorized to "hose down" a spill using a chemical countermeasure if they determine that the fuel could cause an explosion and threaten human health. Nevertheless, they should make every attempt to contain the fuel/chemical mixture and prevent it from entering storm drains or other environments where 100 percent product/oil recovery or containment is not possible.

Inappropriate uses often occur when treated areas are washed clean and the runoff contaminates surrounding areas or enters storm drains or sewer systems directly. Examples of where this may happen include:

- Roads
- Parking lots
- Fields
- Railroads
- Storm drains
- Hangers and storage areas without waste containment systems

OSCs should establish a working relationship with local responders to explain that these products can be used without their permission but in accordance with the NCP.

Can Bioremediation Be Used On Land?

Even if bioremediation products are going to be used on land, their use still must be authorized. This authorization would be granted by the RRT and the OSC if the spill has or may impact navigable water. State and local regulations may apply to the application of bioremediation agents, regardless of the impact to navigable water.

Sorbents, Do Not Have To Be Listed, Right?

Normal sorbent materials can be used without being listed ***Unless*** they incorporate environmentally reactive chemicals or bioremediation agents to assist with their function. Some states, e.g., California, have restrictions on the use of loose sorbents as well. More information on sorbents is provided on the following pages.

Continued on Next Page

What Does It Mean If A Product Is Not Listed?

Products that are not on the NCP Product Schedule, may not have performed even simple toxicological testing or efficacy testing (e.g., many sorbents, which by definition are not required to be listed on the NCP Product Schedule). These products may not have been regulated or evaluated by the reporting process as specified by the NCP Product Schedule and may pose adverse or unacceptable risks to resources or the environment.

What Are The Limitations Even If The Product Is Listed?

Conversely, being listed on the Product Schedule does not mean that the products have been proven effective or are considered non-toxic. In fact, listed products may be highly toxic to native plants and animals.

Regulatory Reminder

Regulations state that you should use known products on the Schedule over unlisted ones, and should always obtain the incident-specific concurrence when using any listed product, unless a pre-approval has been coordinated and authorized by the appropriate RRT.

Education Is The Key

It is also important to continually educate yourself about new methods and technologies. Rapidly evolving technologies can change the need for, amount of, and/or mix of spill countermeasure technologies to be used in spill response operations.

FAQs TO CONSIDER FOR APPLIED TECHNOLOGIES AND PRODUCT USE

Question #1

Does the discharge warrant the use of a product to prevent or substantially reduce a hazard to human life?

YES: Use is authorized as per 40 CFR 300.910 (c)

NO: Use will be governed by pre-approval, case-by-case authorization from the RRT, or applicability of the NCP Product Schedule or other governing state, local, or Federal authority.

Question #2

Is the spill in navigable waters of the United States and adjoining shorelines, the waters of the contiguous zone, in connection with activities under the Outer Continental Shelf Lands Act, activities under the Deepwater Port Act of 1974, or activities that may affect natural resources belonging to, appertaining to, or under the exclusive management authority of the United States, e.g., resources under the Magnuson Fishery Conservation and Management Act of 1976, Endangered Species Act of 1973, and the Migratory Bird Treaty Act as amended?

YES: Authorization is required.

NO: Authorization is not required. Evaluate the product and potential use thoroughly. Products should be used only after considering environmental, health, and safety concerns.

UNKNOWN: Refer to FOSC/SOSC to determine if spill is on navigable waters.

In all cases, OSCs and other decision-makers need to be aware that their decision-making must be in compliance with various Acts, MOAs, and/or Programmatic Agreements. The Area and Regional plans establish policy and guidance for the use of technologies and what is required for such use, including compliance. The policies and guidance's for each region can be maintained in Volume II of this document.

Continued on Next Page

FAQs TO CONSIDER FOR APPLIED TECHNOLOGIES AND PRODUCT USE (CONTINUED)

Question #3 What monitoring is appropriate?

Part C of the Selection Guide provides some general guidance to help plan for appropriate testing and monitoring of each technology class. The Special Monitoring of Applied Response Technologies (SMART) monitoring program is cited for use with dispersant and *in situ* burn technologies.

When a product or technology listed in this Selection Guide is used, some level of monitoring is recommended and may be required under OPA and/or the NCP, if only to verify the effectiveness of the technology used and to determine when to stop using a particular response tool. **Note**: Verify with state(s) trustees to determine what, if any, additional monitoring standards are necessary according to state regulations.

SORBENTS AND THE NCP PRODUCT SCHEDULE

Description

Sorbents are essentially inert and insoluble materials that are used to remove oil and hazardous substances from water or land through adsorption, in which the oil or hazardous substance is attracted to the sorbent surface and then adheres to it. Sorbents may also use absorption, in which the oil or hazardous substance penetrates the pores of the sorbent material. Sorbents use adsorption and absorption processes alone or in combination.

Use

Sorbents may be used in all areas, as long as they are completely recovered after application. Sorbents are generally manufactured in a particulate form for spreading over a spill or as sheets, rolls, pillows, or booms.

NCP Application

The NCP Subpart J requirements do not apply if the product is a sorbent that has not been treated with any chemically reactive substance or biological additive. However, IF IN DOUBT, CONTACT USEPA TO VERIFY THE CLAIMS OF THE MANUFACTURER. If a product is defined as a sorbent, then its use requires no pre-approval or RRT approval prior to use.

Further Information

Contact USEPA HQ at 202-260-2342 or 703-603-9918 for further information about particular sorbent use.

Continued on Next Page

NCP Product Schedule

The following decision table gives examples of sorbent products that do not need to be listed on the NCP product schedule prior to use. If a sorbent product contains solely those materials listed in column one and it does not incorporate environmentally reactive chemicals or bioremediation agents to assist with its function, it does not have to be listed on the NCP product schedule. Before using loose sorbents or sorbents that consist of particulate matter, check with state regulations to ensure there are no restrictions. To prove this exclusion, a vendor should supply a copy of their exclusion sorbent letter as supplied to them by the USEPA Oil Program office (A copy of a draft letter is found in Appendix C).

IF sorbent material consists of:	**AND:**	**THEN:**
Organic: • Peat moss or straw • Cellulose fibers or cork • Corn cobs • Chicken, duck or other bird feathers	Vendor can supply a valid USEPA exclusion sorbent letter for this product	Product can be used. It is recommended to verify with Nick Nichols at 703-603-9918.
Mineral compounds: • Volcanic ash or perlite • Vermiculite or zeolite	Vendor can supply a valid USEPA exclusion sorbent letter for this product	Product can be used. It is recommended to verify with Nick Nichols at 703-603-9918.
Synthetic: • Polypropylene • Polyethylene • Polyurethane • Polyester	Vendor can supply a valid USEPA exclusion sorbent letter for this product	Product can be used. It is recommended to verify with Nick Nichols at 703-603-9918.
Other compounds or products:	→	Contact Nick Nichols at 703-603-9918 to verify product does not require NCP schedule listing

PART A: SCREEN INCIDENT

Introduction

Part A of the Selection Guide provides the means for evaluating, during an actual spill or in a scenario, all potential applied technologies for responding to spilled oil.

Purpose

In ***Part A: Screen Incident***, you will examine the Oil Spill Applied Technologies Overview matrix (Table 1) to determine what technologies might be used for the response. You will then complete Worksheet 1, using the information contained in the Environmental Matrix (Tables 2a, b, or c) that fits the current response conditions being considered.

Note

The first step in the use of this Selection Guide is to screen the incident and determine whether a product or technology category is a viable option for the current response conditions. Part A is a critical step in this progression and **SHOULD NOT** be skipped during the evaluation process. A copy of Worksheet 1 is also located in Appendix H. It has been provided as a blank for photocopying purposes.

Tools Needed to Complete Part A

- Table 1 – Oil Spill Applied Technologies Overview
- Worksheet 1 –Decision-Tracking/Evaluation
- Table 2a, 2b, **or** 2c – Environment-specific matrix
- Table 3 – Relative Impacts of Applied Technologies on Shorelines Matrix
- Table 4 – Relative Impacts of Applied Technologies on Natural Resources Matrix

Worksheet Help

At the end of this section, we have provided an example scenario that will walk you through the evaluation processes and demonstrate the information needs to complete Worksheet 1 and the initial evaluation (Part A - Screen the Incident).

Continued on Next Page

Step Action Table

Follow the step by step table below for ***Part A: Screen Incident.***
NOTE: If you are unsure of any of these steps, please refer to the example scenario in Appendix M.

STEP	ACTION
1.	Locate the Oil Spill Applied Technologies Overview (Table 1), located immediately after this section.
2.	Review all applied technologies for possible use and applicability for the current response conditions of concern. This is done to familiarize you with the different technology categories.
3.	Locate Worksheet 1, which is immediately after the overview.
4.	Following your review of the technology overview (Table 1), mark an "X" under each technology or strategy that you want to consider further on Line A of Worksheet 1.
5.	Refer to the "If /Then" chart on the next page to determine the appropriate Environmental Matrix to use and then continue on to step 6. ***Warning: The Environmental Matrices reflect environmental conditions and is NOT based on zones of jurisdiction.*** Note: Matrices (Tables 2a, 2b, and 2c) are located immediately after Worksheet 1.

Disclaimer:

The objective of the Oil Spill Applied Technology Overview matrix (Table 1) is to give decision-makers an initial sense of what oil spill applied technologies can be used in different oil spill situations.

Please note that this matrix is not intended to be 100 percent accurate for all situations. Its purpose is to assist decision makers in their initial assessment of the applicability of these technologies (products and strategies) to the situation under consideration.

Many other factors also need to be considered prior to using applied technologies. Incident-specific conditions, such as potential environmental impacts, product availability, and advantages and disadvantages should be assessed before making a final decision about whether to use applied technologies and, if so, which ones.

Continued on Next Page

If / Then Chart

The "If / Then" Chart below will assist you in selecting the appropriate Environmental Matrix to use.

IF the oil is on:	THEN use this matrix:
Water in a: • Bay • Harbor • Inlet • Estuary • Slough • River or Creek • Lake or Pond	Inland Waters Matrix (Marine and Fresh) (Table 2a)
Land that can or does affect surface waters: • Marsh or wetland • Beach • Man-made structure • Storm drain • Shorelines • Ditch • Other land types	Adjacent Lands Matrix (Table 2b)
Water in the open ocean	Coastal Waters Matrix (Table 2c)

Example Matrix

Below is a partial example of an Environment Specific Matrix.

Example of - TABLE 2A: Environment Specific Matrix for Inland Waters

INLAND WATERS

Includes: Bay, Harbor, Inlet, Estuary, Slough, River, Creek, Lake, or Pond -Refer to chart on pg 10 for more information

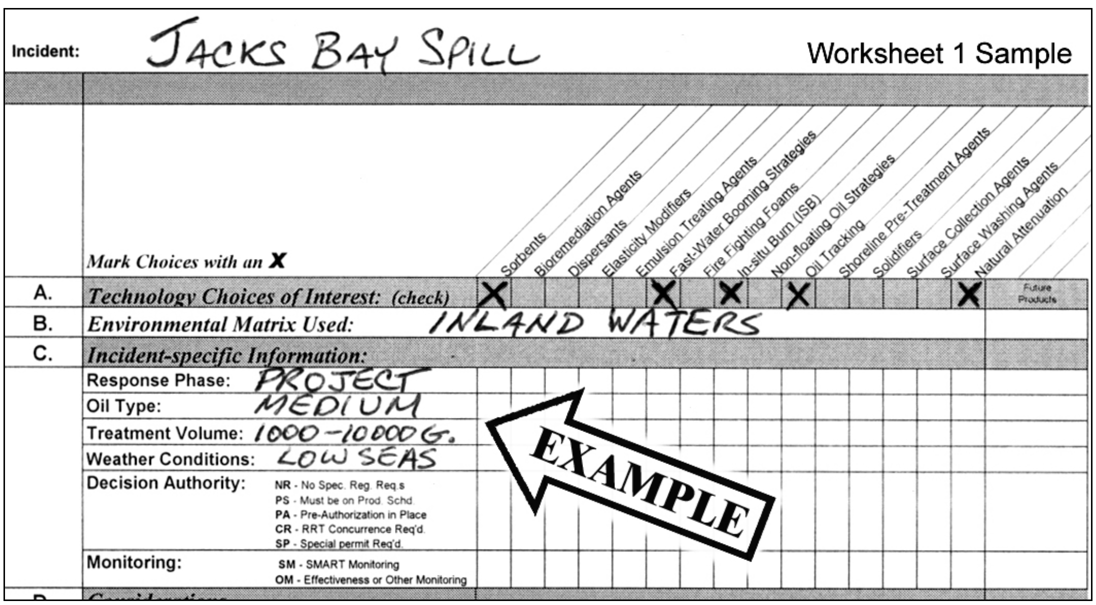
X = consider further

	Alternative Sorbents	Bioremediation Agents*	Dispersants	Elasticity Modifiers**	Emulsion Treating Agents	Fast-Water Booming Strategies	Fire Fighting Foams	In-situ Burn (ISB)	Non-floating Oil Strategies	Oil Tracking	Shoreline Pre-Treatment Agents**	Solidifiers	Surface Collection Agents**	Surface Washing Agents***	Natural Attenuation	Future Products
Response Phase																
Emergency (Days 1 to 3)	X		?	X	X	X	X	X	X	X		X	X		X	
Project (product still mobile)	X			X	X	X	X	X	X	X		X	X		X	
Clean up (discharged product stable)									X						X	
Disposal (transportation and storage)					X				X							
Oil Type																
Very Light Oil / Light Oil (gasoline, diesel fuel, condensate, jet fuel)	X		X	X		X	X	X		X		X	X		X	
Medium Oil (LA crude, AK North Slope)	X		X	X	X	X	X	X		X		X			X	
Heavy Oil (bunker, No. 6 fuel oil)			X		X	X	X	X		X					X	

Continued on Next Page

Step Action Table (Cont'd)

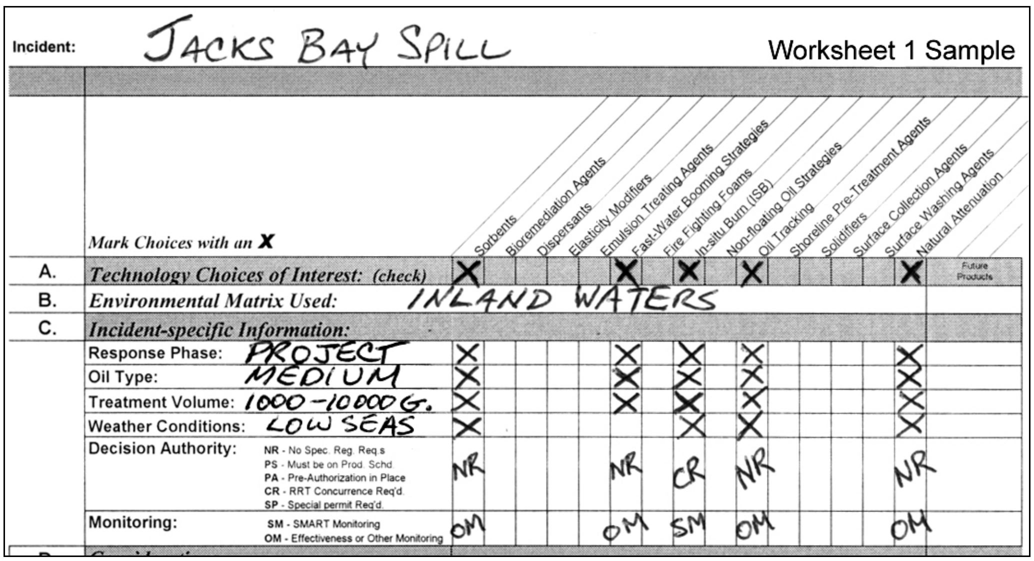
STEP	ACTION
6.	Fill in the title of the appropriate Environmental Matrix on Line B of Worksheet 1 (*refer to example worksheet below*)
7.	Examine the Environmental Matrix chosen (Table 2a, 2b, or 2c) and look at the incident-specific information classifications under each grouping on the left side of the matrix (start with “Response Phase”).
8.	Using the Environmental Matrix, fill in the ***Incident-specific Information*** under Line C on Worksheet 1. *See example below*.



Continued on Next Page

Step Action Table (Cont'd)

STEP	ACTION
9.	Now, copy all the "**X**"s from your chosen environmental matrix (Table 2a, 2b, or 2c) on the ***Incident-specific Information*** for the technologies being evaluated. (R*efer to the example below*.) **Note**: When filling in the box for Decision Authority, copy the letters denoting the types of authority required. Do the same for Monitoring.



Incident: JACKS BAY SPILL — Worksheet 1 Sample

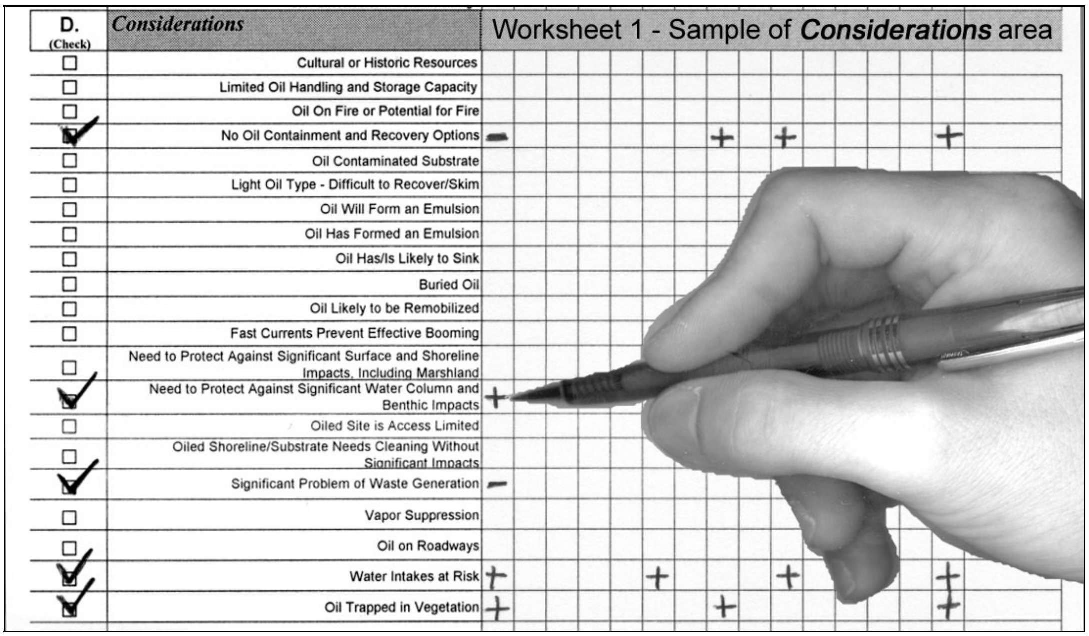
			Sorbents	Bioremediation Agents	Dispersants	Elasticity Modifiers	Emulsion Treating Agents	Fast-Water Booming Strategies	Fire Fighting Foams	In-situ Burn (ISB)	Non-floating Oil Strategies	Oil Tracking	Shoreline Pre-Treatment Agents	Solidifiers	Surface Collection Agents	Surface Washing Agents	Natural Attenuation	Future Products
	Mark Choices with an ***X***																	
A.	*Technology Choices of Interest: (check)*		X					X		X		X					X	
B.	*Environmental Matrix Used:*	INLAND WATERS																
C.	*Incident-specific Information:*																	
	Response Phase:	PROJECT	X					X		X		X					X	
	Oil Type:	MEDIUM	X					X		X		X					X	
	Treatment Volume:	1000-10000 G.	X					X		X		X					X	
	Weather Conditions:	LOW SEAS	X							X		X					X	
	Decision Authority:	NR - No Spec. Reg. Req.s PS - Must be on Prod. Schd. PA - Pre-Authorization in Place CR - RRT Concurrence Req'd. SP - Special permit Req'd.	NR					NR		CR		NR					NR	
	Monitoring:	SM - SMART Monitoring OM - Effectiveness or Other Monitoring	OM					OM		SM		OM					OM	

Step Action Table (Cont'd)

STEP	ACTION
10.	Can you already rule out any of your initial technology choices of interest (Line A of Worksheet 1) just based on the information you have so far? If you can, you may want to do so now. Document your decisions at the bottom/back of Worksheet 1.
11.	Review the ***Considerations*** listed under Line D on Worksheet 1 and check off the ones that are applicable for the current response. Check boxes are provided on the left side of Worksheet 1.

Continued on Next Page

Step Action Table (Cont'd)	STEP	ACTION
	12.	Next, copy all the **+** and **–** symbols from the ***Considerations*** section of the matrix onto Worksheet 1. You only need to copy the symbols that apply to the considerations you have just checked off. See example below.



13.	Discuss which of these criteria and other effects are, or are not, most important for the current response. **Note**: Take into account only those criteria that apply to the current and potential response conditions. Use the chart on the following page to assist in the discussions and decisions. **Note**: If you are unsure of any of these steps, please refer to the example scenario at the end of this section.

Continued on Next Page

Decision

Use the “If-And-Then" chart below to assist in the decision making process:

IF a technology:	AND there are:	THEN
Appears to be well suited for the situation and response capabilities	No overwhelming negatives	Consider using the technology and proceed to step 14.
Does not seem suited for the situation and response capabilities	No overwhelming reasons to use the technology	Consider other technologies

Step Action Table (Cont'd)

STEP	ACTION
14.	Locate Table 3 – Habitat matrix, which is immediately after the environmental matrices.
15.	Using the Habitat matrix (Table 3), review the recommendations given for each product or technology category for the potential application areas being evaluated for applied technology use. After considering the information provided in the Habitat matrix (Table 3), indicate whether you think the technology being considered is useful/appropriate for the current response situation (“+”), not useful/inappropriate (“–”), or may be useful/appropriate (“?”) and insert the correct item in the appropriate box in Line E on Worksheet 1. Do this for each technology being considered.
16.	Locate Table 4 – Natural Resources matrix, which follows the Habitat matrix (Table 3).
17.	Using the Natural Resources matrix (Table 4), review the recommendations given for each product or technology category of interest for the natural resources of concern that may be exposed to the applied technology(s) under consideration.

Continued on Next Page

Step Action Table (Cont'd)

STEP	ACTION
18	Consult with natural resource trustees (state and federal) to evaluate the expected effects/influences (+, **-**, **?**, and **I**) from each product or technology category for the resources listed in the matrix. This natural resource trustee consultation needs to weigh the potential impacts to these natural resources versus the benefits for the overall response operation if an applied technology is used.
19	After considering the information provided in the Natural Resources matrix (Table 4), indicate whether you think the technology being considered is useful/appropriate for the current response situation ("+"), not useful/inappropriate ("–"), or may be useful/appropriate ("?") and insert the correct item in the appropriate box in Line E on Worksheet 1. Document your decisions and special concerns at the bottom/back of Worksheet 1. You may want to have the natural resource trustees initial these decisions.
20.	Record the top (up to three) product or technology choices from this evaluation under Line F on Worksheet 1. Record major advantages and disadvantages for each of the top three choices. Additionally, there is also space available to record any other information that may be useful in the decision-making. **Note**: This worksheet can be circulated among the Unified Command in order to document any consensus reached thus far on the applied technologies of interest.
21.	Continue and Proceed to ***Part B: Review/Select Options*** (evaluating individual products or strategies from the categories you identified on Worksheet 1).

Still Confused About Part A?

Located in Appendix M, an example scenario and worksheet are provided that will guide you through the initial screening of the incident (Part A) and will take you through the completion of Worksheet 1 for this scenario.

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Table 1. Oil Spill Applied Technologies Overview.

Response Technology	Mechanism Of Action	When To Use	Target Areas	Characteristics Of Effective Products	Limiting Factors	Waste Generation	Oil Types	Impacts to Sensitive Resources
Traditional Mechanical/Manual Countermeasures, e.g., boom, skimmers, shovels	▪ Mechanical containment and removal of oil from the water surface (i.e., booms, skimmers) ▪ Manual removal of oil from shorelines and land (i.e., loaders, shovels)	▪ Typically first line of defense during a response ▪ Spills on water, on land or hard surface	▪ Varies	▪ Contains, removes spilled product	▪ Weather conditions ▪ Site accessibility	▪ Varies by method	▪ Varies	▪ May cause stress/ impacts on sensitive resources due to presence of response personnel; ▪ May be invasive/ destructive to land habitats;
Sorbents	▪ Absorption (uptake into the sorbent material) and adsorption (coating of the sorbent surface)	▪ Spill on land or hard surface; ▪ To create a physical barrier around the leading edge; ▪ To immobilize small amounts of free oil that cannot be removed from inaccessible sites	▪ Shorelines at the water/land interface ▪ Hard surfaces with recoverable oil	▪ Low application rate; ▪ Applied with available equipment; ▪ Easy to recover; oil does not drip out	▪ Access to deploy and retrieve products	▪ Concern if only lightly oiled; ▪ May be burned or recycled;	▪ Light to heavy oils; ▪ Not effective on viscous oils	▪ May cause smothering of benthic/attached wildlife if not recovered; ▪ May be ingested by wildlife if not recovered
Bioremediation Agents	▪ Accelerate rate of oil degradation by adding nutrients, microbes, and/or surfactants; ▪ Surfactants break oil into droplets to increase the surface area	▪ After removal of gross contamination; ▪ When further oil removal will be destructive, or ineffective; ▪ When nutrients are limiting natural degradation rates	▪ Any size spill in areas where other cleanup methods would be destructive or ineffective. ▪ As a polishing tool for any size spill.	▪ Treated samples show oil degradation greater than control samples in lab tests; ▪ Key factors are site-specific	▪ Nutrient availability; temperature (>60°F); pH 7-8.5; ▪ Moisture; ▪ Surface area of oil; ▪ Rate of nutrient wash-out, especially for intertidal use	▪ Can significantly reduce volume of oily wastes, if effective	▪ Less effective on heavy refined products; ▪ Not for gasoline, which will evaporate	▪ None expected; ▪ Unionized ammonia can be toxic to aquatic life in low concentrations; ▪ Dissolved O_2 levels may be affected
Dispersants	▪ Break oil into small droplets that mix into the water and do not re-float	▪ When dispersing the oil will cause less impact than slicks that strand onshore or affect surface water resources	▪ Open water	▪ Products have to pass a dispersant effectiveness test to be listed	▪ Low effectiveness with heavy, weathered, or emulsified oils;	▪ Can significantly reduce volume of oil wastes, if effective	▪ Any oil with a viscosity less than 20,000-40,000 cP	▪ Consult with Resource Trustees on environmental issues.
Elasticity Modifiers*	▪ Increase the cohesiveness of the oil, improving skimmer efficiency	▪ On contained slicks of light oils which are difficult to recover		▪ Low application rate; readily mixes with oil; treated oil is not sticky	▪ Low water/air temperatures which make oil viscous and mixing more difficult	▪ Will reduce water pickup by skimmers; ▪ Treated oil can be re-cycled	▪ Light oils	▪ Consult with Resource Trustees on environmental issues.

Response Technology	Mechanism Of Action	When To Use	Target Areas	Characteristics Of Effective Products	Limiting Factors	Waste Generation	Oil Types	Impacts to Sensitive Resources
Emulsion Treating Agents	▪ Composed of surfactants that prevent the formation of or break, water-in-oil emulsions	▪ To separate water from oil, increasing oil storage capacity; ▪ To increase effectiveness of dispersants and *in situ* burning		▪ Low application rate; rapid oil/ water separation (within 1-2 hours)	▪ Not possible to predict effectiveness for an oil, but there is a standard test; will wash out, so emulsion can re-form over time	▪ Will reduce the amount of oily material for handling and disposal	▪ Light to heavy oils	▪ Consult with Resource Trustees on environmental issues.
Fast-water Booming Strategy	▪ High-angle booming strategies which	▪ When high current waters are oiled; ▪ To prevent oil from spreading downstream	▪ High current environments when traditional booming methods are ineffective	▪ No oil entrainment	▪ Boom and specialized equipment availability	▪ Not applicable	▪ Oil that floats	▪ None expected
Fire-Fighting Foams	▪ Act as a barrier between the fuel and fire; suppress vapors; cool the liquid	▪ To prevent ignition or re-ignition of spilled oil		▪ Forms stable heat-resistant foam blanket; applied with standard equipment	▪ Polar solvents can destroy foam; water currents can break foam blanket	▪ Not applicable	▪ Any type of oil that can burn	▪ Consult with Resource Trustees on environmental issues.
In-situ Burning	▪ Removes free oil or oily debris from water surface or land surface by burning oil in place	▪ To quickly remove oil to prevent its spread to sensitive areas or over large areas; ▪ To reduce generation of oily waste ▪ When access is limited ▪ When oil recovery is limited	▪ Remote areas on land or water where oil is thick enough for an effective burn	▪ Removal of free oil from the water surface or land surface ▪ Need oil thickness that will sustain burn	▪ Heavy, weathered or emulsified oils may not ignite, even with accelerants ▪ Wind speed and direction could affect smoke plume ▪ Air Quality monitoring needs to be done	▪ Burn residue can be formed; residue may sink; a semi-solid, tar-like layer may need to be recovered ▪ Erosion in burned on-land areas may occur if burn kills plants in area	▪ Fresh volatile crudes burn best; most oil types will burn ▪ Oil thickness required for minimum ignitable slicks increases with oil weathering, and heavy- component content	▪ Consult with Resource Trustees on environmental issues.
Natural Attenuation	▪ Leave oil in situ and do not treat or recover	▪ Access to spill site is limited or other methods will not provide value	▪ In areas where other response strategies result in more harm than value	▪ Must have monitoring plan in place to assess effectiveness	▪ Resources present in the affected area	▪ Not applicable	▪ Varies	▪ No additional impacts other than the effect of the oil alone
Non-floating Oil Strategy	▪ Various	▪ When oil sinks or travels mid-water	▪ In water		▪ Human health during diving operations ▪ Existing methods are often ineffective, slow and logistics-intensive	▪ Large volumes of collected water will have to be addressed	▪ Heavy oils or heavily weathered oils	▪ Recovery of sunken oil could affect bottom habitats and resources

Response Technology	Mechanism Of Action	When To Use	Target Areas	Characteristics Of Effective Products	Limiting Factors	Waste Generation	Oil Types	Impacts to Sensitive Resources
Shoreline Pre-treatment Agents*	▪ Film-forming or Wetting agents that prevent oil from adhering to or penetrating the substrate	▪ When the oil is heading towards a sensitive shoreline resource or a resource of historical/ archaeological importance		▪ Products need to be sprayed as a thick, even coating ▪ Dissolve or degrade in seawater ▪ Rapid drying time ▪ Low permeability to oil penetration ▪ Readily adhere to substrates ▪ Not be wetted by oil	▪ Biodegradability of the product (no toxic byproducts) ▪ Product should have low contact toxicity ▪ Low application rates ▪ Film-forming products could smother intertidal biota ▪ Oil trajectory monitoring closely monitored	▪ None	▪ Information not available	▪ Consult with Resource Trustees on environmental issues.
Solidifiers	▪ Most products are polymers that physically or chemically bond with the oil, turning it into a coherent mass	▪ To immobilize oil, preventing further spread or penetration; apply to edge to form a temporary barrier; to reduce vapors		▪ Low application rate (10-25% by weight); cure time of a few hours; forms a cohesive mass; easily applied using available equipment	▪ Not effective with viscous oils where mixing is difficult; waves will form clumps not a mass; must be able to recover the solidified oil;	▪ Most products have minimal increase in volume; most are not reversible, so oil must be disposed of or burned	▪ Light to heavy oils; not effective on viscous oils	▪ Consult with Resource Trustees on environmental issues.
Surface Collecting Agents*	▪ Have a higher spreading pressure than oil, so they push or compress oil on the water surface	▪ To push oil out from inaccessible areas to recovery devices; to make the slick thicker to increase recovery rates	▪ To push oil from under docks, piers etc to recovery devices'	▪ High spreading pressure; low evaporation rates; low oil and water solubility; remains liquid at ambient temperature	▪ Rain, winds greater than 5 mph, and moderate currents, all which break the surface film; high oil viscosity	▪ Product does not change the physical condition or volume of oil.	▪ Light oils	▪ Consult with Resource Trustees on environmental issues.
Surface Washing Agents	▪ Contain solvents, surfactants, and additives to clean oiled surfaces; can "lift and disperse" like detergents or "lift and float" to allow oil recovery	▪ To increase oil removal, often at lower temperature and pressure; to flush oil trapped in inaccessible areas; for vapor suppression in sewers	▪ Oiled, hard-surface shorelines ▪ Where oil has weathered and is difficult to remove; ▪ When flushing with containment is possible; ▪ Volatile fuel spills in enclosed environments;	▪ Soak time less than 1 hr; single application; minimum scrubbing, esp. for sensitive substrate;	▪ Apply on land only where washwaters can be collected for treatment; use "lift and float" products on shorelines to allow oil recovery rather than allowing dispersion into water body	▪ Can produce large volumes of washwater which needs collection and treatment	▪ All oil types	▪ Consult with Resource Trustees on environmental issues.

* As of this revision date, there are no products for this category listed on the NCP Product Schedule.

WORKSHEET 1: SELECTION GUIDE DECISION TRACKING/ EVALUATION WORKSHEET

This worksheet is intended to be photocopied for use during drills and incidents

Name(s):

Date:

Incident:

	Mark Choices with an **X**	Sorbents	Bioremediation Agents	Dispersants	Elasticity Modifiers	Emulsion Treating Agents	Fast-Water Booming Strategies	Fire Fighting Foams	In-situ Burn (ISB)	Non-floating Oil Strategies	Oil Tracking	Shoreline Pre-Treatment Agents	Solidifiers	Surface Collection Agents	Surface Washing Agents	Natural Attenuation	Future Products
A.	***Technology Choices of Interest:***																
B.	***Environmental matrix used:***																
C.	***Incident-specific Information:***																
	Response Phase																
	Oil Type																
	Treatment Volume																
	Weather Conditions																
	Decision Authority **NR** - No Spec. Reg. Req.s **PS** - Must be on Prod. Schd. **PA** - Pre-Authorization in Place **CR** - RRT Concurrence Req'd. **SP** - Special permit Req'd.																
	Monitoring **SM** - SMART Monitoring **OM** - Effectiveness or Other																
D. (check)	**Considerations**																
☐	Limited Oil Handling and Storage Capacity																
☐	Oil On Fire or Potential for Fire																
☐	No Oil Containment and Recovery Options																
☐	Oil Contaminated Substrate																
☐	Light Oil Type - Difficult to Recover/Skim																
☐	Oil Will Form an Emulsion																
☐	Oil Has Formed an Emulsion																
☐	Oil Has/Is Likely to Sink																
☐	Buried Oil																
☐	Oil Likely to be Remobilized																
☐	Fast Currents Prevent Effective Booming																
☐	Need to Protect Against Significant Surface and Shoreline Impacts, Including Marshland																
☐	Need to Protect Against Significant Water Column and Benthic Impacts																
☐	Oiled Site is Access Limited																
☐	Oiled Shoreline/Substrate Needs Cleaning Without Significant Impacts																
☐	Significant Problem of Waste Generation																
☐	Vapor Suppression																
☐	Oil on Roadways																
☐	Water Intakes at Risk																
☐	Oil Trapped in Vegetation																
☐	Oil Trapped in Snow and Ice																
☐	Confined Spaces with Water/Vapors? (sewers, culverts, etc.)																
E.	***Habitat and Sensitive Resource Evaluation***																
	Habitats (refer to Table 3, pg. 29)																
	Natural Resources (refer to Table 4, pg. 33)																
F.	***Evaluation Results***																

Top Three Choices:			
Any Major Advantages:			
Any Major Disadvantages:			

Additional Comments/Decisions:

Signatures/Date of Review Team:

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TABLE 2A: ENVIRONMENT-SPECIFIC MATRIX FOR INLAND WATERS

INLAND WATERS

Includes: Bay, Harbor, Inlet, Estuary, Slough, River, Creek, Lake, or Pond -Refer to chart on pg 10 for more information

X = consider further

	Sorbents	Bioremediation Agents*	Dispersants	Elasticity Modifiers**	Emulsion Treating Agents	Fast-Water Booming Strategies	Fire Fighting Foams	In-situ Burn (ISB)	Non-floating Oil Strategies	Oil Tracking	Shoreline Pre-Treatment Agents**	Solidifiers	Surface Collection Agents**	Surface Washing Agents***	Natural Attenuation	Future Products
Response Phase																
Emergency (Days 1 to 3)	X		?	X	X	X	X	X	X	X		X	X		X	
Project (product still mobile)	X			X	X	X	X	X	X	X		X	X		X	
Clean up (discharged product stable)									X						X	
Disposal (transportation and storage)					X				X							
Oil Type																
Very Light Oil / Light Oil (gasoline, diesel fuel, condensate, jet fuel)	X		X	X		X	X	X		X		X	X		X	
Medium Oil (LA crude, AK North Slope)	X		X	X	X	X	X	X		X		X			X	
Heavy Oil (bunker, No. 6 fuel oil)			X		X	X	X	X		X					X	
Non-Floating Oils									X	X					X	
Treatment Volume																
less than 10 gallons	X		?	X								X	X		X	
10 to 100 gallons	X		?	X	X		X	X	X	X		X	X		X	
100 to 1,000 gallons	X		?	X	X	X	X	X	X	X		X	X		X	
1,000 to 10,000 gallons	X		?	X	X	X	X	X	X	X					X	
10,000 to 100,000 gallons			?		X	X	X	X	X	X					X	
greater than 100,000 gallons					X	X	X	X	X	X					X	
Weather Conditions																
Hot (air > 90^O F; water > 80^O F)	X		X	X	X	X	X	X	X	X		X	X		X	
Warm (air > 75-89^O F; water > 65-79^O F)	X		X	X	X	X	X	X	X	X		X	X		X	
Mild / cool (air> 41-74^O F; water > 55-64^O F)	X		X	X	X	X	X	X	X	X		X	X		X	
Cold (air < 40^O F; water < 54^O F)	X		X	X	X	X	X	X	X	X		X	X		X	
High winds / Seas															X	
Moderate Winds / Seas	X		X		X	X			X	X					X	
Low Winds / Seas	X			X		X	X	X	X	X		X	X		X	
Decision Authority (For regional specific policies refer to Vol. II of the Selection Guide)																
No Special Regulatory **R**equirements (**NR**)	NR					NR	NR		NR	NR					NR	
Must be on the NCP **P**roduct **S**chedule (**PS**) (RRT Concurrence is required)			PS	PS	PS							PS	PS			
RRT **C**oncurrence **R**equired (**CR**) (but may NOT have to be on the Product Schedule)			CR	CR	CR			CR				CR	CR			
Special **P**ermit(s) Required (**SP**)									SP							
Considerations																
Oil On Fire or Potential for Fire			+				+									
No Oil Containment and Recovery Options	-		?	-				+		+		-	-		+	
Light Oil Type - Difficult to Recover/Skim	+		?	+		+		+		+	?	+	+		+	
Oil Will Form an Emulsion			?		+				+	+	?				+	
Oil Has Formed an Emulsion			-		+					+	?	-			+	
Oil Has/Is Likely to Sink									+	+					+	
Buried Oil									+						+	
Oil Likely to be Remobilized	N O T A P L I C A B L E															
Oil is Trapped In/On Ice																
Fast Currents Prevent Effective Booming			?			+				+					+	
Need to Protect Against Significant Surface and Shoreline Impacts, Including Marshland	N O T A P L I C A B L E															
Need to Protect Against Significant Water Column and Benthic Impacts	+		-		?		-	+	+	+		+			+	
Site is Access Limited	?		?					+				?			+	
Oiled Shoreline Needs Cleaning Without Significant Impacts	N O T A P L I C A B L E															
Significant Problem of Waste Generation	-		+		+			+				-			+	
Water Intakes at Risk	+		-		-	+	-			+		+	-		+	
Oil Trapped in Vegetation	+							+							+	
Confined Spaces with Water? (sewers, culverts, etc.)			+				+									
Monitoring																
Implement **S**MART **M**onitoring (**SM**)			SM					SM								
Implement Effectiveness or **O**ther **M**onitoring (**OM**)	OM			OM	OM	OM	OM		OM	OM		OM	OM		OM	

(+) = Consider for Use (?) = Case-by-case
(-) = Do not consider for use
d = Fire departments may use without approval. There are special exceptions for fire department emergency response use.
**As of this revision date, there are no products for this category listed on the NCP Product Schedule.
***Refer to Section on Surface Washing Agents for special exceptions for Fire Departments.

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TABLE 2B: ENVIRONMENT-SPECIFIC MATRIX FOR ADJACENT LAND

ADJACENT LAND

Includes: Land that affects surface waters such as marsh, wetlands, beaches, man made structures, storm drains, shoreline ditch or other land types -Refer to chart on page 10 for more information

X = consider further

	Sorbents	Bioremediation Agents	Dispersants***	Elasticity Modifiers**	Emulsion Treating Agents	Fast-Water Booming Strategies	Fire Fighting Foams	In-situ Burn (ISB)	Non-floating Oil Strategies	Oil Tracking	Shore-line Pre-treatment Agents**	Solidifiers	Surface Collection Agents**	Surface Washing Agents****	Natural Attenuation	Future Products
Response Phase																
Emergency (Days 1 to 3)	X							X		X	?	X		X	X	
Project (product still mobile)	X							X		X	?	X		X	X	
Clean up (discharged product stable)		X								X				X	X	
Disposal (transportation and storage)		X														
Oil Type																
Very Light Oil / Light Oil (gasoline, diesel fuel, condensate, jet fuel)		X					X	X							X	
Medium Oil (LA crude, AK North Slope)	X	X					X	X				X		X	X	
Heavy Oil (bunker, No. 6 fuel oil)	X	X					X	X						X	X	
Non-Floating Oil		*not advs					*not advs									
Treatment Volume																
less than 10 gallons	X	X					X	X				X		X	X	
10 to 100 gallons	X	X					X	X			?	X		X	X	
100 to 1,000 gallons	X	X					X	X			?	X		X	X	
1,000 to 10,000 gallons							X	X			?			?	X	
10,000 to 100,000 gallons							X	X							X	
greater than 100,000 gallons							X	X							X	
Weather Conditions																
Hot (air > 90O F; water > 80O F)	X	X						X				X		X	X	
Warm (air > 75-89O F; water > 65-79O F)	X	X						X				X		X	X	
Mild / cool (air> 41-74O F; water > 55-64O F)	X	X						X				X		X	X	
Cold (air < 40O F; water < 54O F)	X							X				X		X	X	
High winds / Seas	X	X												X	X	
Moderate Winds / Seas	X	X										X		X	X	
Low Winds / Seas	X	X						X				X		X	X	
Decision Authority (For regional specific policies refer to Vol. II of the Selection Guide)																
No Special Regulatory **R**equirements (**NR**)	NR					NR	NR		NR	NR					NR	
Must be on the NCP **P**roduct **S**chedule (**PS**) (RRT Concurrence is required)		PS		PS	PS			PS			PS	PS		PS[c,d]		
Incident Specific RRT **C**oncurrence **R**equired (**CR**) (but may NOT have to be on the Product Schedule)		CR		CR	CR			CR			CR	CR		CR[c]		
OSC **P**re-**A**uthorization in Place (**PA**)																
Special **P**ermit(s) Required (**SP**)								SP								
Considerations																
Oil On Fire or Potential for Fire							+	+								
Oil Contaminated Substrate	+	+						+						+	+	
Buried Oil		+													+	
Oil Likely to be Remobilized	+											+		+	+	
Site is Access Limited		+						+						+	+	
Oiled Substrate Needs Cleaning Without Significant Habitat Impacts	+	+						?				?		+	+	
Significant Problem of Waste Generation	-	+						+				-			+	
Vapor Supppression																
Oil on Roadways	+											+		+		
Vapors Trapped in Confined Areas							+							+		
Oil Trapped in Snow and Ice		-						+							+	
Confined Spaces with Water? (sewers, culverts, etc.)																
Monitoring																
Implement **S**MART **M**onitoring (**SM**)								SM								
Implement Effectiveness or **O**ther **M**onitoring (**OM**)	OM	OM		OM	OM	OM	OM	OM	OM	OM	OM	OM	OM	OM	OM	

(+) = Consider for Use (?) = Case-by-case

(-) = Do not consider for use

c = RRT concurrence not required if NOT released to surface waters, refer to Vol. II of the Selection Guide

d = Fire departments may use without approval. There are special exceptions for fire department emergency response use.

*Not advs = not advised **As of this revision date, there are no products for this category listed on the NCP Product Schedule.

Dispersants may be used on land for "fire and/or explosion" and if dispersant product does not enter "waters of the US", i.e., Holland Decision, 1974. * In Development

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TABLE 2C: ENVIRONMENT-SPECIFIC MATRIX FOR COASTAL WATERS

COASTAL WATERS

Includes water in the open ocean -Refer to chart on page 10 for more information

X = consider further

	Sorbents	Bioremediation Agents	Dispersants	Elasticity Modifiers**	Emulsion Treating Agents	Fast-Water Booming Strategies	Fire Fighting Foams	In-situ Burn (ISB)	Non-floating Oil Strategies	Oil Tracking	Shoreline Pre-Treatment Agents**	Solidifiers	Surface Collection Agents**	Surface Washing Agents	Natural Attenuation	Future Products
Response Phase																
Emergency (Days 1 to 3)	X			X	X	X	X	X	X	X		X	X		X	
Project (product still mobile)	X			X	X	X		X	X	X		X	X		X	
Clean up (discharged product stable)									X						X	
Disposal (transportation and storage)					X				X							
Oil Type																
Very Light Oil / Light Oil (gasoline, diesel fuel, condensate, jet fuel)	X		X	X		X	X	X		X		X	X		X	
Medium Oil (LA crude, AK North Slope)	X			X	X	X	X	X		X		X			X	
Heavy Oil (bunker, No. 6 fuel oil)					X	X	X	X		X					X	
Non-Floating Oils									X	X					X	
Treatment Volume																
less than 10 gallons	X											X	X		X	
10 to 100 gallons	X				X		X	X				X	X		X	
100 to 1,000 gallons	X			X	X	X	X	X	X	X		X	X		X	
1,000 to 10,000 gallons	X			X	X	X	X	X	X	X					X	
10,000 to 100,000 gallons					X	X	X	X	X	X					X	
greater than 100,000 gallons					X	X	X	X	X	X					X	
Weather Conditions																
Hot (air > 90° F; water > 80° F)	X			X	X	X	X	X	X	X		X	X		X	
Warm (air > 75-89° F; water > 65-79° F)	X			X	X	X	X	X	X	X		X	X		X	
Mild / cool (air> 41-74° F; water > 55-64° F)	X			X	X	X	X	X	X	X		X	X		X	
Cold (air < 40° F; water < 54° F)	X			X	X	X	X	X	X	X		X	X		X	
High winds / Seas															X	
Moderate Winds / Seas					X	X			X	X					X	
Low Winds / Seas	X			X		X	X	X	X	X		X	X		X	
Decision Authority (For regional specific policies refer to Vol. II of the Selection Guide)																
No Special Regulatory Requirements (NR)	NR					NR	NR		NR	NR					NR	
Must be on the NCP Product Schedule (PS) (RRT Concurrence is required)				PS	PS							PS	PS			
RRT Concurrence Required (CR) (but may NOT have to be on the Product Schedule)				CR	CR			CR				CR	CR			
Special Permit(s) Required (SP)								SP	SP							
Considerations																
Limited Oil Handling and Storage Capacity	-			-	+			+				-			+	
Oil On Fire or Potential for Fire							+	+								
No Oil Containment and Recovery Options	-			-				+		+		-	-		+	
Light Oil Type - Difficult to Recover/Skim	+		+	+		+		+		+		+	+		+	
Oil Will Form an Emulsion					+				+	+					-	
Oil Has Formed an Emulsion					+					+		-			+	
Oil Has/Is Likely to Sink									+	+					+	
Buried Oil									+						+	
Oil Likely to be Remobilized	NOT APLICABLE															
Fast Currents Prevent Effective Booming						?				+					+	
Need to Protect Against Significant Surface and Shoreline Impacts, Including Marshland	+					+		+		+		+			+	
Need to Protect Against Significant Water Column and Benthic Impacts	+			-			-	+	+	+		+			+	
Oiled Site is Access Limited	?							+				?			+	
Oiled Shoreline Needs Cleaning Without Significant Impacts	NOT APLICABLE															
Significant Problem of Waste Generation	-				+			+				-			+	
Monitoring																
Implement SMART Monitoring (SM)								SM								
Implement Effectiveness or Other Monitoring (OM)	OM			OM	OM	OM	OM		OM	OM		OM	OM		OM	

(+) = Consider for Use (?) = Case-by-case

(-) = Do not consider for use

**As of this revision date, there are no products for this category listed on the NCP Product Schedule.

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Table 3 Relative Impacts of Oil Spill Response Applied Technologies on Shorelines. This table was developed from the API (2001) "Environmental Considerations for Marine Oil Spill Response" and the API/NOAA (1995) "Options for Minimizing Environmental Impacts of Freshwater Spill Response" and should be consulted to verify all caveats and restrictions for application based on oil type, weather conditions, etc.

		Sorbents	Bioremediation Agents	Dispersant	Elasticity Modifier
On-Water Habitats	Offshore	?	—	+	?
	Bays and Estuaries	?	—	+	?
	Ponds and Lakes	?	—	—	?
Sub-tidal Habitats	Coral Reef	+	N/A	—	?
	Sea Grass Beds	+	N/A	—	?
	Kelp Forests	+	N/A	—	?
	Soft bottom	+	N/A	?	N/A
	Mixed and hard Bottom	+	N/A	?	N/A
Land Habitats	Exposed Rocky Shores (ESI = 1A)	+	—	N/A	N/A
	Exposed, Solid, Man-made Structures (ESI = 1B)	+	—	N/A	N/A
	Exposed, Wave-cut platforms (ESI = 2)	+	—	N/A	N/A
	Sand Beaches/Tundra Cliffs (ESI = 3 / 4)	+	?	N/A	N/A
	Mixed Sand and Gravel Beaches (ESI = 5)	?	?	N/A	N/A
	Gravel Beaches (ESI = 6A)	+	?	N/A	N/A
	Riprap (ESI = 6B)	+	?	N/A	N/A
	Exposed Tidal Flats (ESI = 7)	+	I	N/A	N/A
	Sheltered Rocky Shores (ESI = 8A)	?	?	N/A	N/A
	Sheltered, Solid, Man-Made Structures (ESI = 8B)	+	?	N/A	N/A
	Peat Shores (ESI = 8C)	?	?	N/A	N/A
	Sheltered Tidal Flats (ESI = 9)	+	I	N/A	N/A
	Marshes (salt to brackish) (ESI = 10A)	+	?	N/A	N/A
	Freshwater Marshes (ESI = 10B)	+	—	N/A	N/A
	Swamps (ESI = 10C)	+	—	N/A	N/A
	Mangroves or Scrub/Shrub Wetlands (ESI = 10D)	+	I	N/A	N/A
	Inundated Lowland Tundras (ESI = 10E)	?	I	N/A	N/A
Ice Environments	Accesible Ice	?	—	?	?
	Inaccessible Ice	?	—	?	?

KEY:

+	Considered to provide value as a response option for this habitat.	?	May provide value as a response option in this habitat.
—	Not considered a viable response option in this habitat.	N/A	Response option not applicable for this habitat.

I Insufficient information- impact or effectiveness of the method could not be evaluated.

Table 3. Continued.

		Emulsion Treating Agents	Fast Water Booming	Fire-fighting Foams	In situ Burning On Land
On-Water Habitats	Offshore	?	?	N/A	N/A
	Bays and Estuaries	?	+	?	N/A
	Ponds and Lakes	—	+	?	N/A
Sub-tidal Habitats	Coral Reef	I	?	—	N/A
	Sea Grass Beds	I	?	—	N/A
	Kelp Forests	I	?	—	N/A
	Soft bottom	I	?	?	N/A
	Mixed and hard Bottom	I	?	?	N/A
Land Habitats	Exposed Rocky Shores (ESI = 1A)	N/A	N/A	?	N/A
	Exposed, Solid, Man-made Structures (ESI = 1B)	N/A	N/A	?	N/A
	Exposed, Wave-cut platforms (ESI = 2)	N/A	N/A	?	—
	Sand Beaches/Tundra Cliffs (ESI = 3 / 4)	N/A	N/A	?	—
	Mixed Sand and Gravel Beaches (ESI = 5)	N/A	N/A	—	—
	Gravel Beaches (ESI = 6A)	N/A	N/A	—	—
	Riprap (ESI = 6B)	N/A	N/A	—	—
	Exposed Tidal Flats (ESI = 7)	N/A	N/A	—	N/A
	Sheltered Rocky Shores (ESI = 8A)	N/A	N/A	—	—
	Sheltered, Solid, Man-Made Structures (ESI = 8B)	N/A	N/A	?	N/A
	Peat Shores (ESI = 8C)	N/A	N/A		N/A
	Sheltered Tidal Flats (ESI = 9)	N/A	N/A	—	N/A
	Marshes (salt to brackish) (ESI = 10A)	N/A	N/A	—	?
	Freshwater Marshes (ESI = 10B)	N/A	N/A	—	?
	Swamps (ESI = 10C)	N/A	N/A	—	?
	Mangroves or Scrub/Shrub Wetlands (ESI = 10D)	N/A	N/A	—	N/A
	Inundated Lowland Tundras (ESI = 10E)	N/A	N/A	?	—
Ice Environments	Accesible Ice	I	? / N/A		?
	Inaccessible Ice	I	? / N/A		?

KEY:

+ Considered to provide value as a response option for this habitat.

? May provide value as a response option in this habitat.

— Not considered a viable response option in this habitat.

N/A Response option not applicable for this habitat.

I Insufficient information- impact or effectiveness of the method could not be evaluated.

Table 3. Continued.

		In Situ Burning On Water	Non Floating Oil Strategies	Pre-Treatment Agents	Oil and Ice Response Strategies
On-Water Habitats	Offshore	+	N/A	N/A	?
	Bays and Estuaries	+	?	N/A	?
	Ponds and Lakes	+		N/A	?
Sub-tidal Habitats	Coral Reef	?	?	N/A	N/A
	Sea Grass Beds	?	?	N/A	N/A
	Kelp Forests	?	?	N/A	N/A
	Soft bottom	?	?	N/A	+
	Mixed and hard Bottom	?	?	N/A	+
Land Habitats	Exposed Rocky Shores (ESI = 1A)	N/A	N/A	I	I
	Exposed, Solid, Man-made Structures (ESI = 1B)	N/A	N/A	I	I
	Exposed, Wave-cut platforms (ESI = 2)	N/A	N/A	I	I
	Sand Beaches/Tundra Cliffs (ESI = 3 / 4)	N/A	N/A	I	I
	Mixed Sand and Gravel Beaches (ESI = 5)	N/A	N/A	I	I
	Gravel Beaches (ESI = 6A)	N/A	N/A	I	I
	Riprap (ESI = 6B)	N/A	N/A	I	I
	Exposed Tidal Flats (ESI = 7)	N/A	N/A	I	I
	Sheltered Rocky Shores (ESI = 8A)	N/A	N/A	I	I
	Sheltered, Solid, Man-Made Structures (ESI = 8B)	N/A	N/A	I	I
	Peat Shores (ESI = 8C)	N/A	N/A	I	I
	Sheltered Tidal Flats (ESI = 9)	N/A	N/A	I	I
	Marshes (salt to brackish) (ESI = 10A)	N/A	N/A	I	I
	Freshwater Marshes (ESI = 10B)	N/A	N/A	I	I
	Swamps (ESI = 10C)	N/A	N/A	I	I
	Mangroves or Scrub/Shrub Wetlands (ESI = 10D)	N/A	N/A	I	I
	Inundated Lowland Tundras (ESI = 10E)	N/A	N/A	I	I
Ice Environments	Accesible Ice	?	?	I	+
	Inaccessible Ice	?	?	I	+

KEY:

+	Considered to provide value as a response option for this habitat.	?	May provide value as a response option in this habitat.
—	Not considered a viable response option in this habitat.	N/A	Response option not applicable for this habitat.

I Insufficient information- impact or effectiveness of the method could not be evaluated.

Table 3. Continued.

		Solidifier	Surface Collecting Agent	Surface Washing Agent	Natural Attenuation
On-Water Habitats	Offshore	?	?	N/A	?
	Bays and Estuaries	?	?	N/A	?
	Ponds and Lakes	?	?	N/A	?
Sub-tidal Habitats	Coral Reef	?	?	N/A	+
	Sea Grass Beds	—	—	N/A	+
	Kelp Forests	—	—	N/A	+
	Soft bottom	?	?	N/A	+
	Mixed and hard Bottom	?	?	N/A	+
Land Habitats	Exposed Rocky Shores (ESI = 1A)	?	N/A	?	+
	Exposed, Solid, Man-made Structures (ESI = 1B)	?	N/A	?	+
	Exposed, Wave-cut platforms (ESI = 2)	?	N/A	?	+
	Sand Beaches/Tundra Cliffs (ESI = 3 / 4)	?	N/A	—	?
	Mixed Sand and Gravel Beaches (ESI = 5)	?	N/A	?	?
	Gravel Beaches (ESI = 6A)	?	N/A	?	+
	Riprap (ESI = 6B)	?	N/A	?	+
	Exposed Tidal Flats (ESI = 7)	?	N/A	N/A	+
	Sheltered Rocky Shores (ESI = 8A)	?	N/A	?	+
	Sheltered, Solid, Man-Made Structures (ESI = 8B)	?	N/A	?	+
	Peat Shores (ESI = 8C)	—	N/A	N/A	+
	Sheltered Tidal Flats (ESI = 9)	?	N/A	N/A	+
	Marshes (salt to brackish) (ESI = 10A)	—	N/A	?	+
	Freshwater Marshes (ESI = 10B)	—	N/A	?	+
	Swamps (ESI = 10C)	—	N/A	?	+
	Mangroves or Scrub/Shrub Wetlands (ESI = 10D)	?	N/A	I	+
	Inundated Lowland Tundras (ESI = 10E)	?	N/A	N/A	+
Ice Environ ments	Accesible Ice	?	I	N/A	?
	Inaccessible Ice	?	I	N/A	?

KEY:

+ Considered to provide value as a response option for this habitat.

? May provide value as a response option in this habitat.

— Not considered a viable response option in this habitat.

N/A Response option not applicable for this habitat.

I Insufficient information- impact or effectiveness of the method could not be evaluated.

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Table 4 Relative Impacts of Oil Spill Response Applied Technologies on Natural Resources.

	Fast Water Booming	Non Floating Oil Strategies	Oil and Ice Response Strategies	Sorbents
MARINE MAMMALS				
Beaked/Toothed Whales: Dolphins, porpoise, whales	+	?	?	N/A
Pinnipeds: seals, sea lions, walrus	+	?	?	+
Furred mammals: sea otter, polar bear	+	?	?	+
Manatees	+	?	N/A	+
TERRESTRIAL MAMMALS				
Swimmers: River otter, muskrat, beaver, mink, etc.	+	?	?	+
Water's edge: deer, fox, raccoon, etc.	N/A	N/A	N/A	+
Domesticated: dog, cat, cattle, etc.	N/A	N/A	N/A	+
BIRDS				
Diving Birds	+	?	N/A	+
Gulls and Terns	+	+	?	?
Raptors	+	+	?	+
Shorebirds	+	+	N/A	+
Wading Birds	+	+	N/A	?
Waterfowl	+	?	N/A	+
Songbirds/other	+	N/A	?	?
AMPHIBIANS AND REPTILES				
Alligators and crocodiles	N/A	?	N/A	+
Sea turtles	N/A	?	?	+
Aquatic/ semi-aquatic turtles, terrapins, snakes and lizards	N/A	?	N/A	+
Terrestrial snakes and turtles	N/A	?	N/A	+
Frogs, salamanders, toads, etc.	N/A	?	+	+ / I
FISH				
Anadromous fish	+	? [a]	?	+
Bottom fish: flounder, rockfish, etc.	+	+ [a]	+	+
Midwater fish	+	+ [a]	+	+
Estuarine fish: mummichugs, silversides, white perch, striped bass, etc.	+	+ [a]	+	+
Freshwater fish	+	? [a]	?	+
Deepwater fish	+	+ [a]	+	+
SHELLFISH				
Bivalves gastropod, clams, oyster, etc.	+	+ [a]	+	+
Crabs, Shrimp, and lobster	+	+ [a]	+	+
Crawdads	N/A	?	N/A	?

KEY:

+ Impact considered minimal.

? Potential impact possible.

— Impact considered likely; not recommended for use when resource is present. **Consult natural resource expert for additional consideration.**

N/A Application not applicable in this resource's habitat.

I Insufficient information – impact or effectiveness of the method could not be evaluated.

	Bioremediation Agents	Dispersant	Elasticity Modifier	Emulsion Treating Agents
MARINE MAMMALS				
Beaked/Toothed Whales: Dolphins, porpoise, whales	**N/A**	—	?	—
Pinnipeds: seals, sea lions, walrus	+ on land	—	—	—
Furred mammals: sea otter, polar bear	+ on land	—	—	—
Manatees	**N/A**	—	—	—
TERRESTRIAL MAMMALS				
Swimmers: River otter, muskrat, beaver, mink, etc.	+ on land	**N/A**	—	**N/A**
Water's edge: deer, fox, raccoon, etc.	+ on land	**N/A**	—	**N/A**
Domesticated dog, cat, cattle, etc.	+ on land	**N/A**	—	**N/A**
BIRDS				
Diving Birds	**N/A**	—	—	—
Gulls and Terns	?	—	?	**N/A**
Raptors	+	—	?	**N/A**
Shorebirds	+	—	?	**N/A**
Wading Birds	+	—	?	**N/A**
Waterfowl	**N/A**	—	—	—
Songbirds/other	?	**N/A**	?	**N/A**
REPTILES				
Alligators and crocodiles	+	?	?	?
Sea turtles	**N/A**	?	?	—
Aquatic/ semi-aquatic turtles, terrapins, snakes and lizards	**N/A**	**N/A**	?	—
Terrestrial snakes and turtles	+		—	**N/A**
Frogs, salamanders, toads, etc.	? / I		? / I	? / I
FISH				
Anadromous	**N/A**	+	+	+
Bottom fish: flounder, rockfish, etc.	**N/A**	+	+	+
Midwater fish	**N/A**	+	+	+
Estuarine fish	**N/A**	+	+	+
Freshwater fish	**N/A**	+	+	+
Deepwater Fish	**N/A**	+	+	+
SHELLFISH				
Bivalves gastropod, clams, oyster, etc.	**N/A**	+	+	+
Crabs	**N/A**	+	+	+
Shrimp and lobster	**N/A**	+	+	+
Crawdads	?	**N/A**	+	**N/A**

KEY:

+ Impact considered minimal.

— Impact considered likely; not recommended for use when resource is present. **Consult natural resource expert for additional consideration.**

? Potential impact possible.

N/A Application not applicable in this resource's habitat.

I Insufficient information – impact or effectiveness of the method could not be evaluated.

	Fire-fighting Foams	In situ Burning On Land	In Situ Burning On Water	Natural Attenuation
MARINE MAMMALS				
Beaked/Toothed Whales: Dolphins, porpoise, whales	?	N/A	—	+
Pinnipeds: seals, sea lions, walrus	?	N/A	—	—
Furred mammals: sea otter, polar bear	?	?	—	—
Manatees	?		—	—
TERRESTRIAL MAMMALS				
Swimmers: River otter, muskrat, beaver, mink, etc.	—	?	?	?
Water's edge: deer, fox, raccoon, etc.	—	?	+	?
Domesticated dog, cat, cattle, etc.	—	?	+	+
BIRDS				
Diving Birds	—	N/A	—	—
Gulls and Terns	—	?	—	—
Raptors	—	?	+	?
Shorebirds	—	?	+	?
Wading Birds	—	?	+	?
Waterfowl	—	?	—	—
Songbirds/other	—	?	N/A	?
REPTILES				
Alligators and crocodiles	—	?	—	?
Sea turtles	N/A	?	—	?
Aquatic/ semi-aquatic turtles, terrapins, snakes and lizards	?	?	—	?
Terrestrial snakes and turtles	— / I	?	N/A	?
Frogs, salamanders, toads, etc.	—	?	?	—
FISH				
Anadromous	+	N/A	+	+
Bottom fish: flounder, rockfish, etc.	+	N/A	+	+
Midwater fish	+	N/A	+	+
Estuarine fish	+	N/A	+	+
Freshwater fish	?	N/A	+	+
Deepwater Fish	+	N/A	+	+
SHELLFISH				
Bivalves gastropod, clams, oyster, etc.	+	N/A	+	+
Crabs	+	N/A	+	+
Shrimp and lobster	+	N/A	+	+
Crawdads	?	N/A	+	+

KEY:

+ Impact considered minimal.

— Impact considered likely; not recommended for use when resource is present. **Consult natural resource expert for additional consideration.**

? Potential impact possible.

N/A Application not applicable in this resource's habitat.

I Insufficient information – impact or effectiveness of the method could not be evaluated.

	Pre-Treatment Agents	Solidifier	Surface Collecting Agent	Surface Washing Agent
MARINE MAMMALS				
Beaked/Toothed Whales: Dolphins, porpoise, whales	N/A	+	N/A	N/A
Pinnipeds: seals, sea lions, walrus	?	+	I	+
Furred mammals: sea otter, polar bear	N/A	+	I	?
Manatees	I	+	I	? / I
TERRESTRIAL MAMMALS				
Swimmers: River otter, muskrat, beaver, mink, etc.	?	+	?	—
Water's edge: deer, fox, raccoon, etc.	?	+	?	?
Domesticated dog, cat, cattle, etc.	?	+	?	?
BIRDS				
Diving Birds	N/A	+	N/A	—
Gulls and Terns	?	+	?	—
Raptors	N/A	+	N/A	—
Shorebirds	?	+	?	—
Wading Birds	?	+	?	—
Waterfowl	?	+	?	—
Songbirds/other		+		—
REPTILES				
Alligators and crocodiles	?	+	?	+
Sea turtles	?	+	?	—
Aquatic/ semi-aquatic turtles, terrapins, snakes and lizards	?	+	?	? / I
Terrestrial snakes and turtles	N/A	+	N/A	?
Frogs, salamanders, toads, etc.		+		—
FISH				
Anadromous/ Other	+	+	+	+
Bottom fish: flounder, rockfish, etc.	+	+	+	+
Midwater fish	+	+	+	+
Estuarine fish	+	+	+	+
Freshwater fish	+	+	+	+
Deepwater Fish	+	+	+	+
SHELLFISH				
Bivalves gastropod, clams, oyster, etc.	+	+	+	+
Crabs	+	+	+	+
Shrimp and lobster	+	+	+	+
Crawdads	+	?	+	N/A

Caveats

[a] - The use of trawls to determine presence of oil would probably have an impact on all fish and shellfish groups listed depending on where in the water column the oil is present. In addition, most trawling efforts tend to result in a number of dead fish being present (result from net pressure and rapid retrieval from depth) that may be scavenged by birds. This scavenging may lead to oiling in some birds. ***It is recommended that all dead fish be kept on board the trawling vessel and disposed of in a proper manner.***

PART B: REVIEW/SELECT POTENTIAL OPTIONS AND PRODUCTS

Introduction

This section of the Selection Guide provides the decision-maker with the means for evaluating detailed information for individual strategies and product categories for use when responding to spilled oil.

Purpose

Review all strategies and products in a detailed manner and allow easy comparison of individual products and strategies to evaluate their potential value to the individual response-specific conditions. Worksheet 2 will be used to facilitate review and comparison of the products.

The general subsections for which summary information is presented for each technology category include:

- Mechanism of action (how it works, what it does)
- When to use
- Authority required
- Availability
- General application requirements
- Health and safety issues
- Limiting factors/environmental constraints
- Monitoring requirements/suggestions
- Waste generation and disposal issues
- References
- Who to call for more information and additional resources

Within each strategy and product category, detailed, strategy/product-specific information is presented in a table format in order to facilitate direct comparison of the various available products. This includes all the products on the NCP Product Schedule, plus others that are not required to be on the Schedule, such as sorbents. Products that are not currently listed on the NCP, but have been in the past are now located in Appendix K. The table organization for each technology category is similar, with some variation, to reflect the most relevant decision issues of interest or concern.

Note

To ensure that you are accessing the most current product pricing information, decision-makers should contact the supplier/vendor.

Continued on Next Page

Step Action Table

Follow the step action table below for Part B: Review/Select Potential Options and Products.

STEP	ACTION
1.	Obtain a blank copy of the Product Selection Worksheet (Worksheet 2) to record information for each product category. Worksheet 2 is on the next page. Another copy is in Appendix H for photocopying. ***Note***: If two product categories/strategies are being evaluated for an incident, fill out a separate Product Selection Worksheet for each category/strategy. ***Note***: If you are considering a category/ strategy that does not involve the use of NCP listed products, such as fast water booming or water intake monitoring, this worksheet is not needed.
2.	Record product category/strategy being evaluated on Line A of Worksheet 2. Review all information in the general category overview.
3.	Identify up to three products in this category to be reviewed. Record a product name in each column on Line B. *Use another copy of the worksheet if more than three products are being evaluated for a product category.*
4.	Complete questions C, D, E, and F for each product being considered. Record product-specific information in the space available for these questions.
5.	Record the toxicity ratings for Inland Silversides (96h) and Mysid Shrimp (48h) for each product in Line G, where applicable. ***Note***: For more information on the toxicity and toxicity ratings and what they mean refer to Appendix E of this volume.

Continued on Next Page

Step Action Table Continued.

6.	Review product-specific information recorded and compare and contrast products. Rank the products in terms of value to the incident-specific response conditions. Identify those products that are not suitable at this time. Record this information in Line H.
7.	Record any additional comments or information that is pertinent to this decision in Line I.
8.	This worksheet is designed to assist in the decision-making process. In Line J, if a product(s) appears to add value to the response, the completed worksheets can be used to demonstrate consensus and can be FAXed to the incident-specific RRT for review and/or approval.
	NOTE: Identifying potential products for use in the response requires additional evaluation criteria in terms of actually testing the product on the oil and developing monitoring capabilities to determine the extent of effectiveness and when to cease using a product. Continue on to Part C to complete your evaluation

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WORKSHEET 2: PRODUCT SELECTION WORKSHEET

This worksheet is intended to be photocopied for each product category evaluated and used during drills and incidents and Faxed to the Incident Specific RRT for review. This worksheet may be used to evaluate 1, 2 or 3 separate products in an individual category.

Name(s):

Date:

Incident:

A:	**Product Category Being Reviewed:**			
	Products of Interest:	**Product 1**	**Product 2**	**Product 3**
B:	**Product Name:**			
C:	**RRT Approval Required? (Y/N)**			
D:	**Can Product Arrive in Time? (Y/N)**			
E:	**Can Product be Applied in Time? (Y/N)**			
F:	**Can Product be removed from the Environment? (Y/N)**			
G:	**Toxicity (Write in numbers and Toxicity Rating. See App E for more information on toxicity and Toxicity Rating)**	Inland silversides (96h): Mysid Shrimp (48h):	Inland silversides (96h): Mysid Shrimp (48h):	Inland silversides (96h): Mysid Shrimp (48h):
H:	**Mark as 1st, 2nd, or 3rd Choice or mark as Not Applicable for this incident**			

I: Additional Comments/Decisions/Recommendations:

J: Initials/Date of Incident-Specific RRT Review of Information:

Initial Box and Include Date Upon Review

USEPA:	☐	Date:	**STATE:**	☐	Date:____________________
USCG:	☐	Date:	**STATE:**	☐	Date:____________________
NOAA:	☐	Date:	**OTHER:**	☐	Date:____________________
USDOI:	☐	Date:	**OTHER:**	☐	Date:____________________

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FAST-WATER BOOMING STRATEGIES

Description

- For the purposes of the Selection Guide, the term "fast water" is applied to any water body with currents of one to six knots.
- Oil containment boom loses oil due to entrainment when the water current normal (perpendicular) to the boom exceeds 0.75 to 1 knot (depending on the oil's specific gravity, viscosity, and other factors). Above this "critical velocity", entrainment can be eliminated or reduced by deploying boom at an angle to the current to divert or deflect floating oil away from sensitive areas or toward areas of lower current velocity where the oil may be contained and recovered.
- With increasing current, the angle of the boom to the current must be reduced to control entrainment.
- Traditional containment booms can be positioned at sharp angles to the current (with great difficulty) to divert oil in up to two or three knots. With developing technologies, a current of six knots is considered the upper limit for controlling floating oil in the foreseeable future.

When to Use

- Fast-water booming strategies (Table 5) should be used whenever the current exceeds the critical velocity for the spilled oil, and entrains under the containment or deflection boom.

Understanding the Problem

- Sixty-nine percent of all oil transported on US waters (645 million tons annually) is transported on waterways in which currents routinely exceed one knot.
- Thousands of facilities with tanks containing millions of tons of oil are located in close proximity to high current waterways.
- During the past decade (1990s), 58% of all oil spills 100 gallons or larger have occurred in high-current waterways.
- Oil containment boom fails to contain oil due to entrainment at currents above 0.75 to 1.0 knots. With a 1.5 knot current, a deflection boom must be angled at approximately 35° to the current to prevent entrainment. At two-knots current velocity, the boom angle must be reduced to about 25° and to about 15° for a three-knot current. These sharp boom angles are very difficult to achieve and maintain, particularly with reversing tidal currents.

Authority Required

- **RRT approval is not required** for employing fast-water booming techniques, but operations personnel should coordinate with appropriate state and local authorities with respect to shoreline private property issues, environmentally sensitive shorelines, and intertidal and subtidal areas when deploying mooring systems.

- Care should be enforced to ensure that coral reefs, seagrass beds, and other particularly sensitive resources are not damaged by boom-mooring systems, by boats, or by personnel operating in shallow water areas.

Availability

- Specialized fast-water booms and related equipment are not generally available in significant quantities at the time of this writing. There is, however, a growing awareness of the need for such resources in fast-water areas.
- Fast-water booming techniques, addressed below, can be implemented using traditional booming equipment.

General Application Requirements

- Fast-water booming strategies to protect sensitive areas must be:
  - well thought out;
  - practiced by well-trained, properly equipped, and experienced crews, under controlled conditions; and
  - refined, prior to implementation during an actual spill response.
- Improper implementation of fast-water booming strategies can seriously endanger boat crews in addition to jeopardizing the success of the operation. A towboat can easily be capsized and submerged when handling boom in a fast-water environment. For this reason alone, some of the newer booming techniques feature boom deployment and positioning using shore-tended lines should be considered where feasible.

Health and Safety Issues

The following health and safety issues should be addressed prior to engaging in fast-water booming operations:

- The Safety Officer must personally address fast-water safety issues or assign a knowledgeable assistant to do so. The Site Safety Plan should specifically address fast-water booming issues.
- As noted above, fast-water booming operations should be well planned and implemented by experienced work crews. Personnel must receive thorough safety briefings stressing operational objectives, procedures, chain of command, potential safety hazards, and required personnel protective equipment.
- Small boat operations, and particularly towing operations, under high-current conditions can be hazardous and should be undertaken only by highly trained and experienced boat crews familiar with the operating area.
- During operations, shoreside work crews may be exposed to the same range of hazards as boat crews, but will likely have had less training/experience.

Personnel wading in shallow, high current waters should be aware of the extreme hazard of foot entrapment and submersion by the current.

- Man-overboard procedures should be discussed and understood by all hands. Positioning a safety boat down current of the booming operations should be considered for potential man-overboard situations.
- Boom towlines and mooring lines can be subjected to high loads in high-current conditions. Boom and line-safe working loads should be considered and the potential for parting and snap-back anticipated. Booming techniques, such as cascading, should be considered as appropriate to reduce boom and line loading.

Monitoring Requirements/Suggestions

- Fast-water booming deployments must be continually monitored to ensure boom angles are appropriate to prevent entrainment, and to ensure that mooring system anchors have not dragged, lines parted, or other system components failed under load.
- Work crews must be prepared to make adjustments as required.

References

Coe, T., and B. Gurr. 1998. Control of oil spills in high speed currents: A technology assessment. US Coast Guard R&D Center, Groton, CT. Report No. CG-D-18-99.

Owens, E.H. 1995. Field guide for the protection and cleanup of oiled shorelines. Environment Canada, Atlantic Region, Environmental Emergencies Section, Dartmouth, Nova Scotia.

Michel, J., S. Christopherson, and F. Whipple. 1994. Mechanical protection guidelines. Hazardous Materials Response and Assessment Division. National Oceanic and Atmospheric Administration, Seattle, WA.

Exxon USA. 1992. Oil spill response field manual. Exxon Production Research Company, Houston, TX.

Who to Call for More Information and Additional Resources

- OHMSETT Testing Facility, PO Box 473, Atlantic Highland, NJ 07716
  Phone: (732) 866-7183; http://www.ohmsett.com

- Marine Spill Response Corporation HQ, 455 Spring Park Place, Suite 200, Herndon, VA 20170 Phone: (703) 326-5617

- USCG Response Plan Equipment Caps Review,
  http://www.uscg.mil/vrp/capsreview.htm

- USCG Research & Development Center, Groton, CT.

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Table 5. Fast-Water Booming Strategy Options.

	Angled Deflection	Site Selection	Boom Selection
Description	When the current exceeds the critical velocity and entrainment prevents effective oil containment, boom can be angled across the current to divert or deflect oil away from sensitive areas or toward lower current areas for recovery. Deflection may be effective in up to three knots of current, if a very sharp boom angle can be maintained across the current (about 15° from the direction of current flow, for a 3 knot current). Newer boom designs and refinements in technique may extend this capability.	Select a protective booming site where current is minimized (e.g. at the widest and/or deepest point of a river or channel, or at the channel entrance or exit, etc.). Select an area where oil can be diverted to a natural collection point or eddy where current allows recovery using skimmers or pumps. A shoreside recovery point accessible by land-based heavy equipment is preferred, but not essential. Floating platforms may be positioned to support oil recovery and temporary storage. Do not select a boom site where booming is impractical due to current, sea state, logistics, etc.	Boom characteristics important for fast-water booming include shallow skirt depth (draft of 6 inches or less) to minimize entrainment, bottom tension member to prevent boom planing, curtain versus fence design for vertical flexibility, high buoyancy to weight ratio to prevent submersion, and sufficient tensile strength to prevent structural failure. **Some manufacturers offer specially designed High Current Booms** incorporating the above features. Shallow draft deflection boom must transition to traditional deeper draft containment boom to hold diverted oil for recovery in the low-current oil collection area.
Equipment Availability	Any reasonably strong, relatively shallow draft, oil containment boom with a bottom tension member can be deployed in a deflection mode across a current. Adequate mooring systems are less readily available but can be assembled with adequate planning.	N/A	High current booms are not widely available at this writing. Any strong boom with a relatively shallow draft and a bottom tension member is a good candidate for fast-current booming
Logistical Needs	Launch site for tow boat(s) and boom near the area to be protected. One or more powerful towboats with adequate towing bitts and sufficient deck space for mooring system stowage and deployment.	**1) N/A**	See Logistical needs for "Angled Deflection" (to the left) on this page

Table 5. Continued.

	Adequate Moorings	Cascade Booming	Shore-Tended Boom
Description	Stretching a length of boom in a relatively straight line across a high current requires application of considerable opposing forces on the two ends of the boom. Once in position, the forces must be maintained, traditionally with mooring systems featuring anchors, which are heavy and/or highly efficient (have high holding power). All components of the boom and mooring systems must have adequate safe working loads to prevent structural failure. In some cases, additional mooring systems must be secured at intermediate points along the boom to overcome lateral forces tending to create boom catenary leading to entrainment.	In some cases, a series of two or more overlapping, "cascade", deflection booms stretched across a high current waterway are more practical than a single long deflection boom spanning the same distance. The shorter, individual cascade boom sections will generate lesser loads in the current and will therefore require lighter rigging, smaller anchors, less powerful towboats, etc. On the other hand, cascade systems are more complex and system simplicity should be an objective to the extent possible. Multiple mooring systems in close proximity can result in fouling of anchors and related operational complications.	In relatively narrow rivers or channels, it may be feasible to rig single or cascade deflection boom sections using only shoreside anchor points. Shoreside anchor points may be trees, large rocks, or installed "deadmen". Boom mooring lines secured to shoreside points are accessible and readily adjustable. Envision a length of boom stretched in a fairly straight line, at a sharp angle across the current, from an upstream anchor point on one side of the river to a downstream anchor point on the opposite side of the river. In addition to the longitudinal mooring lines, other lines on the boom ends can be worked from the shore, at right angles to the boom, to control lateral positioning in the river.
Equipment Availability	Boom mooring systems with the high holding power necessary for deflection booming across a high current are not readily available from booming contractors. Suitable mooring system components can be assembled with adequate advance planning.	More mooring systems and rigging materials, and a little more boom will be required, but the moorings and rigging need not be as robust.	Shore-tended boom mooring systems can be readily assembled using appropriately sized line, shackles, snatch blocks, and other standard marine rigging materials. These systems work best with specially designed high-current booms (See Boom Selection above).
Logistical Needs	Adequate mooring systems for fast-water booming are not readily available. Deployment and especially recovery of heavy anchors requires specially equipped workboats and experienced crews. Pre-spill installation of permanent boom mooring buoys and anchor points ashore, to protect sensitive areas, is highly recommended.	Logistic support to install the more complex cascade system may be of longer duration, but less demanding in terms of the installation of smaller mooring systems and lighter rigging. Smaller, less powerful towboats may be adequate for deployment and recovery of the lighter weight cascade system moorings.	A small boat, heaving line, or other means of passing a messenger line across the river to haul mooring lines and booms across. Winches, "come-alongs", 4-wheel drive vehicles, or other means of hauling, as required. A trained and experienced work crew with a qualified rigger is required.

Table 5. Continued.

	Reduce Relative Velocity	New Innovations
Description	Fast-water booming in open-water areas may allow reducing water velocity relative to the boom by "going with the flow". Tow boats may sweep (U-configuration) oil collection boom through a slick at one knot relative to the slick, while being set back two knots "over the ground", by a three knot current. When filled with oil, the boom ends can be brought together in a "teardrop" configuration and allowed to drift with the current pending removal by skimming. Similarly, in open waters, a skimmer with V-configuration collection boom can recover an oil slick in a high current provided it proceeds at a slow speed through the slick while being set backward by the current.	A number of innovative new ideas have been proposed and tested with varying degrees of success to date. At the time of this writing it is not appropriate to include them in this Selection Guide. Operational systems are not yet available. The Coast Guard R&D Center in Groton, CT, and other sources may be contacted for further information on this subject.
Equipment Availability	Standard booms, skimmers, and towboats may be used, but specialized high-current booms and skimmers will enhance performance. "Open water" operation implies that equipment must be suitable for the sea state and other environmental conditions to be encountered.	
Logistical Needs	No unusual logistical needs would be anticipated beyond those required by offshore or open water operations.	

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NON-FLOATING OIL STRATEGIES

Understanding the Problem

- Non-floating oil spills can have complex behavioral patterns, depending on the API gravity of the oil, the density of the receiving water, and the physical setting of the spill site.
- Denser-than-water oil is expected to mix in the water column as oil drops rather than large, cohesive mats. Oil can accumulate on the bottom under low currents, so releases in harbors with dredged channels and berths in canals could readily sink and form pools of oil on the bottom.
- Releases in areas subject to tidal and riverine flow are likely to be kept in suspension in the water column by currents.
- Floating oil can sink after mixing with sand, either in the surf zone or after stranding onshore.
- Traditional methods for tracking, containment, and recovery are not effective for non-floating oil spills. Refer to the matrices to evaluate possible options for tracking, containing, and recovering oil suspended in the water column and on the bottom.

What to Do

Because non-floating oil can cause environmental and/or other problems, officials might require responders to assess the feasibility of taking action to deal with these oils. General options include:

- Mapping the extent of oil deposited on the bottom;
- Containing oil suspended in the water column; and
- Recovery of oil deposited on the bottom.

Authority Required

Key regulatory issues associated with response to non-floating oil spills can include:

- Getting approval from the Corps of Engineers and applicable state authorities for emergency dredging.
- Getting emergency decant authorization when handling large volumes of water during dredging.
- Disturbing bottom sediments that may be previously contaminated.
- Contamination of bottom sediments that may require additional testing and disposal restrictions during future maintenance dredging operations.

Availability

- Varies widely by equipment type. See Tables 6-8 for each option.

Limiting Factors/Environmental Constraints

- Human health and safety are of primary concern, particularly for dive operations in general and specifically contaminated-water diving.
- Existing methods for tracking oil suspended in the water column are ineffective; methods for mapping oil deposited on the bottom are slow and logistics-intensive.
- Strong currents limit the likelihood of any oil accumulating on the bottom and diver operations.
- Poor water visibility limits ability to locate oil deposits and effectiveness of divers in directing recovery devices.
- Debris on the bottom may make the recovery of sunken oil difficult and could tangle or damage nets and other recovery equipment.
- Not enough is known about the long-term effects of submerged, thick oil residues to determine cleanup endpoints appropriate for different benthic habitats.

Monitoring Requirements/Suggestions

- Since there is very poor documentation on the effectiveness and effects of containment and recovery of non-floating oils, monitoring is very important.

Waste Generation and Disposal Issues

- There are numerous and complex waste disposal issues associated with disposal of both the liquids and solids collected during recovery of non-floating oil spills.
- Large volumes of collected water will have to be decanted and discharged on-scene during recovery operations.

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Who to Call for More Information and Additional Resources

NOAA HAZMAT/SSC, General contact number: 206-526-6317

O'Brien's Oil Pollution Services, Inc., 505 Weyer Street, Gretna, LA 70053
Phone: 504-368-9845; email: oops-usa@ix.netcom.com

Research Planning, Inc., 1121 Park Street, Columbia, SC 29201
Phone: 803-256-7322

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Table 6. Response Options for Mapping of Oil Deposited on the Bottom.

	Visual Observations	Bottom Sampling from the Surface	Underwater Surveys by Divers
Description	Trained observers in aircraft or on vessels look for visual evidence of oil on the bottom	A sampling device (corer, grab sampler, sorbents attached to weights) is deployed to collect samples from the bottom for visual inspection	Divers (trained in contaminated water diving) survey the sea floor either visually or with video cameras
Equipment Availability	Uses readily available equipment	Uses readily available equipment and supplies	Underwater video cameras are readily available, but divers and dive gear for contaminated water operations may not be available locally
Logistical Needs	Low; aircraft and vessels are readily available during spill response	Moderate; requires boat, sampling equipment, GPS for station location	Moderate, depending on the level of diver protection required
Coverage Rate	High for aircraft; low for vessels	Very low; collecting discrete bottom samples is very slow and devices sample only a very small area	Low, because of slow swimming rates, limited dive time, poor water quality
Data Turnaround	Quick	Quick since visual analysis is used	Quick
Probability of False Positives	High, due to poor water clarity, cloud shadows, seagrass beds, irregular bathymetry	Low, except in areas with high background oil contamination	Low, since divers can verify potential oil deposits
Operational Limitations	Good water clarity and light conditions (water depth < 60 ft); weather may restrict flights; only during daylight hours	Realistic only for water depths <100 ft; sea conditions may restrict vessel operations	Water depths of <100 ft (for divers); minimum visibility of 1-2 ft; low water currents
Pros	Can cover large areas quickly using standard resources available at spills	Can be effective in small areas to rapidly define a known patch of oil on the bottom; low tech; has been proven effective for certain spills	Accurate determination of oil on bottom; verbal and visual description of extent and thickness of oil and spatial variations
Cons	Only effective in areas with high water clarity; sediment cover will prevent detection over time; ground truthing is required	Samples a very small area which may not be representative; too slow to be effective over large area; does not indicate oil quantity on bottom	Slow; difficult to accurately locate deposits without GPS; decon of dive gear can be costly/time-consuming

Table 6. Continued.

	Bottom Trawls	Photobathymetry	Geophysical/Acoustic Techniques
Description	Fish nets or trawling gear are towed on the bottom for set distance then inspected for presence of oil	Aerial stereo photography mapping technique to identify and map underwater features. A realistic scale is 1:10,000	Sonar system which uses the differential density and sound speeds in oil and sediment to detect oil layers on the bottom. A fathometer records a single line under the sounder; side-scan sonar records a swath.
Equipment Availability	Readily available in commercial fishing areas	Available from most private aerial mapping companies, with specifications	Variable, and often not available locally; need trained personnel
Logistical Needs	Moderate; requires boat and operators to tow the nets; may need multiple vessels to cover large areas; may need many replacement nets as they become oiled	Aircraft specially equipped to obtain vertical aerial photography with GPS interface	Moderate; requires boat on which equipment can be mounted; need updated charts so that search area can be defined
Coverage Rate	Low; nets have a small sweep area and they have to be pulled up frequently for inspection	High	Moderate; data collected at speeds up to several knots
Data Turnaround	Quick	Slow; aerial photos can be produced in a few days in most places; data interpretation will take 1-2 + days	Medium; data processing takes hours, preliminary data usually available next day; potential sites need ground truthing
Probability of False Positives	Low; oil staining should be readily differentiated from other fouling materials	High; photograph identify potential sites, all of which will need ground truthing	High; identifies potential sites but all need ground truthing
Operational Limitations	Obstructions on the bottom can hang up nets; restricted to relatively shallow depths; sea conditions may restrict vessel operations; heavy debris in water can foul nets	Specifications call for low sun angles and calm sea state; water penetration is limited by water clarity; maximum penetration is 25 ft for very clear water; 2 ft for turbid water; best if baseline "before" photography is available for comparison	Sea conditions have to be relatively calm to minimize noise in the recording
Pros	Can provide data on relative concentrations on the bottom per unit trawl area/time; can survey in grids for more representative aerial coverage	Rapid assessment of large areas; high spatial resolution; good documentation and mapping	Can be used to identify potential accumulation areas; complete systems can generate high-quality data with track lines, good locational accuracy
Cons	Very slow; nets can fail from excess debris accumulation	Limited by water clarity, sun angle, and availability of pre-spill photography for comparisons	Data processing can be slow; requires extensive ground truthing; limited number of skilled operators

Table 7. Response Options for Containing Oil Suspended in the Water Column.

	Air Curtains/Barriers	Net Booms	Silt Curtains
Description	Piping with holes is placed on the bottom and compressed air is pumped through it, creating an air bubble barrier	Floating booms with weighted skirts (3-6 ft) composed of mesh designed to allow water to pass while containing suspended oil	Silt curtains, as used during dredging operations, are deployed as a physical barrier to the spread of suspended oil; weighted ballast chains keep the curtain in place
Equipment Availability	Uses readily available equipment, though in unique configuration	There are commercially available net booms, developed and tested for containing spills of Orimulsion. Little availability in the US	Not readily available; limited expertise in deployment and maintenance
Logistical Needs	Moderate: need system to deploy and maintain bubbler; piping has tendency to clog; high installation costs	Moderate; similar to deployment of standard booms, but with added difficulty because of longer skirt; can become heavy and unmanageable	Moderate; to properly deploy and maintain the silt curtains
Operational Limitations	Only effective in low currents (<0.5 knots), small waves, and water depths < 5 ft	In field tests, the booms failed in currents <0.75 knots. They will work under very few conditions	Only effective in very low currents (<0.5 knots); practical limits on curtain depth are 5-10 ft, which normally doesn't extend to the bottom
Optimal Conditions	To contain oil spilled in dead-end canals and piers; to protect water intakes	Will contain oil only in very low-flow areas, such as dead-end canals and piers	Still water bodies such as lakes; dead-end canals
Pros	Does not interfere with vessel traffic	Can be deployed similar to traditional booms	Can be deployed throughout the entire water column
Cons	Only effective under very limited conditions; takes time to fabricate and deploy, thus only effective where pre-deployed; little data to assess performance	Only contains oil suspended in the upper water column, to the depth of the mesh skirt; if sufficient oil is suspended in the upper water column to warrant the use of nets, then it is likely that the nets will become clogged and will need to be monitored and/or replaced	Only effective under very limited conditions, not likely to coincide with those where suspended oil needs containment; oil droplets are larger than silt and could clog curtain

Table 8. Response Options for Recovering Oil Deposited on the Bottom.

	Manual Removal by Divers	Nets/Trawls	Pump and Vacuum Systems (Diver-directed)
Description	Divers pick up solid and semi-solid oil by hand or with nets on the bottom, placing it in bags or other containers	Fish nets and trawls are dragged on the bottom to collect solidified oil	Divers direct a suction hose connected to a pump and vacuum system, connected to oil-water separator, and solids containers. Viscous oils require special pumps and suction heads. Even in low water visibility, divers can identify oil by feel or get feedback from top-side monitors of changes in oil recovery rates in effluents
Equipment Availability	Contaminated-water dive gear may not be locally available	Nets and vessels readily available in areas with commercial fishing industry	Readily available equipment but needs modification to spill conditions, particularly pumping systems, and capacity for handling large volumes of materials during oil-water-solids separation
Logistical Needs	Moderate; diving in contaminated-water requires special gear and decon procedures; handling of oily wastes on water can be difficult	Low; uses standard equipment, though nets will have to be replaced often because of fouling	High, especially if recovery operations are not very close to shore. On-water systems will be very complicated and subject to weather, vessel traffic, and other safety issues
Operational Limitations	Water depths < 100 ft for routine dive operations; water visibility of 1-2 ft so divers can see the oil; bad weather can shut down operations	Water depths normally reached by bottom trawlers; obstructions on the bottom which will hang up nets; rough sea conditions; too shallow for boat operations	Water depths < 100 ft for routine dive operations; water visibility of 1-2 ft so divers can see the oil; bad weather can shut down operations; solid oil which is not pumpable
Optimal Conditions	Shallow, protected areas where dive operations can be conducted safely; small amount of oil; scattered oil deposits	Areas where bottom trawlers normally work; solidified oil	Sites adjacent to shore, requiring minimal on-water systems; liquid or semi-solid oil; thick oil deposits, good visibility; low currents
Pros	Divers can be very selective, removing only oil, minimizing the volume of recovered materials; most effective method for widely scattered oil deposits	Uses available resources; low tech	Most experience is with this type of recovery; diver can be selective in recovering only oil and effective with scattered deposits
Cons	Large manpower and logistics requirements; problems with contaminated-water diving and equipment decon; slow recovery rates; weather dependent operations	Not effective for liquid or semi-solid oil; nets can quickly become clogged and fail; can become heavy and unmanageable if loaded with oil; could require many nets which are expensive	Very large manpower and logistics requirements, including large volumes of water-oil-solids handling, separation, storage, and disposal; problems with contaminated-water diving and equipment decon; slow recovery rates; weather dependent operations

Table 8. Continued.

	Dredging
Description	Special purpose dredges, usually small and mobile, with ability for accurate vertical control. Uses land- or barge-based systems for storage and separation of the large volumes of oil-water-solids
Equipment Availability	Varies; readily available in active port areas; takes days/week to mobilize complete systems
Logistical Needs	High, especially if recovery operations are not very close to shore, because of large volumes of materials handled. On-water systems will be very complicated and subject to weather, vessel traffic, and other safety issues
Operational Limitations	Min/max water depths are a function of dredge type, usually 2 to 100 ft; not in rocky substrates; bad weather can shut down operations
Optimal Conditions	Large volume of thick oil on the bottom; need for rapid removal before conditions change and oil is remobilized, buried by clean sediment, or will have larger environmental effects
Pros	Rapid removal rates; can recover non-pumpable oil
Cons	Generates large volumes of water/solids for handling, treatment, disposal; large logistics requirements; could re-suspend oil/turbidity and affect other resources

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OIL-AND-ICE RESPONSE STRATEGIES

Description

- Response techniques must vary or be modified when an oil spill interacts with ice.
- Ice habitat presents unique safety issues in terms of cold, ice stability, and wildlife interactions.
- Ice forming on the water surface can persist for a matter of days to several months, depending upon location. Most ice is floating, but occasionally, the ice is frozen to the bottom. Responses to oil spills in ice are divided into two categories (defined by API Marine Manual, [2001]):

Picture courtesy of A. Allen, Spiltec

Accessible ice – can safely support the personnel and equipment suitable for response to a particular oil spill on, in, under, or adjacent to solid ice; and

Picture courtesy of C. Rivet, Canada

Inaccessible ice – cannot safely support response personnel and response equipment (e.g., river systems). Oil spills on, in, under, or adjacent to brash ice, small or fast moving floes, or other ice types which are "inaccessible" must be treated from the air or from vessels working in or alongside, the ice.

- Water/shoreline habitats which experience ice formation in winter months are, in general, considered to have low sensitivity to oil spills. In most instances, the ice along the shoreline or in the adjacent nearshore water acts as a natural barrier, often reducing the amount of oil that might otherwise make contact with the shoreline.
- During the ice growth phase (or following an extended snowfall), the oil can become encapsulated within the ice.

- During the next or subsequent thaw periods, encapsulated oil could be released but is unlikely to adhere to the melting ice, therefore remaining on the water surface or in leads among the ice. The oil in or below the ice surface will often migrate through brine channels (in sea ice) to the surface. The same is true in freshwater environments.
- Booms, other barriers, skimmers, absorbents, and the ice itself often work effectively in containment and recovery of oil for areas with accessible ice. Boom, skimmers, manual oil recovery, and other conventional countermeasures are not effective or are hazardous to use in areas with inaccessible ice, especially when ice is present in river systems with fast-moving currents and under tidal influence.

When to Use

- When oil is spilled in areas where ice is present.
- Natural recovery may be the only response option available, and is the preferred method for spills of light oils (e.g., gasoline) in accessible and inaccessible ice, particularly when oil quantities are small.
- Traditional countermeasures (booming, skimming, barriers/berms, manual and mechanical removal, sorbents, and vacuums) are typically the response options of choice for spills in accessible ice and in riverine systems. In rivers, the currents would normally carry the oil with loose ice toward open water where conventional clean up methods would be used. Ice build up out from shorelines would tend to assist in keeping the oil in the opened channel.
- Additionally, low-pressure ambient and hot water flushing, steam cleaning, dispersants, and in situ (ISB) burning are also recommended options for dealing with oil spilled in accessible ice.
- Many of the conventional countermeasures have reduced effectiveness and serious health and safety issues associated with their use in inaccessible ice conditions. Dispersants and in situ burning are widely accepted methods for responding to oil spills in inaccessible ice conditions in the open ocean. Dispersants are not applicable in lake and riverine environments.
- For spills where the oil is frozen into the ice, collecting and removing the ice and oil is a sensible strategy. A stable platform is needed.

Understanding the Problem

- The presence of ice greatly reduces the rate of natural weathering for petroleum hydrocarbons.
- Oil may become trapped or frozen into the ice, reducing the natural weathering processes.
- Equipment must be able to handle rugged terrain, extreme cold, blowing snow, and the risks associated with operating with heavy loads on accessible and inaccessible ice.

- Equipment in extreme environments must be designed for self-sufficiency in often remote and inhospitable areas where the ability to call for backup or evacuation may not be possible.
- In the Great Lakes, there is often shorefast, accessible ice cover ranging from 40 percent to 100 percent on Lake Erie. The St. Mary's River typically experiences up to 5 months of shorefast ice.
- In Alaska, particularly in the Beaufort Sea and North Slope areas, the ability to respond to oil spills depends largely on the season. The North Slope region is characterized by a band of shorefast ice (much of it bottom-fast as well) in the shallow coastal waters. At the edge of the accessible ice is deeper water, a transition is made to pack ice through a shearing zone characterized by massive pressure ridges, grounded rubble combined with heavy old ice (Tornga, 2000).
    - Tugs and barges can operate when light ice or open water conditions are present, typically early August to September.
    - Deep draft icebreaking vessels can substantially extend the marine operating season offshore, but in the shallow coastal waters of the North Slope area, the shallow draft icebreaking barges extend the season into October.
    - In Alaska, heavy trucks and loaders can operate safely through much of the landfast ice during winter after barges are forced back to the dock, until April when the ice starts soften.
    - Helicopters and hovercraft represent the only vehicles that can achieve continuous access to an offshore site throughout the year. Helicopters require a minimum ice thickness to land and experience downtimes in conditions of fog and icing. Hovercraft are relatively unaffected by thickness or state of the ice, but can experience problems in rough ice and strong winds.
- In the lower 48, the typical incident is confined to spills of oil in navigable waterways, ruptures of pipelines (underwater and on land), and other discharges on land.
    - The thickness and duration of ice presence varies from state to state and from year to year.
    - Oil discharged in lakes/ponds and on land would expect very little current and transportation of the oil. Once detected, responders would need to determine the extent of spread and determine how to contain the oil.
    - Tugs and barges can operate when light ice or open water conditions are present.
    - Conventional response equipment may not function properly in the presence of ice.
    - Containment of oil under ice is primarily done by cutting a slot in ice around oil and placing boom to contain the further spread of the oil. Responders can cut holes in ice to remove oil or wait for the ice to melt and recover oil with normal means. Environmental considerations would determine the urgency for removal.

- ISB is often one of the few practical options for removing oil spilled in ice-covered waters. Often ISB is the only option with the exception of no response or natural attenuation. ISB depends of the characteristics of the spilled oil and how it behaves in the ice environment.

Authority Required

- **RRT approval is not required** for employing conventional countermeasure strategies for recovery /remediation of oil spilled in either accessible or inaccessible ice. However, if dispersants or in situ burning are considered a viable response option, **concurrence of the incident-specific RRT would be required**. Review the summary sheets on dispersants and in situ burning later in this section for additional authorization requirement instructions.
- A detailed health and safety plan should be developed when using any technology in accessible or inaccessible ice environments. This safety plan should deal with hypothermia problems as well as "falls through the ice" issues.

Availability

- Specific equipment designed for oil spills in ice conditions is currently available in several areas of the US, including Alaska and the Great Lakes, and Canada.
- Steel pontoon booms designed for oil recovery in ice infested waters are currently being constructed, tested, and stockpiled at various sites in Canada and the US (Abdelnour, 2000).
  - Stockpile amounts will change over time.

Limiting Factors/Environmental Constraints

- Human health and safety are of primary concern, particularly for operations situated in inaccessible ice or near the edges of the accessible ice.
- Existing methods for tracking oil spilled under the ice are being modified to rapidly detect and trace the oil.

Health and Safety Concerns

The following health and safety issues should be addressed prior to engaging in oil in ice recovery operations:

- The Safety Officer must personally address health and safety issues associated with cold weather response operations, or assign a knowledgeable assistant to do so. The Site Safety Plan should specifically address working conditions associated with cold weather, ice, and hypothermia issues.

Waste Generation and Disposal Issues

- There are numerous and complex waste disposal issues associated with the disposal of liquids and solids recovered during recovery operations when oil is spilled in, or on ice.
- Recovered oil frozen in ice needs to be transported to approved disposal sites.

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Alaska Clean Seas. 1999. Alaska Clean Seas Technical Manual: Volume I Tactics Descriptions. Developed for Alyeska Pipeline Services Company, EXXON Company, BP Exploration Inc., and ARCO Alaska, Inc.

Who to Call for More Information and Additional Resources

Ed Owens, Polaris Applied Sciences, Inc. Bainbridge Island, WA. Phone: 206- 842-2951

Alaska Clean Seas, Prudhoe Bay, AK Phone: 907-659-3207

Emergencies Science Division, Environment Canada, Ottawa, Canada (613) 988-9622

Matt Carr or Carl Lautenburg, USEPA Region 10. Phone: 907-271-3616

Eugene Johnson, Delaware Bay & River Cooperative Inc., Lewes, DE.
Phone: 215-563-8142

Ian Buist and Sy Ross, SL Ross Environmental Research, Ottawa, Ontario, Canada
Phone: (613) 232-1564.

Equipment Deployment:

USCG National Strike Force Coordination Center, Elizabeth City, NC
Phone: 252-331-6000
and Regional Strike Teams

Emergencies Science Division, Environment Canada, Ottawa, Canada   (613) 988-9622

ISB in Ice Environments

Al Allen, Spiltec, Inc., Woodinville, WA (206) 869-0988

Ian Buist and Sy Ross, SL Ross Environmental Research, Ottawa, Ontario, Canada
Phone: (613) 232-1564.

Table 9. Response Options for Detecting Oil Under Ice.

	Underwater Surveys by Divers	Aerial Thermography	Scanning Fluorescence Laser
Description	Divers (trained in contaminated water diving) survey areas under the ice either visually or with video cameras	Using an infrared camera or IR/UV system allows detection of oil under a variety of conditions, discriminate oil from some background.	A laser and fiber optic scanner perform a fast line scan from a height of 50 meters onboard a small helicopter; covers the ground with laser pulses 10 cm apart.
Equipment Availability	Underwater video cameras are readily available, but divers and dive gear for cold, contaminated water operations may not be available locally		Testing phase; required to be attached to small helicopter; uses GPS positioning to mark identified oil on a map for post-processing.
Logistical Needs	Moderate, depending on the level of diver protection required		Extensive; equipment needs are also extensive
Coverage Rate	Low, because of slow swimming rates, limited dive time, poor water quality		
Data Turnaround	Quick		Delayed; must import information and display on three-dimensional GIS system using Virtual Reality technology
Probability of False Positives	Low, since divers can verify potential oil deposits		
Operational Limitations	Water depths of <100 ft (for divers); minimum visibility of 1-2 ft; escape issues		Helicopter and equipment limitations; spill must be accessible by the limits of round-trip travel using helicopters
Pros	Accurate determination of oil under ice; verbal and visual description of extent and thickness of oil and spatial variations	Low cost	Allows responders to travel into the virtual landscape in order to view the environment from different perspectives, allowing a quick response to a number questions.
Cons	Slow; difficult to accurately locate deposits without GPS; decon of dive gear can be costly/time-consuming; health and safety issues of supreme importance.	Inability to discriminate oil from debris on ice and when oil is mixed with slush ice. Sometimes oil-in-water emulsions are not detected.	New technology; not readily available; experienced personnel not readily available; large size, weight, and high cost.

Table 9. Continued.

	Radar	Acoustic Detection	Auger and Underwater Lights
Description		Using ___, oil is detected in ice because the oil behaves as a solid and transmits a sheer wave that can be detected.	Using an auger, drill hole in ice to find oil. Can also use underwater lights to assist in looking for oil under the ice through the auger hole
Equipment Availability		Prototype	
Logistical Needs			
Coverage Rate			
Data Turnaround			
Probability of False Positives	High; up to 95% false targeting.		
Operational Limitations			
Pros	Allows only potential for large area searches and foul weather remote sensing		
Cons	Costly, requires a dedicated aircraft, and is prone to many interferences.	New technology; not readily available.	

Table 10. Response Options Specific for Containing and Recovering Oil Spilled in Ice.

	Fast Water Booming	Sorbents	Bioremediation Agents	Dispersant	Elasticity Modifier	Emulsion Treating Agents
Inland Waters (see page 10 for definition)						
Oil on Ice	?	●	?	✗	✗	●
Oil Mixed in Broken Ice	?	?	●	●	●	●
Oil Frozen in Ice	✗	✗	?	✗	✗	✗
Oil Trapped Under Ice	?	✗	✗	✗	?	✗
Coastal Waters (see page 10 for definition)						
Oil on Ice	?	●	?	✗	✗	●
Oil Mixed in Broken Ice	?	?	●	●	●	●
Oil Frozen in Ice	✗	✗	?	✗	✗	✗
Oil Trapped Under Ice	?	✗	✗	✗	?	✗
Adjacent Lands (see page 10 for definition)						
Oil on Ice	N/A	●	●	N/A	N/A	●
Oil Mixed in Broken Ice	N/A	●	●	N/A	N/A	?
Oil Frozen in Ice	N/A	?	?	N/A	N/A	✗
Oil Trapped Under Ice	N/A	?	?	N/A	N/A	✗

KEY

● Considered to provide value as a response option for this situation.

? May provide value as a response option in this situation.

✗ Not considered a viable response option in this situation.

I Insufficient information- impact or effectiveness of the method could not be evaluated

N/A Response option not applicable for this situation

Table 10. (Continued).

	Fire-fighting Foams	In situ Burning On Land	In Situ Burning On Water	Manual Recovery	Natural Attenuation	Pre-Treatment Agents
Inland Waters (see page 10 for definition)						
Oil on Ice	I	N/A	●	?	I	●
Oil Mixed in Broken Ice	I	N/A	●	?	I	●
Oil Frozen in Ice	I	N/A	✕	●	I	●
Oil Trapped Under Ice	I	N/A	✕	?	I	●
Coastal Waters (see page 10 for definition)						
Oil on Ice	I	N/A	●	?	I	?
Oil Mixed in Broken Ice	I	N/A	●	?	I	?
Oil Frozen in Ice	I	N/A	✕	●	I	?
Oil Trapped Under Ice	I	N/A	✕	?	I	?
Adjacent Lands (see page 10 for definition)						
Oil on Ice	I	●	N/A	●	I	●
Oil Mixed in Broken Ice	I	?	N/A	?	I	●
Oil Frozen in Ice	I	✕	N/A	●	I	●
Oil Trapped Under Ice	I	✕	N/A	?	I	●

KEY

● Considered to provide value as a response option for this situation.

? May provide value as a response option in this situation.

✕ Not considered a viable response option in this situation.

I Insufficient information- impact or effectiveness of the method could not be evaluated

N/A Response option not applicable for this situation

Table 10. (Continued)

	Solidifier	Surface Collecting Agent	Surface Washing Agent
Inland Waters (see page 10 for definition)			
Oil on Ice	●	?	N/A
Oil Mixed in Broken Ice	●	●	N/A
Oil Frozen in Ice	✗	✗	N/A
Oil Trapped Under Ice	?	●	N/A
Coastal Waters (see page 10 for definition)			
Oil on Ice	●	?	N/A
Oil Mixed in Broken Ice	●	●	N/A
Oil Frozen in Ice	✗	✗	N/A
Oil Trapped Under Ice	?	?	N/A
Adjacent Lands (see page 10 for definition)			
Oil on Ice	●	?	●
Oil Mixed in Broken Ice	●	?	●
Oil Frozen in Ice	✗	✗	?
Oil Trapped Under Ice	●	✗	●

KEY

- ● Considered to provide value as a response option for this situation.
- ? May provide value as a response option in this situation.
- ✗ Not considered a viable response option in this situation.
- **I** Insufficient information- impact or effectiveness of the method could not be evaluated
- **N/A** Response option not applicable for this situation

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Response Strategies for Tire Fires
(to reduce production of pyrolytic oil residue)

Description

- An estimated 270 million vehicle tires are disposed of each year in the United States. The management of scrap tires has become a major economic and environmental issue. Although responsible means for disposal, such as recycling, reuse and energy recovery have become more common, the tire dumps of the last forty to fifty years continue to present environmental and safety hazards that will last into the foreseeable future.
- Waste tires are made using approximately 2.5 to 7 gallons of crude oil, mixed with vulcanized or cross-lined polymers, carbon black, dispersing oils, sulfur, synthetic fibers, pigments, processing chemicals, and steel or fiberglass. These components make tires readily combustible, and a potential hazard that must be addressed and planned for.

Table 11. Typical Tire Composition: Passenger Tire Recipe. (Taken from CA IWMB's LEA Advisory # 46, 1997).

Materials	Percentage
Styrene butadiene	46.78%
Carbon black	45.49%
Aromatic oil	1.74%
Zinc oxide	1.40%
Antioxidant 6C	1.40%
Sulfur	1.17%
Stearic acid	0.94%
Accelerator CZ	0.75%
Wax	0.23%

Understanding the Problem

- There are many tire dumps, legal and illegal, that exist throughout the United States. There are decreasing landfill options for used tires and the risk of fire is great.
- Most tire fires are started by arson and generate large amounts of heat, and smoke which makes them extremely difficult to extinguish. Some tire fires burn for months (e.g., the Rhinehart tire fire in Winchester VA burned for nearly 9 months).
- The intense heat also leads to the generation of pyrolytic oil (and other incomplete combustion by-product); a standard passenger car tire can generate about two gallons of pyrolytic oil as it burns and liquefies. The oil mixes with the extinguishing material, and can lead to contaminated soils, surface and ground waters in the surrounding area.

- Traditional fire department tactics have included smothering or cooling the fire with water or foam to extinguish it. The resulting efforts often generate incomplete combustion products, pyrolytic oils, smoke, and other toxic waste products.
- The environmental consequences of major tire fires are significant. A tire fire in Rhinehart, Virginia issued a plume of smoke 3,000 feet high and 50 miles long with fallout reported in three states. This fire also threatened the drinking water in the District of Columbia with lead and arsenic contamination.
- During periods of inverse atmospheric conditions, the contaminants will be kept close to the earth and will cause further problems to the community of population. This could result in Shelter in Place or other public protective actions for citizens with respiratory problems.

What to Do

- In recent times, there have been several fire incidents where the decision was made to allow the tire piles to burn to reduce the amount of polluted water runoff and hazardous smoke generation.
    - the Sinclaireville Fire Department in New York (in charge of the Chautauqua County Tire fire in April 1995),
    - the Manitoba Conservation along with local fire departments (in charge of the April 2001 tire fire west of Winnipeg, Manitoba, Canada), and
    - the Roanoke County Fire and Rescue Department (in charge of the March, 2002 Roanoke, VA Buck Mountain tire fire),
- These agencies had pre-determined that their response efforts would be best served by only addressing any resultant brush fires, rather than trying to douse the tire fires. Roanoke County Fire and Rescue Chief Richard Burch was quoted stating that "The hotter [the pile] burns, the faster it consumes the tires, and the less smoke and runoff we will have" (Roanoke Times, March 25, 2002).

Authority Required

- **RRT approval is not required** for the use of conventional response techniques, but operations personnel should coordinate with appropriate state and local authorities with respect to the use of fire fighting foams.
- **Incident-specific RRT approval is required** to use an applied technology in the open environment **unless used to prevent**
- Examples of agencies with trustee and functional responsibilities during a tire fire would be:

    (a) State and local Police

    (b) Public Works agencies

    (c) State Department of Emergency Management

(d) Regional offices of the Federal Emergency Management Agency (FEMA)

(e) Regional, State or Federal Environmental Protection Agency (EPA)

(f) State Division/Department of Natural Resources or State Forestry Agency

(g) State Fire Marshal's office

(h) Finance, Purchasing and Budget agencies

Availability

- Response strategies for fighting tire fires and dealing with incomplete combustion products (smoke and pyrolytic oils) must be:
  - Well thought out;
  - Practiced b well-trained, properly equipped, and experienced crews under controlled conditions; and
  - Refined prior to implementation during an actual spill response.
- Each product or technology is evaluated for potential functionality for dealing with tire fires, both in assisting with fire suppression and runoff recovery. See Table 14 for a review of each product/technology, its applicability for addressing suppression of the tire fire, and addressing the need to collect/contain any pyrolytic oil produced as a result of incomplete combustion from the use of these products and technologies for the long-term cleanup needs.

> **NOTE**:
> Many of these suggestions found in Table 14 are untried, and are only considered potential response options. Small-scale field-testing of these products and technologies is highly recommended to ensure effectiveness and efficacy.

Health and Safety Issues

- Human health and safety are of primary concern, particularly for response operations in general and specifically threats from air contaminates.
- Tire fires can pose a significant health problem for humans, animals, and the environment. Smoke and a wide variety of incomplete combustion products are generated during scrap tire fires, including:
  - ash (carbon, zinc oxide, titanium dioxide, silicon dioxides, etc.),
  - sulfur compounds (carbon disulfide, sulfur dioxide, hydrogen sulfide),
  - polynuclear aromatic hydrocarbons, which are usually detected in oil runoff (such as benzo(a)pyrene, chrysene, benzo(a)anthracene, etc),
  - aromatic, naphthenic, and paraffinic oils,
  - oxides of carbon and nitrogen,

- particulates,
- pyrolytic oils, and
- various aromatic hydrocarbons including toluene, xylene, benzene, etc.

- These incomplete combustion products are extensive and vary depending on factors such as tire type, burn rate, pile size, ambient temperature and humidity, among others.
- A safety officer should be established immediately to address the need for exclusion zones, personal protection equipment (PPE) for all response personnel, and to ensure that these requirements are being followed.
- All personnel should be equipped with appropriate personal protective gear and be fully instructed in its use. Personal protective clothing (turn-out gear) and self-contained breathing apparatus (SCBA) meeting NFPA standards should also be worn by all personnel working in, or exposed to, the products of combustion.
    - The ash produced in tire fires has been shown to contain high concentrations of heavy metals, including lead, cadmium, and zinc. The CA IWMB reports that the Total Threshold Limit Concentration (TTLC) for zinc should not exceed 5,000 mg/kg.
    - Dermal or skin contact with contaminated materials should be avoided at all times. The metals act as primary irritants by removing the surface film, disturbing the water-holding quality of cells, and injuring the membrane structure of the epidermal cells (CA IWMB LEA Advisory 46).
- The smoke plume may contain hazardous substances that should not be inhaled or allowed to contact the skin. The two substances that are of greatest concern relative to excessive exposure are PAHs and carbon monoxide.
- Increased incidence of respiratory problems, especially in high risk or sensitive populations that include people with chronic lung or heart disease, such as asthma, emphysema, chronic bronchitis, angina, or congestive heart failure.

Pre-incident Planning Needs:

To address tire fires, the following should be considered (much of this list was taken from the IAFC and Scrap Tire Management Council, 2000, publication):

- Pre-incident plans should be developed to identify the special considerations and hazards of a particular site or property so that responding units will know what to expect and how to proceed during initial operations. Pre-incident plans must accommodate the agency's standard operating procedures and specify exactly how those procedures are to be applied should a fire break out at a given location.
- There will be great public concern over the polluting of the air primarily due to the highly visible, thick, black smoke plume from the fire. This is a short-term problem. Air Quality monitoring should be addressed immediately. The incident commander may require the evacuation of population facilities that are directly affected by the smoke plumes.

- A safety officer should be established immediately to address the need for exclusion zones, personal protection equipment (PPE) for all response personnel, and to ensure that these requirements are being followed.
- A detailed health and safety plan must be developed. Exclusion zones, contamination reduction zones, and decontamination zones are all recommended as part of the response to a tire fire.
- The potentially hazardous effects of rubber fire emissions, the physical exertion required to fight such fires, the intense heat, and the often unsanitary conditions of dumps all present unique dangers to fire fighters that need to be recognized as priority health and safety concerns.
- The potential for run-off into, and pollution of, natural resources is a significant concern and should be addressed during size-up. If necessary, immediate efforts should be made to contain pollution from the fire and master-stream runoff.

Limiting Factors/Environmental Constraints

- Scrap tire piles are breeding grounds for millions of mosquitoes, rodents, and snakes. Personnel may need special protection from fleeing rodents, reptiles, and from insects. All food preparation facilities should be enclosed.
- Contaminated run-off water due to the fire fighting and rain needs to be contained and treated. Water sampling of surface waters and ground waters near the tire fire site should be conducted throughout the incident to determine if they are being contaminated by the pyrolytic oil and other compounds resulting from the tire fire.
- Because burning tires can yield oil, officials might require responders to assess the feasibility of taking action to deal with these oils. General response options include:
    - Restrict access to the site
    - Construct dams, ditches, ponds for the collection of drainage waters;
    - Extensive excavation may be required
    - Institute soil erosion controls
    - Collect and treat surface water runoff with gravity settling
    - Collect shallow ground water oily seeps
    - Conduct oil-water separation and transportation to waste water treatment facilities.
    - Skim off hydrocarbons (oil) from runoff and the residual water can be recycled for use on the incident.

Monitoring Requirements/Suggestions

- Monitoring is very important during the actual burn.
- Air sampling and analysis to determine the particulate loads in the plume should be monitored throughout the incident to ensure worker and public safety.

- The plume should be monitored in terms of the particulate matter (PM) that is smaller than 10 microns in diameter. These small particles are easily respired and drawn deeply into the lungs where they can lodge in the lungs and cause damage. Table 12 provides a summary of the USEPA National Ambient Air Quality Standards for particulate matter.
- Table 13 provides a summary of the Air Quality Standards that were specified for response workers during the Filbin Tire Fire in Stanislaus County, California.
- The migrating oil and fire fighting residue needs to be collected/recovered and the site should be evaluated for soil, surface and groundwater contamination. This waste must be considered hazardous material and treated accordingly.
- Monitoring of surface and ground waters should be conducted as soon as possible.

Table 12. National Ambient Air Quality Standards for criteria pollutants of concern during tire fires. Based on the 1997 EPA Revised Particulate Matter Standards.

Criteria Pollutant	Primary Standard	Secondary Standard
Carbon Monoxide		
8 hour average	9 ppm or (10 mg/m^3)	9 ppm or (10 mg/m^3)
1 hour average	35 ppm or (40 mg/m^3)	35 ppm or (40 mg/m^3)
Sulfur Dioxide		
Annual Average	0.03 ppm or (80 µg/m^3)	—
24 hour average	0.14 ppm or (365 µg/m^3)	—
3 hour average	—	0.50 ppm or (1,300 µg/m^3)
Inhalable Particulates (PM 10)		
Annual Average	~0.02 ppm or (50 µg/m^3)	~0.02 ppm or (50 µg/m^3)
24 hour Average	~0.07 ppm or (150 µg/m^3)	~0.07 ppm or (150 µg/m^3)

Table 13. Example of Air Quality Categories for the Filbin Tire Fire. (Taken from the California Office of Environmental Health Hazard Assessment, Integrated Waste Management Board for the Filbin Tire Fire in Stanislaus County, California (1999)).

Air Quality Index Category	PM 10 Reading	Potential Health Effects	Health Protective Action
Good	0-49	None	None
Moderate	50-149	Beginning of respiratory symptoms in very sensitive people	Very Sensitive* persons should begin to limit outdoor exertion
Unhealthy for Sensitive* Groups	150-249	Increased respiratory symptoms and aggravation in sensitive people; possible respiratory effects in general populations	Sensitive* persons should limit outdoor exertion
Unhealthy	250-349	Significant increased respiratory symptoms and aggravation in sensitive people; increased likelihood of respiratory effects in general population	Sensitive* persons, the elderly, and children should avoid outdoor exertion; everyone else should limit prolonged outdoor exertion
Very Unhealthy	350-424	Serious risk of respiratory symptoms and aggravation in sensitive people; respiratory effects likely in general population.	Sensitive* persons, the elderly, and children should avoid any outdoor activity; everyone else should limit prolonged outdoor exertion
Hazardous	425+	Serious risk of respiratory symptoms and aggravation in sensitive people; respiratory effects likely in the general population	Everyone should avoid outdoor exertion; sensitive* persons should remain indoors or evacuate

*Sensitive Groups: people with chronic lung or heart disease, such as asthma, emphysema, chronic bronchitis, angina, or congestive heart failure.

Waste Generation and Disposal Issues

- Many states have regulations regarding the disposal of tire fire debris. In some states, the solid tire fire debris is classified as solid waste and must be disposed of in approved landfill facilities.
- The debris remaining following the cessation of the tire fire burn includes large quantities of pyrolytic oils and oily waters (containing polyaromatic hydrocarbons (PAH) and other metals such as cadmium, chromium, nickel and zinc) and ash that also contains high concentrations of heavy metals (zinc, lead, or arsenic).

References

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Laurence Hammack, "Governor Warner Declares A State of Emergency: Tires, Brush Still Burn." The Roanoke Times. March 25, 2002.

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Todd Hettenbach. "Burning Rubber." Grist Magazine on line. October 13, 2000. Available on line from www.gristmagazine.com/counter/counter101300.stm.

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Indiana Department of Environmental Management (IDEM). 2000. IDEM Guidance Document: Disposal of Tire Fire Debris. OLQ General ID#0106-01-SW. October 31, 2000.

California Integrated Waste Management Board, Office of Environmental Health Hazard Assessment. 2002. Table of Air Quality Categories. Available from the web at: www.ciwmb.ca.gov/PressRoom/Events/1999/FilbinFire/AirQual.htm.

California Integrated Waste Management Board (CA IWMB). 1996. Evaluation of Employee Health Risk From Open Tire Burning. LEA Advisory # 46 – November 6, 1997. Publication No. 232-97-019. Available from the web at: www.ciwmb.ca.gov/LEAAdvisory/46/default.htm.

USEPA Office of Air Quality Planning and Standards. 1997. National Ambient Air Quality Standards (NAAQS).

Who to Call for More Information and Additional Resources

Building and Fire Research Laboratory, NIST. Gaithersburg, MD. Phone: 301-975-5900

NOAA HAZMAT/SSC, General contact number: 206-526-6317

USEPA

International Association of Fire Chiefs. Fairfax, VA. Phone: 703-273-0911

National Fire Prevention Association. Quincy, MA. Phone: 617 770-3000

Local Fire Departments

State Fire Marshall

Local Emergency Planning Commissions

Table 14. Tire fires and the potential uses of products and strategies listed in the Selection Guide.

	Use on the fire (to put out or increase effectiveness of the burn)	Use to stop flow of pyrolytic oils (produced by fire)	Long Term Cleanup
Water	●	✗	?
Sorbents	● (s)	●	●
Bioremediation Agents	N/A	N/A	●
Dispersants	✗ (d)	N/A	N/A
Elasticity Modifiers	✗	?	N/A
Emulsion Treating Agents	? (e)	N/A	N/A
Fire-Fighting Foams	●	●	N/A
In Situ Burning	● (b1)	? (b2)	?
Solidifiers	?	●	?
Surface Collecting Agents	N/A	?	?
Surface Washing Agents	N/A	● (sw)	?
Shoreline Pre-Treatment Agents	N/A	?	?
Oil Tracking	N/A	● (ot)	●

(s) Wet sorbents have been used to prevent the advance of forest fires

(d) Dispersants may function as vapor suppressants (?); when mixed with water they might act like the wetting agents in Class A fire fighting foams?

(e) Emulsion Treating Agents may function as to assist the burn of pyrolytic oils if ISB is considered as an option for removal (?)

(b1) In Situ Burning can be used to create fire breaks and igniters may assist in a more complete combustion of the tire piles (?)

(b2) In Situ Burning may be able to be used on pyrolytic oils (?)

(sw) Surface Washing Agents can be used for spot cleanup on paved areas

(ot) Various Oil Tracking methods should be used when pyrolytic oils enter surface or ground waters

KEY

● Considered to provide value as a response option for this situation.

? May provide value as a response option in this situation.

✗ Not considered a viable response option in this situation.

I Insufficient information- impact or effectiveness of the method could not be evaluated

N/A Response option not applicable for this situation

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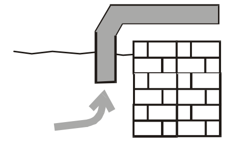

WATER INTAKE MONITORING STRATEGIES

Description

- Monitoring of water intakes at risk of contamination during an oil spill is needed to protect both human health and the water treatment facility. The objective is to detect and track the presence of petroleum hydrocarbons in the water body, as a warning system for downstream users, and at the intake point to protect water supplies.

When to Use

- In a body of water, such as a river or lake, to track the spread and downstream transport of oil in the water column. This information can be used to initialize and calibrate trajectories for the prediction the movement of the leading edge of the plume, the zone of maximum contaminant concentration, and the behavior of the trailing edge.
- At a water intake, either just outside of the intake piping (at the intake depth) or from the raw water feed, to decide when to shut down or re-start water flow.
- In addition to public water supply intakes, consideration should also be made for industrial and agricultural water intakes.

Methodology

There are four basic approaches for detecting petroleum hydrocarbons in water:

1) Visible Sheen – A visible sheen near water intakes is a simple way of detecting oil presence. This is not quantitative or oil-specific.

2) Taste and odor - a standard analysis of raw and finished water quality conducted by drinking water treatment facilities, but this is not quantitative or oil-specific.

3) Collection of individual samples for chemical analysis. Analyses can include:

MTBE – **M**ethyl **t**ertiary **b**utyl **e**ther; a gasoline additive.

BTEX – volatile aromatic compounds of **b**enzene, **t**oluene, **e**thyl benzene, and the **x**ylenes using EPA Method SW-846.

TPH (total hydrocarbons) – the actual compounds measured vary widely by method.

PAHs (polynuclear aromatic hydrocarbons) – using a modified EPA Method 8290 to include alkyl homologues of the prominent PAHs in oil; also can be used to fingerprint the oil

Pros: Individual compounds can be measured by gas chromatography/mass spectrometry (GC/MS). Most laboratories can measure BTEX, which are of greatest concern. Detailed chemical analyses are very appropriate for supporting decisions to close/re-open intakes.

Cons: Even with a nearby laboratory and rapid-turnaround, it often takes 1-2 days for results to be available. Thus, there is no real-time feedback on where the plume is and how to optimize sample collection to delineate the plume. Costs can be very high plus a rapid-turnaround premium for GC/MS analyses.

4) Field fluorometry. Fluorometers measure the natural tendency of some compounds to fluoresce after adsorbing ultraviolet (UV) light. In its simplest form, a fluorometer is a black-box containing a light-transparent cell to contain the sample, a UV lamp (excitation source), a series of optical filters that increase selectivity, a photomultiplier, and a recorder. Configured as a flow-through system, the instrument can be connected to the raw water feed at a water treatment plant, or deployed on a boat with a pump and hose that can be lowered into the water column. In this manner, continuous readings are made. The Ohio River Valley Water Sanitation Commission (ORSANCO) developed a system consisting of a field fluorometer and a flow-through system that is mounted on a boat and able to function at speeds up to 30 miles per hour. This system was devised during the Ashland oil spill in 1988 and was successfully used during two releases to the river of ethylene dibromide and methyl carbamate in 1994.

Pros: Provides rapid, real-time detection and tracking of oil in the water column. The intake can be towed to track the length of the plume, or lowered through the water column to produce a profile of oil concentrations with depth.

Cons: Fluorometer detector response values vary with oil composition and weathering. To convert detector response to a concentration value, a calibration curve must be derived using the spilled oil. Furthermore, oil in the water column is likely to be a mixture of dispersed and dissolved oil; fluorometers work best on analytes in solution. The minimum detection limit of dispersed oil is directly related to the ability of the instrument to differentiate oil fluorescence from that of background (which is from suspended sediments, algae, and tiny animals that may contribute to background fluorescence or adsorb fluorescence).

Health and Safety Issues

- Consider boating safety issues when using field fluorometers on boats.
- Evaluate potential for inhalation hazards to survey teams during spills of volatile oils.

Limiting Factors/Environmental Constraints

- When using fluorometry, it is important to also collect water samples for detailed chemical analysis. The quantitative values obtained from field water samples can be used to establish a response curve to convert raw field response values into “true” concentrations, especially as the oil weathers.
- There are no Federal water quality guidelines for when to shut down water intakes, or when it is safe to re-open them. Each state has its own guidelines. Federal drinking water quality standards for individual organic compounds in finished water that may apply to oil spills are listed below (Table 15). Health advisories may be more appropriate for spill events since they address short-term exposure to contaminants.

- Most of the standard water-quality analyses conducted by water treatment facilities, such as oil and grease, total organic carbon, and taste and odor, are not appropriate for oil spills because they have high detection levels and are not specific to oil. Taste and odor may be useful, in conjunction with chemical analyses, to determine when water quality has returned to normal.
- The standard "priority pollutant" PAH organic compound analysis (EPA Method 8270) is also not appropriate for oil spills since it does not measure the dominant petroleum compounds in oil.
- The application of a dispersant would increase the potential for water intake contamination.

Table 15. Federal Drinking Water Standards for Individual Organic Compounds. One-day and 10-day health advisories listed are based on a 10-kg child.

		Health Advisory	
Compound	**Water Quality Standard (mg/l)**	**1 day (mg/l)**	**10 day (mg/l)**
Benzene	0.005	0.2	0.2
Benzo (a) pyrene	0.0002	-	-
Ethylbenzene	0.7	30.0	3.0
Toluene	1.0	20.0	2.0
Xylenes	10.0	40.0	40.0
MTBE	0.013		

References

Cremeans, W.L., R.M. Meyer, and G.P. Kincaid. 1998. High-speed system for synoptic assessment of riverine near surface water-quality conditions and spill response. U.S. Army Corps of Engineers, Water Quality Section, Huntington District, 7 pp.

Henry, C.B., Jr., P.O. Roberts, E.O. Overton. 1999. A primer on *in situ* fluorometry to monitor dispersed oil. In: Proceedings of the 1999 International Oil Spill Conference, American Petroleum Institute, Washington, DC. Pp. 225-228.

Who to Call for More Information and Additional Resources

USEPA Oil Program Center, Washington, DC 703-603-9918

California DHS Drinking Water Program, Berkeley, CA 94704
Phone: 510-540-2177;
http://www.dhs.ca.gov/ps/ddwem/publications/regulations/regulations/index

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BIOREMEDIATION AGENTS
(A Category on the NCP Product Schedule)

Mechanism of Action

The objective of bioremediation is to accelerate the rate of hydrocarbon degradation due to natural microbial processes by:

<u>Nutrient Enrichment</u> - addition of nutrients (generally nitrogen and phosphorous) to stimulate microbial growth. Assumes nutrient availability is a limiting factor. Also called biostimulation.

<u>Natural Microbe Seeding</u> - addition of high numbers of oil-degrading microorganisms. Assumes indigenous hydrocarbon degraders are low in number or not effective at degrading the oil. Will require addition of nutrients if not included in the microbe product. Also called bioaugmentation.

- The ultimate end products are carbon dioxide and water.
- Some products contain surfactants to break up the oil into droplets, increasing the surface area of the hydrocarbons and thus the rate of microbial degradation.

When to Use

- After other techniques have been used to remove free product and gross contamination.
- When further oil removal is likely to be destructive, ineffective, or cost-prohibitive.
- <u>Nutrient Enrichment</u>: when nutrients are limiting rates of natural biodegradation.
- <u>Natural Microbe Seeding</u>: when indigenous hydrocarbon microbes capable of degrading hydrocarbons are present in low numbers (<106/gram sediment)

<u>On Water:</u>

- CONSIDER for sheens and sediment contamination in small, static water bodies such as natural ponds and man-made lagoons; aeration may be needed to maintain oxygen levels
- NOT for use on oil slicks on flowing water, such as rivers, streams, and large lakes
- NOT for gasoline spills (since it will quickly be removed by evaporation without treatment)

<u>On Land:</u>

- YES for many conditions, esp. where the substrate can be tilled, irrigated, etc.
- CONSIDER for thick or highly weathered oils on shorelines or land surfaces

Authority Required

- **Incident–specific RRT approval is required**; Products **must** be on the NCP Product Schedule in order to be considered for use.
- **NOTE**: As of December, 2002, there were 14 bioremediation agents on the NCP Product Schedule.

- Verify need for applicable state requirements.
- Prior to listing, products must submit efficacy test results to be listed on the Product Schedule. The evaluation criteria were established by a scientific panel under the USEPA Bioremediation Action Committee and are noted as minimal standards for acceptance.
  - The test uses Alaska North Slope crude oil with water-oil control, oil-nutrients, and oil-agent.
  - Samples are taken at day 0, 7, and 28 for GC/MS analysis of alkanes and aromatics, and gravimetric change in weight after 28 days.
  - The standard for listing is: The products need to perform statistically significantly better than the control.
  - The conditions of the efficacy test are ideal: closed, well-mixed flasks where neither nutrients nor microbes are lost from the system, competition from indigenous microbes is minimal, and aeration is good.
  - Performance in the field will most certainly differ.

Availability

- Seldom an issue since they are not used in the emergency phase of a spill. See Table 16 for product-specific availability.

General Application Requirements

- Liquid products are diluted in water and applied with spray system. Dry products are applied by hand or powder spray systems.
- Frequent re-application is required for nutrients dissolved in water and sprayed as a dilute solution, depending on the rate of wash out (fast for intertidal areas, slower for rainfall infiltration);
- Granular or encapsulated nutrients dissolve more slowly.
- For oiled soils, products need to be mixed into the material (adding nutrients, if required), by tilling or disking.
- Regular tilling or other means of aeration is needed to maintain minimum oxygen levels.
- Irrigation may be needed to maintain minimum moisture levels.

Health and Safety Issues

- All products have to be tested to show that they do not contain pathogens.

Limiting Factors/Environmental Constraints

- Microbial degradation of hydrocarbons requires: microbes, nutrients, oxygen, moisture, and TIME. Any of these factors can be limiting.

- Degradation proceeds faster at warm temperatures (>60°F), neutral pH (optimum is 7-8.5), and high surface area of the contaminant.
- Expect degradation to take months to years, especially where control of moisture, temperature, mixing rate, etc. is limited.
- Avoid using ammonia-based fertilizers adjacent to waterbodies because un-ionized ammonia is toxic to aquatic life at very low levels. Nitrate is just as good a nitrogen source, minus the toxicity.
- Check fertilizers for their metal content since some common fertilizers contain relatively high levels of metals.

NOTE:
The NCP Subpart J does not explicitly require toxicity testing of bioremediation products. At EPA's discretion, bioremediation agents that contain ingredients such as surfactants and other chemicals, or any other component the EPA designates may cause harm to the environment, may be required to perform the (LC50) toxicity test currently required for all other NCP Product Schedule product categories. Manufacturers of products may have performed their own toxicity tests. For questions relating to toxicity of bioremediation products, please refer to the Oil Program Product Schedule Manager, Mr. William (Nick) Nichols at the USEPA Oil Program Center, Washington, DC. Phone: 703-603-9918.

Monitoring Requirements/Suggestions

- Monitoring is required to ensure that target moisture, nutrient (2-5 mg nitrogen/liter), and oxygen (2 mg/L) are being maintained, and determine re-application rates.
- Take samples before and at set intervals after treatment to determine that degradation is occurring and at sufficient rates. Specialized chemical analyses are needed to prove degradation (GC/MS of alkanes and aromatics). Sampling plan should cover the expected duration of degradation (months after treatment).

Waste Generation and Disposal Issues

- Effective use of bioremediation agents should significantly reduce the amount of oily wastes generated.

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Who to Call for More Information and Additional Resources

USEPA-ORD, 26 West Martin Luther King Dr., Cincinnati, OH 45268
Phone: 513-569-7668

NOAA-HAZMAT, Seattle, WA 98115 Phone: 206-526-6317

USEPA Oil Program Center, Washington, DC. Phone: 703-603-9918

Table 16. Characteristics of Bioremediation Agents Listed on the NCP Product Schedule (as of December, 2002).

	BET BIOPETRO	BioGee HC	INIPOL EAP 22	Land and Sea 001	Micro-Blaze
General Description	Powder	Liquid	Oleophilic liquid	Tan dried and ground plant material	Concentrated, white liquid; perfumed; when mixing, add product to water or solution will foam.
Active Ingredients	NP	Microbes	Nutrients	Microbes, Nutrients	Nutrients, Microbes, and Surfactants
Nutrient Composition	NP	NP	Microemulsion	NP	NP
How does it change the oil behavior?	NP	No immediate change	Softens the oil; can cause oil to lift off substrates	Immediate protection to flora and fauna; Changes oil from a liquid to a non-sticking solid	Surfactant cleaves oil droplets into molecules small enough for microbes to effectively digest.
Availability (amount per location)	NP	NP	NP	10 tons - San Antonio, TX	10,000 gal, Houston, TX
Application Rate	Varies. Contact BET for specific technical advice	1 gal/yd^3 soil; 0.25 gal/1,000 ft^2 water surface	1:10 product to oil	1:3 product to oil	Spills-1:10, product to oil, as 3-6% solution; Soil- 1 gal per 10 yd^3 at 3-6% solution
Application Method	Contact BET for specific technical advice.	Spray	Spray product neat onto oiled surfaces	On water, spread over contaminated area at 1 to 3 ratio. On soil, blend to depth equivalent to contamination level.	Mix in hand-held sprayers; educt into spray systems; pour concentrate directly on oil**;** in all cases, use broom or pressurized water stream to agitate the solution; then rinse clean with water and vacuum up liquids; **do not** discharge untreated solution to waterbodies.
Temperature Limitations	45°-100°F	34-140°F; optimal is 83°F	>52°F	32 to 135°F; optimal is 77-86°F for microbe activity	>32°F
EPA Efficacy Test (Reports % reduction of components over a 28 day period)	Alkanes: 99% Aromatics: 67% Gravimetric weight decrease: 30%	Alkanes: NP Aromatics: NP Gravimetric weight decrease: 13%	Alkanes: 94% Aromatics: 23% Gravimetric weight decrease: 50%	Alkanes: 43% Aromatics: 32% Gravimetric weight decrease: 25%	Alkanes: 94% Aromatics: 48% Gravimetric weight decrease: 12%
Use in Fresh Water?	Yes	Yes	Yes	Yes	Yes

	BET BIOPETRO	BioGee HC	INIPOL EAP 22	Land and Sea 001	Micro-Blaze
Use in Salt Water?	Yes	Yes, salinity may have slight effects	Yes	Yes	Yes, but effectiveness is reduced above 10% salinity
Inland Silversides 96h	NP	NP	135	NP	NP on NCP; 1390 value provided by vendor
Mysid Shrimp 48h	NP	NP	23	NP	NP on NCP 1230 value provided by vendor
Solubility in water	NP	Assume 100% soluble	Dispersible	Not Applicable	99% soluble
Other Information	Product works at pH 5.5-8.5 and dissolved oxygen level of 3 to 5 mg/l.	Product works at pH 4.5-9.5, optimally at pH 7.0	Does not contain trace metals	Optimum pH of 6 – 8	Use as a grease digester in wastewater systems; storage tank cleaning of benzene and other organics; long term bioremediation projects in soil.
Application Assistance Information*	BioEnviroTech 281-351-5594 800-758-3253	RMC Bioremediation 318-219-3929 Fax: 318-219-3920 www.rmcbio.com	Elf Aquitaine 202-659-1810	Land and Sea Restoration LLC 210-650-5556	Verde Environmental, Inc. 713-691-6468 800-626-6598 Garner Environmental Services- 409-935-0308 www.micro-blaze.com
Unit Cost **	NP	NP	NP	$60 per bag	$25.00 $40.00 per gal.
Photograph of Product (photos are added as they become available)					

NP = Information Not Provided

* For additional technical assistance on product application, contact the supplier listed on the NCP Product Schedule Notebook.

** Unit costs are based on 2002 information supplied by the vendors, where provided. For a more up-to-date cost estimate, contact the supplier listed in the NCP Product Schedule. Generally, product prices decrease as purchase volume increase, and may also vary between distributors. Product application rates often vary greatly depending on use.

Table 16. Continued.

	Oil Spill Eater II	Oppenheimer Formula	Pristine Sea II	PRP	S-200
General Description	Amber liquid, ferment smell	Powder	Biological Additive Powder or liquid bacterial mixture	Granular, yellow powder (0.25 to 500 micrometers) with a wax coating that makes it float, oleophilic, and hydrophobic	Light amber liquid
Active Ingredients	Nutrients, Enzymes, and Surfactants	Microbes; oil absorbing clay mixed with hydrophobic Archaeobacteria	NP	Enzymes	Nutrients
Nutrient Composition	Nutrient enhancement product with nitrogen, phosphorus, and readily available carbon and vitamins	NP	NP	Enzyme names: oxidoreductases, transferases, hydrolases, lyases, isomerases, and lipases	NP
How does it change the oil behavior?	Emulsifies oil (breaks the oil into droplets) in 3-10 minutes; complete bioremediation occurs in 2-30 days	Will absorb sheens and rainbows	NP	Immediate change – binds the oil. Does not allow the oil to sink or emulsify. Reduces stickiness	Bioremediation accelerator
Availability (amount per location)	1,000-2,000 gal, Dallas, TX	10 tons in Austin, TX	1,500 lbs in Montpelier, ID	10,000lbs.- Houston, TX 10,000lbs.- Houma, LA 60,000lbs- Pittsburgh, PA	NP
Application Rate	1 gal product/50 gal crude oil, as a 2% solution; 1 gal product /100 gal light oil at 1% solution	10 lbs per acre surface on open water; 100 lbs per 1,000 square feet on soil or rocks.	Varies. Contact vendor for assistance.	1:2 product to oil; 50 lb/1,000 ft^2 of contaminated surface, 1 ton of PRP covers 40,000 ft^2 to a depth of ¼ inch	1:10 product to oil; 1 lb/sq. yard of surface area
Application Method	Mix 1-2% solution using ambient water; spray on oiled surface. Reapply if oil persists on water and shorelines. On soils, use same application rate, keep soils moist, till area 1x/week, add more product as needed. Can be applied by any eductor spray system.	Spray dry powder directly or as a water mix with nutrients	"Soak at a rate of 1kg to 4L influent waste and 4L tap-water, or add directly to your system."	Apply dry powder to small spills; for large spills and in open waters, mix or educt with water and spray affected area.	Applied with pressurized sprayers or back pack sprayers
Temperature Limitations	28°F to 120°F; bioremediation slows below 40°F	32-150°F; optimal is 82°F	40°F to 120°F; bioremediation slows below 50ºF	Wax is sensitive to heat at 85°F, melts at 120°F	50-120°F; optimal is 86°F
EPA Efficacy Test (Reports % reduction of components over a 28 day period)	n-paraffins NA Aromatics NA Gravimetric weight decrease: Under Review (contact EPA)	Alkanes: 89% Aromatics: 38% Gravimetric weight decrease: 10%	Alkanes: 96% *(These are 20 d tests)* Aromatics: 90% *(These are 20 d tests)* Gravimetric weight decrease: NP	Alkanes: 12% Aromatics: 3% Gravimetric weight decrease: 1%	Alkanes: 32% Aromatics: 0.05% Gravimetric weight decrease: 28%

	Oil Spill Eater II	Oppenheimer Formula	Pristine Sea II	PRP	S-200
Use in Fresh Water?	Yes	Yes	Yes	Yes	Yes
Use in Salt Water?	Yes	Yes, to 20% salt, optimal is 0.5-3.5%	Yes	Yes	Yes
Toxicity (LC-50, ppm); Note: a low value = high toxicity					
Inland Silversides 96h	NP on NCP; 58 value provided by vendor	NP	NP	NP on NCP: 354,000 (48h) reported by vendor	40
Mysid Shrimp 48h	NP on NCP; 152 value provided by vendor	NP	NP	NP on NCP 68,000 reported by vendor	21
Solubility in water	100% soluble	NP	Non Soluble	Insoluble	
Other Information	Does not contain trace metals. Eliminates adhesion, and reduces fire hazard and toxicity in 3-10 minutes. Light end sheen disappears immediately upon application.	www.obio.com	Improves settling and minimizes foam formation and/or production. No trace metals		
Application Assistance Information*	Oil Spill Eater International 972-669-3390	Oppenheimer Biotechnology, Inc. 512-474-1016	Marine Systems 225-755-7711 702-871-1884	Petro Rem, Inc. 412-279-9745	International Environmental Products, LLC 610-644-4588 or email at info@oilgone.net
Unit Cost**	$.81 per spilled gal light oil $1.62 per spilled gal heavy oil	$30 per lb volume discounts available	$16.50 per lb or $2.48 per spilled gal oil	$12-$20 per lb depending on quantity and purchase location	
Photograph of Product (photos are added as they become available)					

NP = Information Not Provided

* For additional technical assistance on product application, contact the supplier listed on the NCP Product Schedule Notebook.

** Unit costs are based on 2002 information supplied by the vendors, where provided. For a more up-to-date cost estimate, contact the supplier listed in the NCP Product Schedule. Generally, product prices decrease as purchase volume increase, and may also vary between distributors. Product application rates often vary greatly depending on use.

Table 16. Continued.

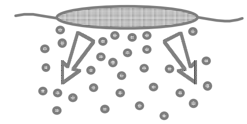
	Step One	System E.T. 20	VB591 Water	Vita-Bugg	WMI-2000
General Description	Liquid	Brown powder	Yellow powder	Powder	Tan powder, with yeast odor
Active Ingredients	Microbes, Nutrients	Microbes	Oleophilic compounds	Nutrients	Microbes
Nutrient Composition	Phosphoric acid	NP	NP	Oleophilic	None; product requires nutrient supplements
How does it change the oil behavior?	Starts digesting oil particles immediately	No immediate change	No immediate change	No immediate change	No immediate change
Availability (amount per location)	Unlimited Amount- Embarrass, MN	Sufficient to treat 2 million yd^3, Houston, TX	15,000 lbs.- Houston, TX	15,000 lbs.- Houston, TX	500-1,000 lb, Houston, TX
Application Rate	Provided by vendor at time of purchase	Varies	5-15 lbs. of product to 1 barrel of spilled oil	5-15 lb/bbl oil; 6 lb/1,000ft^2	1.4 lb/1,000ft^2, inoculation concentration of 5-9 billion spores per gram
Application Method	Provided by vendor at time of purchase	Spray reconstituted organisms, broadcast nutrients, mix into affected soils	Apply with hand held pressurized dust blowers or boat mounted dust blowers. Follow up application recommended after 48 hours.	Use conventional powder spraying equipment to apply product; additional applications at 48-72 h as needed	Activate culture in water for 2 h, then spray or inject, mix in nutrients, and till/aerate
Temperature Limitations	50-135°F; optimal is 70-90°F	41-95°F ; optimal is 39-95°F	None	None	35-100°F, optimal at 45-90°F
EPA Efficacy Test (Reports % reduction of components over a 28 day period)	Alkanes: 44% Aromatics: 55% Gravimetric weight decrease: 51%	Alkanes: 99% Aromatics: 77% Gravimetric weight decrease: 18%	Alkanes: 97% Aromatics: 73% Gravimetric weight decrease: 18%	Alkanes: 97% Aromatics: 73% Gravimetric weight decrease: 18%	Alkanes: 60% Aromatics: 33% Gravimetric weight decrease: 44%
Use in Fresh Water?	Yes	Yes	Yes	Yes	Yes
Use in Salt Water?	Yes	Yes, but salt water adapted bacteria must be specified	Yes	Yes	Yes
Inland Silversides 96h	NP	NP	NP	NP	NP
Mysid Shrimp 48h	NP	NP	NP	NP	85% survival at 2,500 ppm (24h)
Solubility in water	100% soluble	NP	Soluble	Soluble	Soluble

	Step One	System E.T. 20	VB591 Water	Vita-Bugg	WMI-2000
Other Information			.9gm/cc water soluble 2.5gm/100cc oil soluble	www.bionutratech.com 0.9gm/cc- water soluble 2.5gm/100cc oil soluble	Optimal pH 7.0-8.0
Application Assistance Information*	B&S Research Inc 218-984-3757	Quantum Environmental Technologies, Inc. 619-535-0664	BioNutraTech, Inc. 281-894-7471 www.bionutratech.com	BioNutraTech, Inc. 281-894-7371	Waste Microbes, Inc. 713-956-4001 800-460-4507
Unit Cost**	$1.20/yd^2 - $20/yd^2 for water $1.50/yd^3 - $12/yd^3 for soil	NP	$8-$12 per lb.	NP	Unit cost = $25 per lb.
Photograph of Product (photos are added as they become available)					

NP = Information Not Provided

* For additional technical assistance on product application, contact the supplier listed on the NCP Product Schedule Notebook.

** Unit costs are based on 2002 information supplied by the vendors, where provided. For a more up-to-date cost estimate, contact the supplier listed in the NCP Product Schedule. Generally, product prices decrease as purchase volume increase, and may also vary between distributors. Product application rates often vary greatly depending on use.



DISPERSANTS

(A Category on the NCP Product Schedule)

Mechanism of Action

- Mixtures of surfactants and solvents.
  - Surfactants reduce the interfacial tension between oil and water and promote effective delivery of the surfactant to the oil.
  - Solvents dissolve any solid surfactant, reduce the viscosity of the product so it can be sprayed effectively, and promote rapid solubility of the dispersant into the oil.
- Prevents small droplets from recoalescing and forming bigger, more buoyant droplets that float to the surface, re-creating sheens.

When to Use

- When dispersing the oil will cause less environmental impact than surface slicks that will strand on shore or impact sensitive water-surface resources (e.g., birds).
- Dispersants should be considered when other techniques would be inappropriate to use, such as mechanical recovery in rough seas.
- For large spills, consider application to the leading edge or parts of the slick that threatens sensitive shoreline habitats or bird concentration areas. Typical offshore dispersant applications are targeted at the thicker portions of the slick so that more oil can be treated.
- Based on real-time use, 100 % effectiveness is not presently possible. Oil that does not disperse will still need to be addressed by the response.

Authority Required

- **It is the policy of the US EPA to not allow dispersants use in freshwater. Possible exceptions to this policy will be region specific.**
- **Incident-specific RRT approval is required** to use dispersants. **NOTE**: As of December, 2002, there were ten dispersants on the NCP Product Schedule: Corexit 9500, Corexit 9527, Dispersit SPC 1000™, Mare Clean 200, Neos AB 3000, Nokomis 3F-4, PetroBioDispers, and SeaBrat #4 (Table 17).
- Products must achieve an effectiveness of at least 45% dispersion of the oil in laboratory testing to be listed on the Product Schedule.
- For dispersant use/consideration, RRT III requires the following:
  - For waters within established pre-approval zones – at FOSC discretion (Incident-specific RRT notification required) following the guidance of the DRAFT Region III Dispersant Operation Plan provided in Volume II, Dispersants Operations Implementation Plan of this Selection Guide.

- For all other areas – FOSC required to seek incident-specific RRT approval and follow the dispersants use guidance outlined in the Region III Regional Contingency Plan's Memorandum of Understanding (MOU) for Dispersants, in Volume II, Appendices.

Availability

Dispersant products manufactured in the US are readily available, with stockpiles at selected coastal sites.

- See specific-product tables (Table 17) for amounts and locations.
- Stockpile amounts will change over time.

General Application Requirements

- There are two primary dispersant delivery systems being used today: aerial and vessel-based systems. Backpack type spray systems have been manufactured and used for applying dispersants but their use is not addressed in detail here.
- Aerial spraying systems include spray buckets (payload of 7-21 bbls) deployed from helicopters; specially equipped DC-3 aircraft (payload of 30 bbls); and cargo aircraft fitted with an ADDS (Airborne Dispersant Delivery System) pack (payload of up to 150 bbls).
- There are two primary types of vessel-based delivery systems; spray booms and water monitors or cannons. Depending on boom height, nozzle pattern, and the desired dispersant to oil application ratio, dispersant can be applied from spray booms at full concentration. However, in both spray booms and water monitors, dispersant is usually diluted with seawater. Proportioning of the dispersant is usually accomplished by use of an eductor or a positive displacement metering pump.
- Dispersants are applied using spraying systems at a target treatment rate of 5 gal per acre of oil, to achieve a dispersant to oil ratio of 1:20; application rates will vary with spill and oil conditions.
- Multiple applications may be needed over a period of days.
- Use vessels when weather grounds aircraft or for smaller spills close to shore or near pre-staged equipment.
  - A boat operating at 5 knots while spraying a 40 foot swath can only treat about one half square mile in 12 hours. A slick thickness of 0.1mm in this case equates to treatment of approximately 830 barrels per day assuming the vessel has the necessary dispersant storage and fuel capacity to operate all day. (National Research Council, 1989; API Task Force, 1986; Belore,1985: Chau *et al.*,1986; McAuliffe, 1986).
  - An additional factor in deciding when to consider vessel based systems are the availability of vessels with sufficient stability to keep the extended spray arms at the desired height and the availability of spotter aircraft to direct the vessel(s) to the thickest portions of the slick.
  - Water monitors are gaining popularity on small spills due to the widespread availability of vessel with fire monitors installed. The most critical factors in using this method are selecting a water compatible dispersant, providing a means of proportioning the dispersant in desired concentration, and producing a spray that maximizes contact of the dispersing agent on the top of the slick with only slight penetrating impetus. Exxon recommends the installation of a metal screen on the monitor nozzle to achieve droplet sizes in the 400-600µm.

- Good spraying operations include skilled personnel in all positions, spotter aircraft to direct the spray applications, and excellent communications among the group.
- The availability of vessels over dispersant aerial spray assets makes this method attractive in some areas. Spray booms should be rigged as far forward a practicable to avoid interference from the bow wake. On spray booms, fan shaped nozzle patterns permit a more even application than cones that tend to deliver more product at edges of their pattern while the vessel advances.
- Sources of vessel mounted spray equipment are identified in the World Catalog of Oil Spill Response Products and the International Oil Spill Control Directory, and other publications.

Health and Safety Concerns

- Ensure that dispersants are not applied in areas where on-scene personnel could be sprayed or affected by overspray.
- Deploy monitoring crews in vessels only under safe sea conditions.

Limiting Factors/Environmental Constraints

- Effectiveness decreases with heavy, weathered, and emulsified oils.
- Effectiveness of current formulations decreases significantly with decreasing salinity; essentially, there is no effective freshwater dispersant.
- Most become ineffective when the viscosity reaches 20,000 cP. Corexit 9500 may be effective on oils with a viscosity up to 40,000 cP, extending the "window of opportunity" for dispersant application.
- Most pre-approvals specify a minimum water depth (usually 30 feet), distance from shore, or a specific, sensitive resource such as coral reefs, and maximum time after release. Other constraints include separation distance from rafting birds and avoidance of spraying over marine mammals and sea turtles.
- Not likely to be 100% effective; often requires mechanical recovery and/or shoreline cleanup.

Monitoring Requirements/Suggestions

- Follow the Special Monitoring of Applied Response Technologies (SMART), which consists of a hierarchy of activities:
  - visual aerial observations by trained observers;
  - fluorometry sampling of the dispersed plume, tracked by drifters; and
  - water sampling to validate the quantitative fluorescence values and characterize the composition of the dispersed oil.
- Monitoring should not be a prerequisite for dispersant approval in any specific incident.

Waste Generation and Disposal Issues

- Effective use of dispersants should significantly reduce the amount of oily wastes generated.

References

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Scholz, D.K., J.H. Kucklick, R. Pond, A.H. Walker, A. Bostrom, and P. Fischbeck. 1999. A Decision-maker's Guide to Dispersants: A Review of the Theory and Operational Requirements. American Petroleum Institute, Health and Environmental Sciences Department, Washington, DC. API Publication Number 4692. 38 p.

USCG, NOAA, USEPA, and CDC. 1999. Special Monitoring of Applied Response Technologies (SMART). A Joint Project.

Who to Call for More Information and Additional Resources

- USEPA Oil Program Center, Washington, DC Phone: 703-603-9918
- USEPA ERT, Edison, NJ, 08837 Phone: 732-321-6740
- NOAA-HAZMAT, Seattle, WA 98115 Phone: 206-526-6317
- USCG National Strike Force Coordination Center, Elizabeth City, NC Phone: 252-331-6000
- OHMSETT Testing Facility, PO Box 473, Atlantic Highland, NJ 07716
  Phone: (732) 866-7183; http://www.ohmsett.com

Table 17. Characteristics of Dispersants Listed on the NCP Product Schedule (as of December, 2002).

	Corexit 9500	**Corexit 9527**	**Dispersit SPC**	**JD-109**	**JD-2000**
Dispersant Type	Glycol Ether Concentrate; solvent is paraffinic	Glycol Ether based Concentrate; solvent is ethylene glycol monobutyl ether	Concentrate; surfactants are water based	NP	NP
Availability	ABASCO 281-470-0440	ABASCO 281-470-0440	Maritime Solutions, Inc. 212-747-9044	GlobeMark Resources Ltd. 937-643-1796	GlobeMark Resources Ltd. 937-643-1796
Application Rate	Apply undiluted at 2-10 gal per acre, or a dispersant:oil ratio of 1:50 to 1:10	Apply undiluted at 2-10 gal per acre, or a dispersant:oil ratio of 1:50 to 1:10	Apply at 2-10 gal per acre; or dispersant:oil ratio of 1:50 to 1:10	Apply at 2-10 gal per acre; or dispersant to oil ratio of 1:50 to 1:10	Apply at 2-10 gal per acre; or dispersant:oil ratio of 1:50 to 1:10 at a 5-10% dilution rate
Application Method	Spray neat as droplets	Spray neat as droplets	Spray neat as droplets	Spray neat as droplets	Spray as droplets
Temperature Limitations	Above -30°F	Above -30°F	Above - 25°F	32°-120°F	Above 30°F
EPA Dispersant Effectiveness Test (%)	Prudhoe Bay crude: 49 S. Louisiana crude: 45 Average of above: 47	Prudhoe Bay crude: 51 S. Louisiana crude: 31 Average of above: 41	Prudhoe Bay crude: 52 S. Louisiana crude: 50 Average of above: 51	Prudhoe Bay crude: 30 S. Louisiana crude: 53 Average of above: 41	Prudhoe Bay crude: 39 S. Louisiana crude: 84 Average of above: 61
Vendor Lab Report on Effectiveness (%)	Prudhoe Bay crude: 45 S. Louisiana crude: 55 Average of above: 50	Prudhoe Bay crude: 37 S. Louisiana crude: 63 Average of above: 50	Prudhoe Bay crude: 40 S. Louisiana crude: 105 Average of above: 73	Prudhoe Bay crude: 29 S. Louisiana crude: 91 Average of above: 58.5	Prudhoe Bay crude: 60 S. Louisiana crude: 78 Average of above: 69
Use in Fresh Water?	Not effective	Not effective	Yes		
Use in Salt Water?	Yes	Yes	Yes	Yes	Yes
Worker Safety (Level of Protection)	Level D	Level D	Level D	NP	NP
NCP Reported Toxicity of Dispersant Alone (LC-50, ppm) **Note: a low value = high toxicity**					
Inland silversides (96h)	25.2	14.6	3.5	1.9	407
Mysid shrimp (48h)	32.2	24.1	16.6	1.2	90.5
NCP Reported Toxicity of Dispersant & No. 2 Fuel Oil (1:10 ratio) (LC-50, ppm) Note: a low value = high toxicity					

	Corexit 9500	Corexit 9527	Dispersit SPC	JD-109	JD-2000
Inland silversides (96h)	2.61	4.49	7.9	3.8	3.6
Mysid shrimp (48h)	3.4	6.6	8.2	3.5	2.2
Solubility in Water	Soluble in fresh water; dispersible in sea water	Soluble	Soluble	Soluble	Dispersible in fresh and salt water
Application Assistance Information*	NSFCC Nalco/Exxon (800) 333-3714 (281) 263-7205	NSFCC Nalco/Exxon (800) 333-3714 (281) 263-7205	U.S. Polychemical Corp. 845-356-5530 800-431-2072	Vopak 937-643-1796	Vopak 937-643-1796
Unit Cost**	$17.65 per gal.	Unit cost = $16.85 per gal.	NP	NP	NP
Photograph of Product (photos are added as they become available)					

NP = Information Not Provided
NFSCC = National Strike Force Coordination Center
* For additional technical assistance on product application, contact the supplier listed on the NCP Product Schedule Notebook.

** Unit costs are based on 2002 information supplied by the vendors, where provided. For a more up-to-date cost estimate, contact the supplier listed in the NCP Product Schedule. Generally, product prices decrease as purchase volume increases, and may also vary between distributors.

Table 17 Continued.

	Mare Clean 200	Neos AB 3000	Nokomis 3-F4	PetroBioDispers	Sea Brat #4
Dispersant Type	Concentrate; solvents are paraffinic hydrocarbons	Concentrate; solvents are paraffinic hydrocarbons	NP	NP	NP
Availability	Klinview Corporation 714-753-0821	NEOS Company Ltd. JAPAN 078-331-9381	Mar-Len Supply, Inc 510-782-3555	Petro Bio Corporation 203-966-4573	Petro Bio Corporation 203-966-4573
Application Rate	Apply a dispersant:oil ratio of 1:5 (53-66 gal per ton of oil)	Apply a dispersant:oil ratio of 1:4 to 1:2.4 (65-125 gal per ton of oil)	Apply a dispersant:water ratio of up to 1:30	5% to 10% solution	5% to 10% solution
Application Method	Spray neat as droplets	Spray neat as droplets	Spray on spill directly from drum using a "T" connection and hose	Recommended application is by aircraft, fireboat monitors or similar apparatus	Recommended application is by aircraft, fireboat monitors or similar apparatus
Temperature Limitations	Above 21°F	Above 32°F	Above 32^{O}	No known restrictions	No known restrictions
EPA Dispersant Effectiveness Test (%)	NP	NP	NP	Prudhoe Bay Crude: 56 S. Louisiana Crude: 53 Average of above: 54.5	Prudhoe Bay Crude: 56 S. Louisiana Crude: 53 Average of above: 54.5
Vendor Lab Report on Effectiveness (%)	Prudhoe Bay crude: 64 S. Louisiana crude: 84 Average of above: 74	Prudhoe Bay crude: 20 S. Louisiana crude: 90 Average of above: 55	Prudhoe Bay Crude: 62 S. Louisiana Crude: 65 Average of above: 63.5	Prudhoe Bay Crude: 51 S. Louisiana Crude: 63 Average of above: 57	Prudhoe Bay Crude: 51 S. Louisiana Crude: 63 Average of above: 57
Use in Fresh Water?	Yes	Yes	Yes	Yes	Yes
Use in Salt Water?	Yes	Yes	Yes	Yes	Yes
Worker Safety (Level of Protection)	NP	NP	NP	NP	NP
NCP Reported Toxicity of Dispersant Alone (LC-50, ppm) **Note: a low value = high toxicity**					
Inland silversides (96h)	1,996	91.1	29.8	13.5	13.5
Mysid shrimp (48h)	938	33	32.2	78.9	78.9
NCP Reported Toxicity of Dispersant & No. 2 Fuel Oil (1:10 ratio) (LC-50, ppm) **Note: a low value = high toxicity**					
Inland silversides (96h)	42.0	57.0	100	6	6
Mysid shrimp (48h)	9.84	25.0	58.4	2.7	2.7

	Mare Clean 200	Neos AB 3000	Nokomis 3-F4	PetroBioDispers	Sea Brat #4
Solubility in Water	NP	NP	Soluble	Soluble	Soluble
Application Assistance Information*	Taiho Industries Co., Ltd. 81-33-445-8111	NEOS Company, Ltd. Kobe 078-331-9384	Mar-Len Supply, Inc 510-782-3555	Petro Bio Corporation 203-966-4573	Petro Bio Corporation 203-966-4573
Unit Cost**	NP	NP	NP	NP	NP
Photograph of Product (photos are added as they become available)					

NP = Information Not Provided
NFSCC = National Strike Force Coordination Center

* For additional technical assistance on product application, contact the supplier listed on the NCP Product Schedule Notebook.

** Unit costs are based on 2002 information supplied by the vendors, where provided. For a more up-to-date cost estimate, contact the supplier listed in the NCP Product Schedule. Generally, product prices decrease as purchase volume increases, and may also vary between distributors.

ELASTICITY MODIFIERS

(These Products would be listed under Miscellaneous on the NCP Product Schedule)

Mechanism of Action

- Elasticity modifiers increase the viscoelasticity of the treated oil to improve the efficiency of removal by skimmers or other methods.
- They are composed of long-chained, oil-soluble organic polymers, such as polyisobutylene (a chewing gum additive).
- They dissolve in the oil, modifying the oil's mechanical properties.

When to Use

- Elasticity modifiers are more effective on light oil products, significantly increasing the skimming rate and reducing the amount of water collected.
- They should always be applied to contained slicks, so that the treated oil is immediately recovered.
- They are ideal for thin slicks of No. 2 fuel oil or diesel that are very difficult to recover with mechanical equipment or sorbents.
- Liquid Elastol is recommended by the manufacturer for use on medium to heavy oils.

Authority Required

- **Incident-specific RRT approval is required**. There are only two commercially available elasticity modifiers, Elastol Slurry and Liquid Elastol; both were formerly listed on the NCP Product Schedule. **NOTE**: As of December 2002, there were **NO** products listed on the NCP Product Schedule for this category.

Availability

- Both Elastol Slurry and Liquid Elastol are readily available from various suppliers.

General Application Requirements

- Liquid Elastol is sprayed at recommended application rates as follows: 1 gal of Liquid Elastol treats 13 gal of gasoline; 34 gal of diesel; 84 gal of medium oil; 150 gal of heavy oil.
- Slurry Elastol is educted into a water spray system for application at rates of 100-1,500 ppm (0.01-0.15%). One half-pound of Elastol slurry treats: 100 gal of gasoline; 200 gal of diesel; 300 gal of medium oil; and 500 gal of heavy oil. The slurry particles float on water.
- Water spray provides the energy required to mix the product into the oil. Water spray can be used to herd the treated oil towards the skimmer with minimal dispersion into the water column.
- Warm temperatures, wind, and wave action reduce the time for Elastol to dissolve in the oil. Dissolving time for Elastol Slurry is 1-2 hours.

- Special types of skimmers may be required; drum skimmers work best, whereas disk and oleophilic skimmers are less effective.
- Do not over apply product, which makes the oil very sticky and more difficult to recover.
- Treat heavy, weathered oils carefully since dissolving time is greatly increased and there is a risk of over application.
- Controlling the quantity of material applied to an oil slick is often very difficult. Thus, the potential to make the oil sticky and even more difficult to recover will be high, as will be the waste of product.
- Treated oil should be stored in wide-mouth containers, and not in bladders or containers with narrow openings where getting the treated oil out can be difficult.

Health and Safety Issues

- All products required Level D personal protection with splash protection. Respiratory protection is required when handling the dry slurry.

Limiting Factors/Environmental Constraints

- Water salinity has no impact on effectiveness.
- Low water/air temperatures make heavy oils more viscous and mixing of the product into the oil more difficult.
- Both Elastol Slurry and Liquid Elastol are insoluble in water.
- Liquid Elastol has very low toxicity; LC50 for mummichug (96 h) is >100,000 ppm and for brine shrimp (48 h) is >100,000 ppm.
- Elastol Slurry has low toxicity; LC50 for mummichug (96 h) is >18,000 ppm, for brine shrimp (48 h) is >18,000 ppm, and for water flea (48 h) is >5,000 ppm.
- Main environmental concern is for unrecovered, treated oil, which may be more persistent.
- Treated oil can be very sticky and is more likely to adhere to fur, feathers, vegetation, and dry shorelines (though less likely to adhere to wetted shorelines).

Monitoring Requirements/Suggestions

- None generally required other than good practice.
- Make sure that the product is not over-applied.

Waste Generation and Disposal Issues

- Since less water is picked up by skimmers, product use should reduce the amount of oily liquids generated.
- The recovered oil can be recycled for use; the product does not affect it.
- The viscoelastic properties of the treated oil can be broken by passing the oil through a shear pump. Also, dilution with untreated oil will render it non-viscoelastic.

References

Michel, J., C.B. Henry, and J.M. Barnhill. 1993. Use of Elastol during the Unocal spill on the Neches River, 24 April 1993. Prepared for Regional Response Team VI, NOAA, Seattle, WA. 10 pp.

Who to Call for More Information and Additional Resources

NOAA-HAZMAT, Seattle, WA 98115 Phone: 206-526-6317

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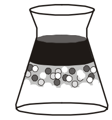

EMULSION TREATING AGENTS

(These Products would be listed under Miscellaneous on the NCP Product Schedule)

Mechanism of Action

- Used to:
  - prevent the formation of an emulsion (emulsion inhibitors); or
  - break the emulsion into separate oil and water phases (emulsion breakers).
- Also known as demulsifiers.
- Most are composed of water-soluble surfactants that modify the properties of the oil/water interface, by displacing, mixing with, or chemically neutralizing the naturally occurring emulsifying surfactants in the oil, thus inhibiting or destabilizing the emulsion.
- Definition: Emulsions can contain 20-80% water, increasing the volume of oily material by up to a factor of four; can increase the oil viscosity by many orders of magnitude, greatly reducing effectiveness of skimmers and pumps.

When to Use: Emulsion Inhibitors

- To prevent emulsification of oil on the water surface.
- To increase the window of opportunity for other response options, such as dispersants or in situ burning. Used in field trials in the North Sea in conjunction with dispersants.
- For oils known to form stable emulsions, use to:
  - prevent an increase in the volume of oily material to be recovered, or
  - increase the recovery rate of skimmers.

When to Use: Emulsion Breakers

- To break emulsions.
- To increase the effectiveness of other response options such as dispersants or in situ burning. Lab tests showed that treatment with emulsion breakers allowed successful burning of otherwise unignitable emulsions.
- In containers, use to separate water from the oil, so it can be discharged, allowing more effective storage and transport, particularly for on-water systems. A high recovery skimmer can exceed its onboard storage in hours.

Authority Required

- **Incident-specific RRT approval is required** to use emulsion treating agents in the open environment or in closed containers where the separated water is discharged back into the environment without treatment.
- **Incident-specific RRT approval is NOT required** if applied in closed containers and if the separated water is sent to a treatment facility (e.g., wastewater treatment plant).

CAUTION: Contact treatment facility prior to product use.

- **NOTE**: As of December, 2002, there is only one product listed on the NCP Product Schedule (Zyme-Flow; under Miscellaneous Oil Spill Control Agents) that meets the definition of an emulsion treating agent for this Job Aid. Refer to Table 18.

Availability

- Readily available from many commercial vendors; a mature product for the oil production industry.
- Developing technology for open-water application; needs more research before use during spill emergencies is viable.
- Potential benefits can be significant when on-scene storage of oily liquids is limited.

General Application Requirements:

- Use systems similar to dispersants (aerial, vessel, hand-held spraying systems), but have lower application rates (100-2,000 ppm). Higher rates are for breaking emulsions; lower rates are for inhibiting emulsification.
- Like dispersants, some mixing energy, either by wave action or mechanical action, is needed. For emulsion breakers, separation time should be within 1-2 hours.

Health and Safety Concerns

- Most products would require Level D personal protection, and a respirator when working with a product in confined spaces (e.g., filling spray systems on aircraft).

Limiting Factors/Environmental Constraints

- Not possible to predict the most effective product for each emulsion, but there are standard tests to measure a product's effectiveness for specific emulsions.
- In field trials of open-water application, treated slicks spread over larger areas and more readily dispersed into the water below.
- Over time (at a rate which is unknown), anionic products will leach out of the oil and an emulsion can form (or re-form). The rate of leaching is higher in fresh water.

- Very few products have toxicity data available, making it difficult to evaluate products for their potential impacts.
- May enhance solubility of oil in the separated water relative to conventional recovery approaches. The presence of dispersed oil and greater solubility of the aromatic compounds could produce discharge water more toxic than that normally generated during gravity separation. Thus, separated water may have to be treated before discharge under certain conditions.
- Use is cautioned when in proximity to water treatment plants.

Monitoring Requirements/Suggestions

- Since there is little spill-related experience in the US, monitoring should be conducted to document product effectiveness and effects.

Waste Generation and Disposal Issues

- Use of emulsion treating agents would reduce the amount of oily material generated for handling, transport, and disposal. In containers, separated water would likely have to be tested and/or treated prior to discharge in accordance with applicable state requirements.

References

Buist, I., J. McCourt, and J. Morrison. 1997. Enhancing the in-situ burning of five Alaskan oils and emulsions. In: Proc. 1997 Intl Oil Spill Conference, American Petroleum Institute, Washington, DC pp. 121-129.

Fiocco, R.J., K.W. Becker, M.A. Walsh, J.N. Hokstad, P.S. Daling, and A. Lewis. 1995. Improved laboratory demulsification tests for oil spill response. In: Proc. 1995 Intl Oil Spill Conference, American Petroleum Institute, Washington, DC. pp. 165-170.

Knudsen, O.O., P.J. Brandvik, and A. Lewis. 1994. Treating oil spills with W/O emulsion inhibitors – A laboratory study of surfactant leaching from the oil to the water phase. In: Proc. 17th Arctic and Marine Oil Spill Program Technical Seminar, Environment Canada, Ottawa, Canada. Pp. 1023-1034.

Who to Call for More Information and Additional Resources

American Petroleum Institute, Washington, DC 20005 Phone: 202-682-8300

USEPA ERT, Edison, NJ 08837 Phone: 732-321-6740

Table 18. Characteristics of Emulsion Treating Agents Listed on the NCP Product Schedule (as of December, 2002).

	Zyme-Flow
General Description	Concentrate; contains surface active agents; designed to make heavy crudes pumpable and to break adhesion between oil and soil, rock, or sand
Availability	United Laboratories, Inc. 630-377-0900 / 800-323-2594
Application Rate	Dilution rate of emulsion treating agent:oil varies from 1:50 to 1:200.
Application Method	Pressure spray or soak with agitation
Temperature Limitations	> 0ºF
Use in Fresh Water?	Yes
Use in Salt Water?	Yes
Worker Safety (Level of Protection)	Level D
Toxicity (LC-50, ppm) **Note: a low value = high toxicity**	Values derived from using concentrated product (no dilution)
Inland silversides (96 h)	35
Mysid shrimp (48h)	26
Solubility in Water	Soluble
Is Treated Oil Recoverable?	Yes
Other Information	Effective in all non-frozen waters; salinity not a factor; will not emulsify oil; separated water can be collected and reused pH: 7.0 to 8.0
Application Assistance Information*	United Laboratories, Inc. 630-377-0900 800-323-2594
Unit Cost **	Unit Cost = $29.90 per gal.
Photograph of Product (photos are added as they become available)	

* For additional technical assistance on product application, contact the supplier listed on the NCP Product Schedule Notebook.

** Unit cost estimates are based on 2002 information supplied by the vendor. For a more up-to-date cost estimate, contact the supplier listed in the NCP Product Schedule. Generally, product prices decrease as purchase volume increase, and may also vary between distributors. Product application rates often vary greatly depending on use.

FIRE-FIGHTING FOAM

(These products are not required to be listed on the NCP Product Schedule)

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

Understanding the Problem

There are two types of fires:

<u>Class A fires</u>: involve combustible products such as vegetation, wood, cloth, paper, rubber, and many plastics.

<u>Class B fires</u>: involve flammable liquid fuels. There are two liquid fuel categories:

- <u>hydrocarbon fuels</u>, such as gasoline and crude oils; as well as ethylene, propylene, and butylene
- <u>alcohol fuels</u>, or polar solvents that mix easily with water, such as acetone, ethanol, and isoproponal.

Foams are used for extinguishing flammable and combustible liquids as well as non-liquids. Unlike other extinguishing agents like water, dry chemicals, CO_2, etc., a stable, aqueous foam can extinguish a flammable or combustible liquid fire by one or more of following mechanisms of:

- Cooling the fuels and any adjacent metal surfaces;
- Separating the flame/ignition source from the fuel surface;
- Suppressing the release of flammable or toxic vapors that can mix with air;
- Smothering the fuel surface fire; and
- Preventing reflash or reignition of the fuel

Water alone is not always effective as an extinguishing agent on flammable liquids. Water, when used on hydrocarbon fuels, has a specific gravity denser than most hydrocarbon fuels, so when the water is applied directly to the fuel surface, the water will typically sink beneath the fuel surface and will have little or no impact on reducing the fire. Additionally, if the liquid fuel burns hotter than 212ºF, then there is the possibility of the water boiling beneath the flammable liquid, causing the inadvertent spread of the hydrocarbon fuel during the water boil off process. Because of these and other reasons, foams have become the industry standard for dealing with hydrocarbon fuels and other flammable liquids that are transported, processed, stored, or used as an energy source (Chemguard, Inc., 2001).

Foams are a stable mass of small air-filled bubbles that have a lower density than oil, gasoline, or water. Foams are composed of three ingredients: water, foam concentrate, and air. When mixed in the correct proportions, these three ingredients form a homogenous blanket that is used to smother flames and induce vapor suppression. Modern day foams can be used in fresh, brackish, and high salinity waters.

When addressing a flammable fuel fire, the responder must determine if the product involved is a standard hydrocarbon fuel or polar solvent fuel. Some foam concentrates are designed specifically for hydrocarbon fuels and do not work with polar solvents and vice versa.

When to Use Fire-Fighting Foam

Class A Fires: Foam is used to:

- make water go further; foam holds water, then slowly releases it
- increase the wetting characteristics from the surfactants in the foam, which makes the water penetrate the fire better
- cling to fuels
- act as a thermal barrier
- Class B Fires: Foam is used to:
- separate, forming a cohesive floating blanket which acts as a barrier between the fuel and fire
- cool, lowering the temperature of the liquid
- suppress, or smother, preventing the release of vapors, thus ignition or re-ignition. Film-forming products can produce a film to suppress formation of flammable vapors

Types of Foam Concentrates

There are 8 general types of foams that are available in application rates of 1, 3, or 6%, depending on the fire source or fuel type.

- Protein foams are used in 3% and 6% concentrations.
  - Consists of protein hydrolysate, foam stabilizers and preservatives
  - Intended of for Class B hydrocarbon fires, however it can be used on Class A fires
  - Must be applied gently or indirectly to the fuel source
  - Must be applied with an air aspirating discharge device

- Fluoroprotein foams are used in 3% and 6% concentrations.
  - Consists of same ingredients as protein foams with the addition of fluorocarbon surfactants
  - Intended for Class B hydrocarbon fires, however it can be used on Class A fires
  - More resistant to fuel contamination/pickup and more mobile than protein foam
  - Can be applied directly and from a distance
  - Recommended application with air-aspirating discharge device

- Aqueous Film Forming Foams (AFFF) are used in 1%, 3%, and 6% concentrations.
  - Ingredients consist of synthetic foaming agents, solvents, fluoro-chemical surfactants, salts, and foam stabilizers
  - Intended for Class B hydrocarbon fires, however it can be used on Class A fires
  - Forms an aqueous film on the surface of the fuel
  - Can be applied using aspirating or non-aspirating discharge devices

- Film Forming Fluoroprotein foams (FFFP) are used in 3% and 6% concentrations.
  - FFFP is a combination of AFFF and Fluoroprotein foam
  - Intended for Class B hydrocarbon fires, however it can be used on Class a fires
  - Contains quick knockdown of AFFF along with burnback resistance of Fluoroprotein foam
  - Can be applied using aspirating or non-aspirating discharge devices

- <u>Alcohol Resistant Aqueous Film Forming Foam</u> (AR-AFFF) is used in 3% and 6% concentrations.
  - Consists of AFFF as a base with an added high molecular weight polymer
  - Intended for both types of Class B fires, however it can be used on Class A fires
  - When used on a polar solvent fuel, it protects the foam from being destroyed or absorbed by the fuel
  - Can be used as 3% concentrate on hydrocarbon fuel and 6% on polar solvent fuel
  - Can be applied using aspirating or non-aspirating discharge devices

- <u>Alcohol Resistant Film Forming Fluoroprotein</u> (AR-FFFP) is used in 3% and 6% concentrations.
  - Consists of FFFP as a base with an added high molecular weight polymer
  - Intended for both types of Class B fires, however it can be used on Class A fires
  - When used on a polar solvent fuel, it protects the foam from being destroyed or absorbed by the fuel
  - Can be used as 3% concentrate on hydrocarbon fuel and 6% on polar solvent fuel
  - Can be applied using aspirating or non-aspirating discharge devices

- <u>Medium and High Expansion Foams</u> are used in 1%-3% concentrations.
  - Consists of hydrocarbon surfactants and solvents
  - Intended for both types of Class B fires as well as Class A fires
  - Expansion ratio of 300:1 to 1,250:1 for high expansion and 50:1 to 300:1 for medium expansion foam
  - Contains very little water and is suitable for rapid smothering and cooling
  - Must be applied using an expansion foam generator

- <u>Class A</u> foam is used in .1%-1% concentrations.
  - Consists of biodegradable mixture of foaming and wetting agents
  - Intended for Class A fires, however it may be effective on some Class B fires
  - Reduces surface tension and produces foam which allow greater penetration and allow water to remain and cling to horizontal and vertical surfaces
  - Must be used with an air aspirating system

Limiting Factors

- Optimal foam production occurs at 40-100°F.
- Most products are effective with fresh or seawater.
- Foams generated separately from protein, fluoroprotein, FFFP, and AFFF can be applied in sequence or simultaneously.
- Most foam products may be mixed with dry chemical extinguishing agents to provide greater fire protection capability. However, foam products of different type and manufacturer should never be mixed.

Environmental Concerns

Many products contain synthetic surfactants and solvents (e.g., diethylene glycol butyl ether) that fall under CERCLA and EPCRA reporting requirements for releases or discharges to the environment.

- Most uses would be under the thresholds for non-manufacturing facility.
- Some large-scale uses might trigger reporting under CERCLA. Check the MSDS to determine if releases have to be reported.

Recent work by Oregon State University has shown that foams have impacted groundwater at military bases in Florida and Nevada that had fire-training facilities no longer in use. Concentrations of foams detected in groundwater at these sites ranged from 0.1 to 7.1 ppm; some of the groundwater samples at the higher concentrations actually foamed.

It is not known if the surfactants in the foams will affect the transport and biodegration of other contaminants associated with the foam during its use (e.g., fuel components and solvents), potentially causing an additional source of groundwater contamination.

Discharge to wastewater treatment facilities:

- Foam solutions cause copious foaming in aeration ponds, even at very low concentrations, which can interfere with wastewater treatment.
- High BOD in foam can cause shock loading and plant upset.
- Foam concentration in influent water should not exceed 1,700 ppm (1 gal of foam solution to 588 gal of influent water). Defoamers can reduce but not eliminate foaming. There are no other known pretreatment options.
- Foam solutions have tendency to emulsify fuels, which will interfere with operation of oil/water separators as part of storm water treatment or pre-treatment prior to discharge to wastewater facilities.

DISCHARGES TO WATERBODIES WITHOUT TREATMENT:

- Can cause foaming in rivers and streams at very low concentrations.
- The surfactants are the primary cause of environmental concerns for toxicity and persistence. There are very limited aquatic toxicity data available, and toxicity will vary widely depending on the product composition. Most available data show LC50s for fathead minnow and water flea in the range of 200-2000 ppm and for rainbow trout and bluegill in the range of 500-1500 ppm, indicating that toxicity is relatively low. LC50s for algae were lower, in the range of 140-180 ppm.
- Fluoro-chemical surfactants are very resistant to degradation. They also leach through soils, potentially contaminating ground water.
- Surfactants in foam solutions have a tendency to emulsify fuels, and used foam solutions will probably be heavily contaminated with the fuel.

Guidelines for Use

- Wherever possible, used foam solution should be collected and disposed of properly (discharge to wastewater treatment plant or hazardous waste facility)
- In the absence of existing containment (e.g., storm-water sewer in a facility), use manual containment, including:
  - blocking sewer drains and diverting fire-fighting runoff to collection.
  - building portable dikes on land.
  - deploying booms in water to contain foam for recovery.
- Be prepared to handle large volumes of fire-fighting water.

- Be aware that foam will emulsify light fuels, increasing the potential for dispersion into the water column.
- Do not allow foam to drift into areas where it could come into contact with wildlife, such as birds and marine mammals, because the surfactants could interfere with the waterproofing of fur and feathers.

References

NFPA. 1998. Standard for Low-Expansion Foam. Prepared by Technical Committee on Foam, National Fire Protection Association, Inc., Quincy, Mass., 62 pp.

American Chemical Society's ASAP email announcement. July 14, 1999. Groundwater Impacted by Fire-Fighting Foams. To be published in Environmental Science & Technology Journal.

Who to Call for More Information and Additional Resources

NOAA-HAZMAT, Seattle, WA 98115 Phone: 206-526-6317

National Institute of Standards and Technology, Fire Research Laboratory, Gaithersburg, MD 20899
Phone: 301-975-5900

National Foam, Inc. Phone: 610-363-1400

USEPA Oil Spill Center/Scientex, Inc., Arlington, VA Phone: 202-260-2342 or 703-603-9918

Chemguard, Inc., Mansfield, TX 76063 Phone: 817-473-9964

Ansul, Inc., Marinette, WI 54143 Phone: 715-735-7411

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Table 19. Characteristics of fire fighting foams (Taken from Chemguard, Inc., 2001).

	Protein Foam	Fluoroprotein Foam	Film Forming Fluoroprotein (FFFP)
Description	Composed of hydrolyzed protein, foam stabilizers, and preservatives	Composed of hydrolyzed protein, foam stabilizers, preservatives, and fluorocarbon surfactants	Derivative of AFFF and Fluoroptotein foam where additional fluorocarbon surfactants have been added
How does It work	Produces a highly stabilized air foam. Relatively slow moving foam when used to cover the surface of a flammable liquid.	Produces a stable foam for vapor suppression Rapid spreading foam creates cooling effect Is also used in storage tanks with hydrocarbon fuels	Forms a film on the surface of the fuel depriving the fire of air Reduces surface tension of water
Logistical Needs	Must always use an air aspirating-type discharge device	Can be used through non-aspirating discharge device For sub-surface injection it can be applied with a high back pressure foam maker	Can be used through non-aspirating discharge devices
Equipment	Balanced and In-line Balanced pressure pump proportioning equipment Balanced pressure bladder tank proportioners Around the pump proportioners Fixed or portable in-line venturi proportioners Hand line nozzles with fixed induction	Balanced and In-line Balanced pressure pump proportioning equipment Balanced pressure bladder tank proportioners Around the pump proportioners Fixed or portable in-line venturi proportioners Hand line nozzles with fixed induction	Sprinkler heads and spray nozzles Air aspirating hand lines and monitor nozzles Foam makers
Coverage/ Technique Required	**Application technique is critical**	Use subsurface method of forcing expanded foam through base of storage tank	Can be applied directly to the fuel Use subsurface method of forcing expanded foam through base of storage tank
Application Rates	3% to 6% application rate 0.16 gpm/sq. ft. for hydrocarbon fuels with low water solubility	3% to 6% application rate 0.16 gpm/sq. ft. for hydrocarbon fuels with low water solubility	3% to 6% application rate 0.10 gpm/sq. ft. for hydrocarbon fuels with low water solubility

	Protein Foam	Fluoroprotein Foam	Film Forming Fluoroprotein (FFFP)
Operational Limitations			
Pros	Recommended for laying a foam blanket on runways prior to a distressed aircraft landing	More resistant to fuel contamination/pickup than protein foams. Foam blanket is more mobile when discharged onto flammable liquids Allows discharging foam to be applied directly onto the fuel surface Foam blanket will not become saturated by fuel vapors	Fast fire knockdown speed Long lasting heat resistance High vapor suppression
Cons	Can become contaminated with fuel if plunged directly into the fuel surface. Slow knockdown speed	Fairly slow knockdown speed	

Table 19. Continued

	Aqueous Film Forming Foam (AFFF)	Alcohol Resistant Film Forming Fluoroprotein Foam (AR-FFP)	Alcohol Resistant Aqueous Film Forming Foam (AR -AFFF)
Description	Manufactured from synthetic materials such as: hydrocarbon surfactants, solvents, fluoro-chemical surfactants, salts, and foam stabilizers	Consists of FFFP as a base with an added high molecular weight polymer	Consists of AFFF as a base with an added high molecular weight polymer
How Does it Work?	Foam blanket drains water creating an aqueous film over the fuel that deprives the fire of air The fast moving blanket moves over the fire creating more insulation As the foam drains water it creates more film healing the areas where the foam has been disturbed	When used on a polar solvent fuel, it protects the foam from being destroyed or absorbed by the fuel	The foam creates a membrane rather than a film which separates the water in the foam blanket from the attack of the fuel
Equipment	Balanced and In-line Balanced pressure pump proportioning equipment Balanced pressure bladder tank proportioners Around the pump proportioners Fixed or portable in-line venturi proportioners Hand line nozzles with fixed induction		Balanced and In-line Balanced pressure pump proportioning equipment Balanced pressure bladder tank proportioners Around the pump proportioners Fixed or portable in-line venturi proportioners Hand line nozzles with fixed induction
Logistical Needs	Can be applied using aspirating or non-aspirating discharge devices	Can be applied using non-aspirating discharge device however an aspirating device is recommended for polar solvent fuels	Can be applied using non-aspirating discharge device however an aspirating device is recommended for polar solvent fuels
Coverage/ Technique Required	Can be applied directly to the fuel Use subsurface method of forcing expanded foam through base of storage tank	Should be applied gently however it can resist fuel contamination and be mixed with hydrocarbon fuels without affecting performance	Should be applied gently so a membrane is allowed to form disabling the fuel from contaminating the foam
Application Rate	1%-6% application rate 0.10 gpm/sq. ft. on hydrocarbon fuels with low water solubility	3% for hydrocarbon fuels 6% for polar solvent fuels 0.10 gpm/sq. ft. on hydrocarbon fuels with low water solubility	3% for hydrocarbon fuels 6% for polar solvent fuels 0.10 gpm/sq. ft. on hydrocarbon fuels with low water solubility
Operational Limitations			

	Aqueous Film Forming Foam (AFFF)	Alcohol Resistant Film Forming Fluoroprotein Foam (AR-FFP)	Alcohol Resistant Aqueous Film Forming Foam (AR -AFFF)
Pros	Fast fire knockdown speed	Can be used on more applications than standard FFFP or fluoro-protein foam concentrates Quick fire knockdown speed High vapor suppression	
Cons	Fairly low heat resistance Fairly low vapor suppression		Fairly low heat resistance

Table 19. Continued.

	Medium and High Expansion Foam	Class A Foam Concentrate
Description	Manufactured from a combination of hydrocarbon surfactants and solvents	Biodegradable mixture of foaming and wetting agents
How Does it Work?	Fire control and extinction is achieved by smothering and cooling	Reduces surface tension of water allowing for greater penetration Gives water foaming ability allowing it to cling to surfaces without runoff
Equipment	High Expansion foam generators: mechanical blower or water aspirating Balanced pressure bladder tank type proportioner Balanced and In-line Balanced pressure pump proportioning equipment In-line fixed or portable venturi type proportioners (eductors) Around the pump type proportioners	Compressed air systems Balanced pressure pump or bladder tank fixed sprinkler system In-line fixed or portable venturi type proportioners (eductors)
Logistical Needs	Always applied using an air aspirating discharge device	Can be applied with regular water stream equipment
Coverage/ Technique	Can be applied directly to the fuel because of the low density foam	Can be applied directly to the Class A fire source
Application Rate	1% to 3% application rate Medium expansion: 50-300:1 High expansion: 300-1,250:1	0.1% to 0.5% application rate
Operational Limitations		
Pros	Low water content reduces water damage Vapor suppression Useful when runoff is not desirable	Effectiveness of water is increased up to 5 times
Cons	Not suitable for outdoor use Poor heat resistance	

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IN SITU BURNING ON LAND

Description

- This guidance covers use of in situ burning of oil on land, including wetlands. The objective is to remove free oil and oily debris from the substrate by burning the oil in place.
- This section <u>does NOT</u> address disposal issues by incineration.

When to Use

Consider *in situ* burning under these conditions:

– To quickly remove oil to prevent it's spread to sensitive sites or over large areas.

– To reduce the generation of oily wastes, especially where transportation or disposal options are limited.

– Where access to the site is limited by shallow water, soft substrates, thick vegetation, or the remoteness of the location.

– As a final removal technique, when other methods begin to lose effectiveness or become too intrusive.

Favorable conditions include:

– Remote or sparsely populated sites (at least 0.5-1 mile from populated areas).

– Calm winds (so the smoke plume rises high into the air and for better fire control).

– Fresh crudes or light/intermediate refined products that burn more readily and efficiently.

– Mostly herbaceous vegetation, though some shrubs and trees are fire tolerant.

– Dormant vegetation (not in the active growing season).

– Unvegetated areas, such as dirt roads, ditches, dry streambeds, idle cropland).

– In wetlands, when there is a water layer covering the substrate (prevents thermal damage to soil and roots, and keeps oil from penetrating substrate). However, a water layer is not mandatory, at a minimum, the soils should be water saturated.

– Snow and ice that provides natural containment and substrate protection.

Authority Required

- For inland burns, approval from the appropriate state agencies (including the agency regulating air quality) is required. Approval process may vary by region/state. Consult with RRT for approval guidance.

- **Incident-specific RRT approval is not required unless an accelerant (burning agent) is used**; but, Trustee notification is strongly recommended, and may be required by the RRT. ISB MOUs are located in Volume II of this Selection Guide.
- A burn plan should address health and safety issues, burn methods, monitoring plans, and post-burn cleanup and restoration.

General Application Requirements

- Notify local fire and police departments prior to the burn, and secure the site. Must have concurrence with local public safety official.
- Areas outside of the planned burn area are wetted down or protected with a firebreak, if needed.
- The free oil and/or oiled combustible materials (vegetation, logs, debris) are ignited. A common accelerant used in prescribed burns is a 70/30 mix of diesel and gasoline, though flame or drip torches, flares, lighters, blowtorches, hay, and varsol have been used at oil spills.
- After the initial burn, it may be necessary to re-ignite any remaining oil, extinguish hot spots, or remove burn residues.

Health and Safety Issues

- Make human health and safety of responders and potentially affected populations of primary concern.
- Site conditions (particularly wind speed and direction) will determine whether the smoke plume poses a threat to the public, thus each spill has be evaluated on a case-by-case basis.
- Have a plan for extinguishing the fire. The local fire department may not have the resources to standby, so have a backup plan.

Limiting Factors/Environmental Constraints

- Heavy, weathered, or emulsified oils may not ignite, even with accelerants.
- A crust or residue is often left behind after burning and may need to be broken up or removed, to speed revegetation.
- Prolonged flooding of a burned wetland may kill burned plants if they are completely submerged.
- Erosion may be a problem in burned areas if plant cover is reduced; short-term erosion control measures may be needed.
- The site may need protection from overgrazing, especially since herbivores may be attracted to new growth at burned sites.
- Fire ecologists and practitioners can provide valuable knowledge and experience on the appropriateness of burning oil in different habitats.

Monitoring Requirements/Suggestions

- Since there is very poor documentation on the effectiveness and effects of burning oil on land, monitoring of any burn site is very important.
- Air quality monitoring may be required at the edges of populated areas. USCG and USEPA both have teams with expertise and equipment to provide air monitoring. Follow the SMART (Specialized Monitoring of Applied Response Technologies) plan provided in Volume II of this Selection Guide.
- Describe and photograph the burn site before and after the burn, record detailed information on the burn, including duration, residue type and volume, water depth before/after the burn, visible impacts, post-burn activities (e.g., residue removal methods), restoration efforts and results, etc.

Waste Generation and Disposal Issues

- *In situ* burning should significantly reduce the amount of oily wastes generated.

References

Dahlin, J.A., S. Zengel, C. Headley, and J. Michel. 1999. Compilation and review of data on the environmental effects of in situ burning of inland and upland oil spills. American Petroleum Institute, Washington, DC.

J. Michel, Z. Nixon, H. Hinkeldey, and S. Miles. 2002. Recovery Of Four Oiled Wetlands Subjected To *In Situ* Burning. Prepared for American Petroleum Institute, Washington, DC. API Pub. No. 4724.

S.L. Ross Environmental Research, Ltd. 1998. Identification of oils that produce non-buoyant in situ burning residues and methods for their recovery. Prepared for American Petroleum Institute and Texas General Land Office by S.L. Ross, Ottawa, Canada. 50 p.

Who to Call for More Information and Additional Resources

Al Allen, Spiltec, Inc., Woodinville, WA 98072 Phone: 206-869-0988

Louisiana State University, Baton Rouge, LA Phone: 504-388-4295

USCG National Strike Force Coordination Center, Elizabeth City, NC Phone: 252-331-6000

USEPA ERT, Edison, NJ 08837 Phone: 732-321-6740

USCG Response Plan Equipment Caps Review (1999) http://www.uscg.mil/vrp/capsreview.htm

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IN SITU BURNING ON INLAND WATERS

Description

- To remove oil from the water surface by burning the oil in place.
- This section does NOT address disposal issues by incineration.

When to Use

- Consider *in situ* burning under these conditions:
  - To quickly remove oil to prevent its spread to sensitive sites or over large areas. Removal rates of 50,000 gal/hour can be achieved for a burn area of 10,000 ft^2; under prime conditions, removal efficiencies can exceed 90%.
  - When oil recovery is limited by available oil storage and handling capabilities.
  - To reduce the generation of oily wastes, especially where transportation or disposal options are limited.
  - Where access to the site is limited by shallow water, ice, or the remoteness of the location.

Authority Required

- Approval from the appropriate state agencies (including the agency regulating air quality) is required. Approval process may vary by region/state. Consult with RRT for approval guidance.
- **Incident-specific RRT approval is not required unless an accelerant (burning agent) is used**; but, Trustee notification is strongly recommended and may be required by the RRT. ISB MOUs are included in Volume II of this Selection Guide.
- Burn Plan is required and should address health and safety issues, burn methods, monitoring plans, and post-burn cleanup and restoration. Use the ISB Evaluation & Response Checklist included in Volume II of this Selection Guide.

General Application Requirements

- Notify local fire and police departments prior to the burn, and secure the site.
- Burning oil generates large volumes of black smoke, so consider using radio broadcasts to notify the public and broadcast to mariners of a safety zone in navigable waters.
- The oil slick must be thick enough to ignite and sustain the burn.
- The oil must be heated to a temperature at which the oil will be vaporized and support combustion in the air above the slick (the hydrocarbons vapors burn, not the liquid itself).
- Accelerants include:
  - gelled gasoline, which is commonly used for aerial ignition;

– sodium and gasoline, solid propellants (rocket fuels)

– hand-deployed igniters include rags, paper, sorbents, etc. soaked in a 70/30 mix of diesel and gasoline; lighters; flares; and torches.

- Once 1m2 of burning slick as been established, ignition can be considered accomplished.

Health and Safety Issues

- Make human health and safety of responders and potentially affected populations of primary concern.
- Site conditions (particularly wind speed and direction) will determine whether the smoke plume poses a threat to the public, thus each spill must be evaluated on a case-by-case basis.
- Have a plan for extinguishing the fire. For slicks contained in booms, the burn can be terminated by releasing the boom and allowing the oil to spread to less than the minimum thickness.

Limiting Factors/Environmental Constraints

- Oil thickness: minimum ignitable thickness for fresh, volatile, crude oil is 1 mm; for aged, unemulsified crude oil and diesel fuels, 2-5 mm; for residual fuel oils, about 10 mm. Oil must be contained, either naturally, such as by ice, or by booms.
- Maximum wind speed: about 20 knots (10-12 m/s); seas should not exceed 2-3 ft. Consideration should be made as to the direction of the smoke plume and its proximity to populated areas.
- Effect of emulsification: little effect on up to 12% water; notable decrease between 12-25% water; and zero burn efficiency for stable emulsified oil with >25% water, based on lab tests. Will vary with the stability of the emulsion.
- Good visibility: Essential. Burns should be conducted during daylight hours and under VFR conditions so the burn can be observed from aircraft.
- Consult with state and federal resource managers: Need to determine if there are any biological resources of concern in the area, or special constraints.
- Recovery of burn residue: Can form a semi-solid, tar-like layer and may need to be recovered. Rules of thumb for residue thickness:
  - Crude oil up to 10-20 mm, residue thickness is 1 mm.
  - Thicker crude slicks generate thicker residues; emulsified slicks are much greater.
  - For light and middle distillate fuels, residue thickness is 1 mm, regardless of slick thickness.
- Sinking burn residue: The burn residue from crude oil burns may sink. Recent studies have predicted that about half of international crude oils would tend to sink in seawater, but only after cooling.
  - It may be possible to collect the burn residues while they are still hot and buoyant. Nets deployed under the burn area might allow capture of sinking residues.
- Recovery of sunken burn residue: It may be necessary to recover sunken burn residue from the bottom, if the amounts are significant and site conditions conducive.

Monitoring Requirements/Suggestions

- Air quality monitoring may be required at the edges of populated areas. USCG and USEPA both have teams with expertise and equipment to provide air monitoring. Follow the SMART (Special Monitoring of Applied Response Technologies) plan contained in Volume II of this Selection Guide.
- The NRT recommends, as an air quality guideline, an upper limit of 150 micrograms of PM-10 per m3 of air, averaged over 1 hour.

Waste Generation and Disposal Issues

- *In situ* burning should significantly reduce the amount of oily wastes generated.

References

Buist, I.A., S.L.Ross, B.K. Trudel, E. Taylor, T.G. Campbell, P.A. Westphel, M.R. Myers, G.S. Ronzio, A.A. Allen, and A.B. Nordvik. 1994. The science, technology, and effects of controlled burning of oil spills at sea. MSRC Tech. Report Series 94-013. Marine Spill Response Corporation, Washington, DC 382 p.

Buist, I.A. 1998. Window of opportunity for *in situ* burning. Paper presented at the MMS *In situ* Burning of Oil Spills Workshop, New Orleans, LA. Nov. 2-4, 1998. Minerals Management Service, Washington, DC. 9 p.

NRT. 1995. Igniters and ignition technology for *in situ* burning of oil. Fact Sheet prepared by the National Response Team Science and Technology Committee. October 1995.

S.L. Ross Environmental Research, Ltd. 1998. Identification of oils that produce non-buoyant *in situ* burning residues and methods for their recovery. Prepared for American Petroleum Institute and Texas General Land Office by S.L. Ross, Ottawa, Canada. 50 p.

Who to Call for More Information and Additional Resources

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- USCG National Strike Force Coordination Center, Elizabeth City, NC Phone: 252-331-6000
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- USCG Response Plan Equipment Caps Review (1999) http://www.uscg.mil/vrp/capsreview.htm

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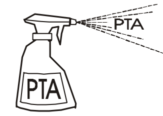

SHORELINE PRE-TREATMENT AGENTS

(Products in this Category would be listed under Miscellaneous on the NCP Product Schedule)

Mechanism of Action

- Shoreline Pre-treatment Agents are applied to the substrate prior to oil landfall to prevent oil from adhering to, or penetrating, the substrate.
- There are two subclasses of products:
  - <u>Film-forming Agents</u>: form a physical barrier that prevents the oil from adhering, staining, absorbing, and contaminating the shoreline, and
  - <u>Wetting Agents</u>: affect the oil/water interface and thus help the water displace the oil from the substrate.

When to Use

- Oil is heading towards a sensitive shoreline resource (e.g., marsh, sheltered tidal flat) or a resource of historical/archaeological importance.

Authority Required

- **Incident-specific RRT approval is required. NOTE**: As of December 2002, there is no category designated for shoreline pre-treatment agents on the NCP Product Schedule.

Availability

- No products are currently available in the US. However, products in this category are being used in Europe.
- There is the potential use of Surface Washing Agents serving as shoreline pre-treatment agents. The use of a listed product in this manner is the decision of the incident-specific RRT.

General Application Requirements

- The characteristics of a shoreline pre-treatment agent include:
  - Product needs to be sprayed as a thin, even coating on the substrate;
  - Are readily available;
  - Dissolve or degrade in seawater;
  - Rapid drying time;
  - Low permeability to oil penetration;
  - Readily adhere to intertidal substrates (e.g., sand, gravel, bedrock); and
  - Not be wetted by oil.
- Narrow window of opportunity for use. Timing of application is critical when using shoreline pre-treatment agents; products need to be applied to the oil/shoreline interface just prior to stranding of oil for effective use.
- Oil spill trajectory monitoring would have to be closely monitored.

Health and Safety Issues

- Refer to health and safety information from Surface Washing Agents when proposing to use a surface washing agent as a shoreline pre-treatment agent.

Limiting Factors/Environmental Constraints

- Biodegradability of the product – product should degrade rapidly without toxic by-products.
- Products should have low contact toxicity as it is applied directly on the intertidal substrates.
- Products should have low application rates and low aqueous toxicity values so that impacts to intertidal and subtidal resources are minimal.
- Products used as a film could potentially smother intertidal biota by reducing oxygen levels.

Monitoring Requirements/Suggestions

- Make sure that the product is not over-applied.

Waste Generation and Disposal Issues

- Not an issue; product should rapidly degrade within the water column or on the substrate surface.

References

Walker, A.H., J. Michel, G. Canevari, J. Kucklick, D. Scholz, C.A. Benson, E. Overton, and B. Shane. 1993. Chemical Oil Spill Treating Agents. Marine Spill Response Corporation, Washington, DC. MSRC Technical Report Series 93-015. 328 p.

Walker, A.H., J.H. Kucklick, and J. Michel. 1999. Effectiveness and Environmental Considerations for Non-dispersant Chemical Countermeasures. Paper 147: An issue of special reports reviewing oil spill countermeasures. *Pure Appl. Chem*., 71(1).

Who to Call for More Information and Additional Resources

USEPA ERT, Edison, NJ 08837 Phone: 732-321-6740

USEPA Oil Program Center, Washington, DC Phone: 703-603-9918

NOAA-HAZMAT, Seattle, WA 98115 Phone: 206-526-6317

American Petroleum Institute, Washington, DC 20005 Phone: 202-682-8300

Environment Canada, Emergencies Sciences Division, Ottawa, Canada

CEDRE, BP 20 413 - 29604 BREST cedex - France Phone: 33 (0)2 98 33 10 10

MAFF, Nobel House, 17 Smith Square, London, Phone: 020 7238 3000

SOLIDIFIERS

(Products in this Category are listed under Miscellaneous on the NCP Product Schedule)

Mechanism of Action

- Solidifiers are products which, when mixed with oil, turn the oil into a coherent mass.
- Most products are synthetic polymers that either physically or chemically bond with organic liquids, not allowing the material to be squeezed out. There is usually little change in the specific gravity of the treated oil.
- Products that are essentially sorbents are not included because they are considered to be mechanical countermeasures.

When to Use

- To immobilize the oil, to prevent further spread, or penetration into the substrate. In some cases, the edge of the oil can be treated, forming a solidified barrier to prevent further spreading.
- Solidification can eliminate the free product thereby reduce the vapor pressure of volatile oils.
- Product booms or pillows could be deployed along sensitive areas before the oil approaches, or downstream of oil containment areas to recover sheens.
- Solidifiers are well suited for small spills on land to prevent, for example, run-off into drains and rivers.

Authority Required

- **Incident-specific RRT approval is required**. Consultation with trustees is recommended.
- **NOTE**: As of December 2002, four products are listed as Miscellaneous Oil Spill Control Agents on the NCP Product Schedule, (Alsocup, Cheap Insurance, Waste Set PS 3200, and Waste Set 3400) (Table 20). These products are considered solidifiers as described in this Selection Guide.
- There are two additional products (Enviro-Bond 403 and Rubberizer) that have received sorbent status by the EPA, but are included in Table 20 of this Section; these products are considered solidifiers as defined in this Selection Guide. Additionally, <u>Appendix K contains information on solidifier products that are not currently listed on the NCP Product Schedule</u>.

General Application Requirements

- Most products are granular and can be placed in booms or pillows or applied dry, by hand or with a portable broadcast system to cover large areas. In recent tests, an all-fiber blower worked better than an air-blast pesticide sprayer and a hydro-seeder..
- On floating oil, mixing is usually needed, and can be done with a strong water spray. Booms and pillows can be used like similar sorbent products.
- Free product application rates vary from 10-50 percent by weight of the liquid to be recovered. Controlling application rates can be difficult, and they are usually higher than specified because of overspray under field conditions.

- Solidification (cure time) can occur immediately or take up to 18 hours to form a firm, cohesive mass.
- For free product used on land, recovery is usually by manual pickup or sweeping, and is limited primarily by access. On water, the treated oil must be contained and recovered, using fish netting, wire screens, or hand tools (e.g., rakes, shovels).

Health and Safety Issues

- Workers spreading powdered solidifiers should wear appropriate breathing protection to prevent inhalation of any product dust.
- Solidified oil on surfaces may increase the chance of slips, trips, and falls.

Limiting Factors/Environmental Constraints

- Effectiveness is likely to decrease for emulsified, weathered, thick, or heavy oils because of the difficulty of mixing the product into viscous liquids.
- Water salinity does not have an effect on solidification. Low water temperatures slow solidification, mostly by increasing the oil's viscosity.
- Most all products float even after interacting with oil. Under 40 CFR Subpart 300.910 - Authorization of Use, the use of sinking agents or products that will cause the oil to sink is prohibited. 40 CFR Subpart 300.900 is included in its entirety as Appendix F in this Volume.

CAUTION: Reject any products that could cause the oil to sink, such as clays.

- When waves are present, formation of small clumps and not one large mass is likely.
- Solidifiers have relatively low toxicity, and many products are considered to be non-toxic. However, for free product there may be concern about the fate and secondary effects of treated and unrecovered oil and unreacted product, since in the field, overspray on water is likely. Thus, applications should be done in small, controllable areas.
- Like sorbents, the use of solidifiers requires access to deploy, and then recover the product. The potential for physical disturbance of habitats, as well as smothering by excess loose product, should be considered.
- Solidifiers will inhibit the natural processes of dispersion and evaporation, which act to remove oil from the surface of the water.
- If not recovered, solidified oil will weather very slowly, thus residues may be very persistent.
- Use of solidifiers may impair the operation of conventional recovery equipment.
- Options available for waste disposal may be limited for the solidified oil.

Monitoring Requirements/Suggestions

- None generally required other than good practice.

Waste Generation and Disposal Issues

- Most products pick up oil with minimal increase in volume.
- Most solidifiers are not reversible, so the solid material has to be stored and properly disposed of. Though producers may state that the solidified material can pass leachate tests (and thus be disposed of in non-hazardous landfills), each case will have to be tested.
- Disposal options for large volumes would include use as a fuel source in cement kilns, incinerators, etc. These options would require time for testing and permitting.

References

PERF, 1994. Solidifiers for oil spill response: Phase 1: Solidifier materials and effects on oil. Petroleum Environmental Research Forum (PERF) Project No. 92-16.

PERF, 1996. Oil spill solidifiers for upstream/downstream land application. Petroleum Environmental Research Forum (PERF) Project No. 94-14.

Who to Call for More Information or Additional Resources

Environment Canada, Emergencies Sciences Division, Ottawa, Canada Phone: (613) 988-9622

USEPA Oil Program Center, Washington, DC Phone: 703-603-9918

NOAA-HAZMAT, Seattle, WA 98115 Phone: 206-526-6317

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Table 20. Characteristics of Solidifier Products evaluated by PERF (1994, 1996) and/or on the NCP Product Schedule (as of December, 2002).

	Alsocup	CI Agent Blue	Enviro-Bond 403	Rubberizer	Waste Set PS 3200	Waste Set PS 3400
General Description	Granular material	White, odorless powder; block co-polymers	Granular material; block co-polymer	Granular material; mixture of hydro-carbon polymers	White, odorless powder; block co-polymer	White, odorless powder; block co-polymer
Listed in US?	**YES**	**YES**	**NO;** Received Sorbent Letter From EPA	**NO;** Received Sorbent Letter From EPA	**YES**	**YES**
Availability within 48 h	Stockpiles of 2,000 lbs in Chino, CA and 58,000 lbs in Ohio	50,000 lb in 72 hrs 20,000 lb in 48 hr 10,000 lb stockpile in Louisville 20,000 lb in Detroit	45,000 lb. NE 40,000 lb. SE 65,000 lb. Central 80,000 lb. SW 30,000 lb. W	10,000 lb stockpile, San Diego, CA and Houston, TX	Stockpile in Grand Rapids, MI	Stockpile in Grand Rapids, MI
Application Rate, % by weight of product to oil (per manufacturer)	10	10-30	14-25	18	20; may vary with viscosity and temperature	20; may vary with viscosity and temperature
Application Rate (lab test, with med. crude, Environment Canada)	Not tested	Not tested	18	24	Not tested	Not tested
Application Rate (PERF tests)	Not tested	diesel: 39 medium crude: 35 Bunker C: 36	diesel: 35 medium crude: 37 Bunker C: 38	diesel: 35 medium crude: 47 Bunker C: 50	Not tested	diesel: 35 medium crude: 30 Bunker C: 35
PERF Test Comments	NP	Product formed a firm pancake with gasoline, diesel, and Arab medium and Alaska North Slope crudes. With Bunker C and Maya crude, the material solidified but remained sticky	Formed a firm pancake with gasoline and Maya crude. Other oils solidified, but remained either sticky or gummy.	Product solidified all oil types. With gasoline, the pancake was firm; with diesel, it was firm but fell apart when lifted. Crude oils and bunker C solidified but did not form a cohesive mass	Not tested	Product formed a firm pancake with gasoline and all crude oils. The Maya crude was solidified after 2 days of stirring. Diesel and bunker C did not form a cohesive pancake; however, the materials solidified

	Alsocup	CI Agent Blue	Enviro-Bond 403	Rubberizer	Waste Set PS 3200	Waste Set PS 3400
Cure Time	Gasoline/Diesel – instantaneous; oil or hydraulic fluids will solidify to form a weak pancake that will break apart when disturbed. Can be removed with a pump.	Gasoline/Diesel- instantaneous; Oil/Hydraulic Fluids- 1-2 minutes up to 1 hour	5 minutes	20 minutes	< 1 minute	< 1 minute
Solidification Process (from PERF report)	Chemical bond with oil; oil cannot leach once bound with Alsocup	Oil is absorbed into the interior of the particle where a chemical reaction takes place	Chemical bond with oil by cross linking polymers. No heat reaction	Solidification is by a physical bond	Oil is absorbed into the particle interior where a chemical reaction takes place	Oil is absorbed into the particle interior where a chemical reaction takes place
Use in Fresh Water?	Yes	Yes	Yes	Yes	Yes	Yes
Use in Salt Water?	Yes	Yes	Yes	Yes	Yes	Yes
Can the Oil be Returned to a Liquid	No	No	No	No	Yes; patented process	Yes; patented process
Disposal/Recycling Issues	Jelled mass may be recycled for use in rubber products	Can be disposed of in sanitary landfills in most cases	Can be disposed of in sanitary landfills or used as co-generation, or incineration	NP	NP	NP
Toxicity (LC-50, ppm) Note: a low value = high toxicity	Mummichug >100 (96h); Brine shrimp >100 (48h)	Mummichug 2,227 (96h); Brine shrimp 2,617(48h)	Brine shrimp >100,000 (48h)	NP	Mummichug >10,000 (96h); Brine shrimp 5431 (48h)	Mummichug >10,000 (96h); Brine shrimp >10,000 (48h)
Solubility in water	Insoluble	Insoluble	Insoluble	Insoluble	Insoluble	Insoluble
Other Information	Does not absorb water; agitation (manual or wave action) is necessary	See website: www.itscheapinsurance.com www.onsitewastemgmt.com	Web site: www.enviro-bond.com		Land use preferred	Water use preferred

	Alsocup	CI Agent Blue	Enviro-Bond 403	Rubberizer	Waste Set PS 3200	Waste Set PS 3400
Application Assistance Information*	ALSOCUP 714-490-1613	OnSite Waste Management. 502-241-1996 800-255-6073	On site management: 231-258-0400	HAZ_MAT Response Technologies, INC. 800-542-3036	C.B. Environmental, Inc. 616-784-0770	C.B. Environmental, Inc. 616-784-0770
Unit Cost**	NP	Unit cost = $6 to $16 per lb.	$3.10-$3.75 per lb. depending on quantity	NP	NP	NP
Photograph of Product (photos are added as they become available)						

NP = Not provided

* For additional technical assistance on product application, contact the supplier listed on the NCP Product Schedule Notebook.

** Unit costs are based on 2002 information supplied by the vendors, where provided. For a more up-to-date cost estimate, contact the supplier listed in the NCP Product Schedule. Generally, product prices decrease as purchase volume increases, and may also vary between distributors. Product application rates often vary greatly depending on use.

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Sorbents

(These Products may be listed under Miscellaneous on the NCP Product Schedule)

Mechanism of Action

- Sorbent is a general term applied to both absorbents and adsorbents. The source of these products can be natural or synthetic. They can be organic, inorganic, or mixed in composition. Proper use of these materials depends on the type of spill, location, and type of sorbent to be used. (ASTM definition)
- *Absorption* – a process where the material taken up is distributed throughout the body of the absorbing material. (The body of the absorbing material must swell.)
- *Adsorption* – a process where the material taken up is distributed over the surface of the adsorbing material
- Sorbing material can include: natural organic substance, synthetic organic substance, an inorganic substance, or a mixture of the three. The material may also be treated with oleophilic and hydrophobic compounds to improve performance.
- Typically low density (less than 1.0 g/cm3) allowing the sorbent to float on water.
- Sorbents are produced in the following forms: sheets, pads, blankets, and mats; loose unconsolidated particulate material; pillows and socks; booms; sweeps; and agglomerated unit (e.g., pom pom, yarn, or netting).
- Efficiency depends upon the capacity of the particular sorbent, wave or tidal energy, and viscosity and stickiness of the oil.

When to Use

- In nearshore, calm areas where oil needs to be recovered.
- Spill conditions vary widely. See Table 21 for an analysis of the type oil types best suited for each sorbent product category.
- When the decision-maker wants or is willing to try sorbents that are different from those normally used.

Authority Required

- **Incident-specific RRT member approval is NOT required** if the product is **NOT required** to be listed on the NCP Product Schedule under the Miscellaneous Oil Spill Control category. **Incident-specific RRT member approval WOULD be required** for sorbents that are required to be listed on the NCP Product Schedule. Refer to Appendix G for the list of products that have been evaluated by USEPA and determined not required to be listed on the NCP Product Schedule. A draft copy of the official USEPA letter for sorbents not required to be listed on the NCP Product Schedule is provided in Appendix C.

Availability

- Varies widely. See Table 21 for a description of the sorbent characteristics in addition to the three traditional sorbent materials (polyurethane, polyethylene, and polypropylene). **NOTE**: As of December, 2002, there were no sorbent products listed on the NCP Product Schedule.
- This Selection Guide does not address individual product costs due to the very large number of products available, in various forms, for the sorbent categories listed in Table 21.

General Application Requirements

- In general, sorbent material is placed on land, the water surface (fresh/estuarine/salt) or along the shore at the waterline.
- Recovery of all sorbent material is **mandatory**. Loose particulate sorbent material must be contained in mesh or other material before applying to water. Loose sorbent can be applied to water or hard surface, such as concrete floors as long as it can be completely recovered.

Health and Safety Issues

- Varies widely. In general, only potential health effect could result from inhaling loose particulate.

Limiting Factors/Environmental Constraints

- All sorbents, conventional or alternative, must be retrieved for proper disposal. Sorbent use may be better for recovering small quantities of oil in order to avoid generating excessive amounts of waste.
- Oiled and unoiled sorbents left in place too long can break apart and present an ingestion hazard to wildlife, or smother animals and plants.
- Not enough is known about the long-term impacts from some of the sorbents.
- Access for deploying and retrieving sorbents should not adversely affect wildlife nor impact soft or sensitive habitats (marshes, sheltered tidal flats, etc.).
- Should not be used in a manner that might endanger or trap wildlife.

Monitoring Requirements/Suggestions

- Monitoring of all sorbent use locations is very important to ensure that all sorbent can be recovered for proper disposal.
- Monitoring may be even more important for sorbents to ensure that oiled sorbents do not sink, break down, etc. over time.

Waste Generation and Disposal Issues

- Sorbents must be collected and properly disposed of. Check product specific requirements on the following table.
- Care should be taken to select and use sorbents properly, to prevent generation of large quantities of lightly oiled sorbent.
- Recycling of sorbents, rather than disposal, should be emphasized.

References

Cooper, D., S. Penton, K. Rafuse, and A.B. Nordvik. 1994. An evaluation of oil sorbent materials. In: Proc. 1994 Arctic and Marine Oil Spill Program (AMOP). Environment Canada, Vancouver, BC, Canada, pp. 581-592.

Overstreet, R. and J.A. Galt. 1995. Physical processes affecting the movement and spreading of oils in inland waters. NOAA Hazardous Materials Response and Assessment Division, Seattle, WA. Report No. HMRAD 95-7. 46 pp.

ASTM International, 2001. Standard Methods of Testing Sorbent Performance of Absorbents. Standard No. F716-82. Book of Standards Vol 11.04, pp.927 – 931

ASTM International, 2001. Standard Methods of Testing Sorbent Performance of Absorbents. Standard No. F726-81. Book of Standards Vol 11.04, pp.932 - 938

Who to Call for More Information and Additional Resources

USEPA Oil Program Center, Washington, DC Phone: 703-603-9918

USCG Research and Development Center, Groton, CT Phone: 860-441-2733

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Table 21. Characteristics of Sorbents. Developed from Cooper *et al.* (1994).

	Imbiber Beads™	Pristine Sea I	Sorbent Clay/Treated Clay	Natural Organic	Wood Fiber (Cellulose)
General Description	The oil is absorbed into the interior of the hydrophobic particles. The beads swell up to 3 times their original size ***Received sorbent certification letter as stated in NCP300.915(g)(4) Certification***	Oleophilic treated clay. A sorbent material consisting solely of materials listed in section 300.915 (g) (1) of the NCP	Composed of fine particles of aluminum silicates and other materials or any such material that has been treated to be hydro-phobic and/or oleophilic; loose	Composed of naturally derived materials (not including wood fibers) such as peat moss, millet, cotton, etc.; loose	Cellulose-based sorbents such as wood chips, sawdust, cork, and any paper derivatives. Includes cellulose-based sorbents that contain synthetic polymers used for structural integrity; varies
Example		Treated hydor-phobic/Oleophilic clay	Treated Kitty Litter	Puffed Millet Bagasse	Cellulose Fiber Mat
Oil Viscosity Effectiveness Range[1]; (average gm Oil per gm sorbent)	Not tested by Cooper *et al.*, 1994	10 to 15,000 cP; (<10) Relatively consistent in sorbent capability.	10 to 15,000 cP; (< 10) Relatively consistent in sorbent capability	10 to 15,000 cP; (< 10) Relatively consistent in sorbent capability	10 to 50,000 cP; (<20) Relatively consistent in sorbent capability
Anticipated Value	May reduce vapor rates five to six times	Readily available	Readily available		

1 For relative oil/product viscosity scales, refer Table 22.
2 Traditional sorbent materials.

Table 21. Continued.

	Feathers	Treated Natural Organics	Treated Wood Fiber (Cellulose)	Expanded Mineral
General Description	Any sorbent that uses feathers as its oleophilic component, including feathers contained in polysheath;	Composed of naturally derived materials (not including wood fibers) such as peat moss, millet etc., which has been treated to become hydrophobic and/or oleophilic (e.g., Natural Sorb);	Cellulose-based sorbents such as wood chips, sawdust, cork and paper derivatives which have been treated to become hydrophobic and/or oleophilic;	Formed from minerals that expand upon heating to yield low bulk density material such as perlite and vermiculite
Example	Untreated Waterfowl Feathers	Heat Treated Peat Ammoniated Bagasse	Treated Cellulose Treated Coconut fibers	Vermiculite
Oil Viscosity Effectiveness Range[1]; (average gm Oil per gm sorbent)	10 to 50,000 cP; (< 60) Greatest sorbency between 100 to 3,000 cP	10 to 15,000 cP; (~ 10) Relatively consistent in sorbent capability	10 to 50,000 cP; (< 10 for cellulose; < 20 for coconut fibers) Greatest sorbency for coconut fibers between 3,000 to 15,000 cP	10 to 15,000 cP; (< 10) Relatively consistent in sorbent capability
Anticipated Value	Readily available			

1 For relative oil/product viscosity scales, refer to Table 22.
2 Traditional sorbent materials.

Table 21. Continued.

	Foamed Glass	Polyurethane[2]	Polyethylene[2]	Polypropylene[2]
General Description	Formed from amorphous silicate glass foam, consisting of spheroid-shaped particles with numerous cells and characterized by very low bulk densities	Formed for many of the various polymers that contain -NHCOO- linkages. Such polymers are generally foamed	Formed from polymers of ethylene	Formed from polymers of propylene. Generally bonded together by heat or needle punching and usually come in the form of pads or mats
Example	Sodium/Calcium Borosilicate Glass	Polyurethane Foam	Polyethylene Pulp	Polypropylene Mat
Oil Viscosity Effectiveness Range[1]; (average gm Oil per gm sorbent)	10 to 100 cP; (< 10) Product samples unavailable; testing incomplete	10 to 50,000 cP; (10 > 30) Greatest sorbency between 10 to 1,000 cP	10 to 50,000 cP; (10 > 20) Greatest sorbency between 100 to 8,000 cP	10 to 50,000 cP; (10 > 20) Relatively consistent in sorbent capability
Anticipated Value	Hard to find			Readily available; Sorptive capacity typically 10-25 times its weight.

1 For relative oil/product viscosity scales, refer to Table 22.
2 Traditional sorbent materials.

Table 21. Continued.

	Cross-Linked Polymers	**Other Polymers**	**Silicate Sorbents**	**Mixtures**
General Description	Plastic sorbents formed from molecules lightly cross-linked to each other, which imparts imbibing qualities to the material, i.e., alkylstyrenes	Polymer-based sorbents that fall outside the other polymer categories such as rubber, collagen, and polymers of formaldehyde	Formed from silicates, not including clays and treated clays, such as diatomaceous earths and synthetic silicate sorbents. These sorbents are normally finely divided powders	Formed from mixtures of various materials. A single type of sorbent contained within a polysheath does not qualify as a mixture
Example	Alkylstyrene Copolymer	Polyamine Flakes Ground Rubber Flexible Collagen Sponge	Natural Diatomaceous Earth	Wood Fiber, Clay, and SiO2, combined
Oil Viscosity Effectiveness Range[1]; (Average gm Oil per gm sorbent)	10 to 15,000 cP; (<< 10) Relatively ineffective for all oil viscosities tested	10 to 15,000 cP; (10 > 70 for polyamine flakes; << 10 for ground rubber; 20 > 80 collagen) Greatest sorbency between 100 to 8,000 cP for polyamine flakes Greatest sorbency between 10 to 100 cP for collagen	10 to 3,000 cP; (< 10) Relatively consistent in sorbent capability	10 to 15,000 cP; (< 10) Relatively consistent in sorbent capability
Anticipated Value				

1 For relative oil/product viscosity scales, refer to Table 22.
2 Traditional sorbent materials.

Table 22. Viscosity ranges for oils used in testing by Cooper *et al*. (1994) and other familiar substances (Overstreet and Galt, 1995) at room temperature.

Liquid	**Actual Viscosity (cP) of Oil Products (Cooper *et al.*, 1994)**	**Relative Viscosity (cP) of Oil and Other Products (Overstreet & Galt, 1995)**
Water	-	1
Kerosene	-	10
Albert Sweet Mixed Blend (ASMB)	37	-
SAE 10 motor oil	-	100
Saudi Light Crude Oil	250	-
Weathered Saudi Light Crude Oil	700	-
Glycerin or castor oil	-	1,000
Weathered Saudi Light Crude Oil	1,100	-
17% ASMB / 83% Bachaquero Mixture	3,400	-
Corn syrup	-	10,000
Bachaquero Crude	12,200	-
Weathered Bachaquero Crude	24,000	-
Extensively Weathered Bachaquero Crude	40,000	-
Molasses	-	100,000
Peanut butter	-	1,000,000

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SURFACE COLLECTING AGENTS
(This is a Category on the NCP Product Schedule)

Mechanism of Action

- Chemicals that " push" or "compress" oil on the water surface into a smaller area, to form thicker slicks that are more readily recovered.
- They exert a spreading pressure on the water surface greater than the oil slick. They contain special types of surfactants to reduce the surface tension of water, thus increasing the spreading pressure. Also called herding agents.
- Effective agents must have the following characteristics: Remain as a liquid at ambient temperatures of use; High spreading pressure (>35 x 10-7 Newtons/m); Low evaporation rate; Low water and oil solubility; Will not disperse or emulsify.

When to Use

- To push oil out from inaccessible areas (e.g., under piers) to recovery devices.
- To collect oil into a smaller area and thicker slick to increase recovery rates.
- For short-term protection in areas where deploying booms is not possible or could cause more damage (e.g., in very shallow water in front of a wetland).
- Herders are most effective where they have something to push against (e.g., docks or semi-enclosed areas). Their use in the open sea is more limited.

Authority Required

- **Incident-specific RRT approval is required. NOTE**: As of December, 2002, there were no surface collecting agents on the NCP Product Schedule. However, as defined in this document, the Product Rapidgrab 2000 (listed as a Miscellaneous Oil Spill Control Agent) is classified as a surface collecting agent and is addressed in Table 23.

Availability

- See the following table (Table 23) for the current availability of this product.

General Application Requirements

- The product is applied by spray systems (hand-held, vessel-mounted, or from aircraft) in very small quantities (1-15 gallons per linear mile) to the water surface at the perimeter of a slick.
- Do not allow the product to come into contact with operational parts of oil recovery devices because it will cause oil to be repelled from them.

Health and Safety Issues

- Use appropriate level of personal protection for each product (See product comparison tables on the following pages).

Limiting Factors/Environmental Constraints

- Limiting factors include rain, winds greater than about 5 mph, and moderate currents, all which will break the surface film, rendering the product ineffective.
- They are more effective on thin films and low viscosity oils.
- Because of their low application rates and low water solubility, acute toxicity is of most concern in very shallow waters.

Monitoring Requirements/Suggestions

- Visual monitoring to determine whether product use is effective, and when reapplication is needed.

Waste Generation and Disposal Issues

- None. The product does not change the physical condition or volume of the oil. The product is not recovered.

References

Walker, A.H., J. Michel, G. Canevari, J. Kucklick, D. Scholz, C.A. Benson, E. Overton, and B. Shane. 1993. Chemical Oil Spill Treating Agents. Marine Spill Response Corporation, Washington, DC. MSRC Technical Report Series 93-015. 328 p.

Who to Call for More Information and Additional Resources

NOAA-HAZMAT, Seattle, WA 98115 Phone: 206-526-6317.

Table 23. Characteristics of Surface Collecting Agents.

	RapidGrab 2000
General Description	Non-ionic liquid formulation with a specific gravity of 0.84
Is Product Listed for Use in US?	Yes. Listed under Miscellaneous on the NCP.
Availability within 48 h (see Note below)	GlobeMark Resources, Ltd. 937-643-1796
Application Rate (per manufacturer)	Spray neat as droplets on oil sheen
Spreading Pressure	NP
Solubility in water	Soluble in oil and solvents
Use in Fresh Water?	NP
Use in Salt Water?	NP
Toxicity (LC-50, ppm) Note: a low value = high toxicity	
Mummichug 96 h	5.1
Brine shrimp 48 h	2.3
Unit Cost	NP
Photograph of Product (photos are added as they become available)	

NP = Information not provided

Note: As of December, 2002, there were no Surface Collecting Agents on the NCP Product Schedule. For this Selection Guide, RapidGrab 2000 (listed on the NCP Product Schedule as a Miscellaneous Oil Spill Control Agent) is classified as a surface collecting agent due to its mechanism of action. The current availability of this product is not known.

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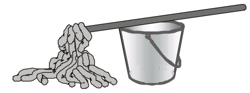


SURFACE WASHING AGENTS

(This is a Category on the NCP Product Schedule)

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

Mechanism of Action

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

"Lift and disperse" products are those for which the product literature states that the oil is dispersed, emulsified, or encapsulated. Thus, the washwater from these products should not be flushed into waterbodies or left untreated, but must be contained, recovered, and properly treated.

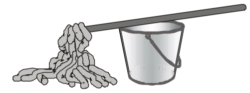
“Lift and float" products are those where the released oil is not dispersed but readily floats on the water surface and is recoverable. Thus, the washwater from these products should not be flushed into waterbodies, but should be contained, recovered, and properly treated.

When to Use

- On hard-surface shorelines where there is a strong desire to remove residual oils.
- When the oil has weathered so that it cannot be removed from a substrate using ambient water temperatures and low pressures.
- When the oil is trapped in areas inaccessible to physical removal but which can be flushed and the washwaters contained, such as in sewers, storm drains, and ravines.
- For volatile fuel spills that have entered sewers, for vapor suppression, and to enhance flushing recovery, as long as all washwaters are recovered and prevented from being discharged into the environment.

Authority Required

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



- **NOTE**: As of december, 2002, there were 21 surface washing agents listed on the NCP Product Schedule. **For this Selection Guide, PES-51 and PX-700 (listed on the NCP Product Schedule as Miscellaneous Oil Spill Control Agents) are classified as surface washing agents due to their mechanism of action**. Only products listed on the NCP Product Schedule are reported in Table 24. Appendix K contains information on Surface Washing Agents that have been removed from the NPC Product Schedule.
- Fire Departments and HAZMAT teams have the authority to “hose down” a spill using a chemical countermeasure if they determine that the spilled oil could cause an explosion and/or threaten human health.

CONTAINMENT AND RECOVERY SHOULD BE THE NORM, NOT THE EXCEPTION

Availability

- Varies widely by product. See Table 24 for specific products.

General Application Requirements

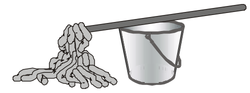
- Products are sprayed either neat or diluted with water. For small applications, hand-held units such as hudson sprayers are used; larger, diluted applications use eduction systems coupled with fire hoses, power washers, etc.
- Application rates vary widely and may be difficult to monitor and control.
- There is some period for soaking or scrubbing, and then the area is flushed with water. Heated water (in both spray and flush) is sometimes required for very sticky oils.
- All released oil must be recovered, so systems are needed to contain and treat the washwater from "lift and disperse" products, which can require considerable operational support.
- Washwaters from using "lift and float" products may be discharged after oil separation, **though** there will be site-specific requirements.

Health and Safety Issues

- All products required Level D personal protection with splash protection.
- Slips, trips, and falls from working on oily surfaces may be of concern.

Limiting Factors/Environmental Constraints

- On shorelines, there are usually restrictions on direct spraying of intertidal biota and flushing across sensitive substrates.
- Only those products which have been documented to be safe to use on vegetation should be applied to vegetated areas.
- Under no conditions should washwaters from land surfaces be allowed to enter waterbodies without proper treatment. Check with wastewater plant operators before washwaters are flushed into sewers to make sure that they can accept the wastes.



- Use lift and float products in open-water settings, to allow oil recovery. Exception would be in high energy environments where the oil cannot be recovered (so it would be better to let it disperse rather than re-oil adjacent areas).

Monitoring Requirements/Suggestions

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

Waste Generation and Disposal Issues

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

References

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

Revion 5 Regional Response Team Surface Washing Agent protocols.

Who to Call for More Information and Additional Resources

USEPA-ORD, Cincinnati, OH 48256 Phone: 513-569-7668

USEPA-ERT, Edison, NJ 08837 Phone: 732-321-6740

NOAA-HAZMAT, Seattle, WA 98115 Phone: 206-526-6317

Environment Canada, Emergencies Sciences Division, Ottawa, Canada Phone: (613) 988-9622

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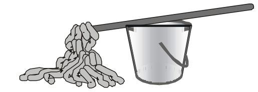

Table 24. Characteristics of Surface Washing Agents Listed on the NCP Product Schedule (as of December, 2002).

	Aquaclean	**Biosolve**	**CN-110**	**Corexit 7664**	**Corexit 9580**
General Description	Alkaline, green, water-based detergent concentrate	Thick, pink, water-based detergent concentrate	Clear amber; slightly viscous liquid	Water-based concentrate containing non-ionic surfactants	Surfactants in a de-aromatized hydrocarbon-based solvent. Yellow.
Availability (amount per location)	As needed on demand; manufacturer at Madison, Indiana	At least 5,000 gal at Westford, MA; 200-1000 gal each in NY, CA, OK, IL, and Alberta, Canada	Varies; manufactured in Broussard, LA; distributed by LK Enterprises in Oceanside, CA	Varies; manufacturer at Sugar Land, TX	varies; Sugar Land, TX; 3-5 days lead time for production of 400 bbl/day
Application Rate	Spray 33%-50% solution to cover contaminated area	1:6 product to oil, applied as a .5%-6% solution	1:10 product to oil, applied as 1 gal (10% solution)/100 ft2	1:25 product to oil, applied as 1-3% solution at 1 gal/10-15 ft2	1:2.5 product to oil, applied at 1 gal (neat)/100 ft2
Application Method	Pressure spray solution on oiled area, then agitate using solid stream of rinse water	Pressure spray solution on oiled area, then agitate using solid stream of rinse water	Spray diluted product on oiled area, let soak, then rinse, preferably with fresh water. Diluted product can be sprayed prior to oil contamination to act as a repellant	Spray solution on oiled area, then rinse. Never spray as a fog or mist; droplets only	Spray neat product on oiled area, soak, then rinse with high-pressure water; for persistent oil, use hot-water rinse
Soak Time	3-5 minutes	None	30-60 minutes	None	0-30 minutes
Temperature Limitations	Water temp. should be above 41°F	Keep from freezing	Water temp. should be above 32°F	None	None
Effectiveness in Environment Canada lab test	Not tested	Not tested	Not tested	Freshwater: 25% Saltwater: 27%	Freshwater: 69% Saltwater: 53%
Use in Fresh Water?	Yes	Yes	Yes	Yes	Yes
Use in Salt Water?	? says to dilute product & rinse with fresh water	Yes	Yes	Yes	Yes
Toxicity (LC-50, ppm) Note: a low value = high toxicity	Mummichug 70.7 (96h); Brine shrimp 11.7 (48h) Did not enhance toxicity of No. 2 fuel oil	Fathead minnow > 750 (96h); Rainbow trout 9 (96h); Algae growth 30 (72h)	Did not enhance toxicity of No. 2 fuel oil	Mummichug >1,000 (96h); Rainbow trout 850 (96h); Zebra fish >10,000 (48h); Brine shrimp >10,000 (48h) Did not enhance toxicity of No. 2 fuel oil	Mummichug >10,000 (48h); Rainbow trout >10,000 (96h); Brine shrimp 2,400 (48h); Oyster larvae 38 (48h) Did enhance toxicity of No. 2 fuel oil for shrimp
Inland silversides 96 h	70.7	6.4	52,200	87	87

	Aquaclean	Biosolve	CN-110	Corexit 7664	Corexit 9580
Mysid shrimp 48 h	32.7	3.6	12,300	584	32
Solubility in water	100%	100%	100% in freshwater	100%	Insoluble
Other Information	100% solution pH = 11.8; 1% pH = 10; Manufacturer recommends use as industrial cleaner, not for use in the environment	Contains no nutrients, enzymes or bacteria cultures; primarily used for vapor suppression	pH = 11.4 Product can be used as a repellant - when applied to surface, will not allow oil to adhere	Can be used to water-wet surface so oil will not adhere to it	Lab and field tests on salt marshes and mangroves showing little effects on plants when exposed to this product
Is Treated Oil Recoverable?	No; the oil is dispersed	"Yes, the oil can be vacuumed or sorbed."	Yes; released oil can be skimmed	No; the oil is dispersed	Yes; at least partially
Application Assistance Information*	Madison Chemical Company, Inc. 812-273-6000	The Westford Chemical Corp. 978-392-0689 508-885-1113 800-225-3909	Chemex, Inc. 318-837-9148	NFSCC ABASCO 281-931-4400	NFSCC ABASCO 281-931-4400
Unit Cost**	Unit cost = $6.00 per gal.	Unit cost = $25.90 per gal.	$14-$16 per gallon	NP	NP
Photograph of Product (photos are added as they become available)					

* For additional technical assistance on product application, contact the supplier listed on the NCP Product Schedule Notebook.

** Unit costs are based on 2002 information supplied by the vendors, where provided. For a more up-to-date cost estimate, contact the supplier listed in the NCP Product Schedule. Generally, product prices decrease as purchase volume increase, and may also vary between distributors. Product application rates often vary greatly depending on use.

NP Not provided

NSFCC National Strike Force Coordination Center

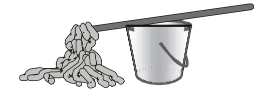

Table 24. Continued.

	CytoSol	Do All #18	F-500	FM-186-2	Gold Crew SW
General Description	Biosolvent containing methyl esters derived from vegetable oils and bioremediation enhancers. No surfactants or emulsifiers. Amber color.	NP	NP	NP	Concentrated water based hydrocarbon-releasing agent. Suppresses VOC vapors while releasing entrapped oils.
Availability (amount per location)	Distributors: Point Richmond and Carson, CA; Seattle, WA	20 to 40 drums in Damon, Texas; 4-5 day lead time for additional product	Distributor in Fayetteville, GA	Distributor in West Sacramento, CA	3,500 gal, San Diego, CA 1,000 gal, Houston, TX
Application Rate	Between 0.5:1 and 1:1 product to oil applied neat	Dilute 1:50 to 1:3 product to water depending on application method	1 part product:8 parts hydrocarbon:32 parts water	Apply neat	Dilute 1:10 or higher depending on type of oil or refined product
Application Method	Spray neat product on contaminated area, let soak, then rinse with water deluge or gentle spray	Spray, mop, agitate, soak, steam or pressure wash product on affected area then rinse	Standard fire apparatus spray nozzle with agitation	Apply through power washer or steam powered unit, for pre-soak use hand pump sprayer	First soak, then pressure or steam wash the area with 1%-5% solution
Soak Time	At least 1 hour; longer in cold weather	Varies	NP	15-60 minutes depending on weather and oil type	15-60 minutes
Temperature Limitations	NP	None	33^{o}-211^{o}F	None	25^{o}F to 120^{o}F
Effectiveness in Environment Canada lab test	Not tested	NP	NP	NP	NP
Use in Fresh Water?	Yes	Yes	Yes	Yes	Yes
Use in Salt Water?	Yes	Yes	Yes	Yes	Yes
Toxicity (LC-50, ppm) Note: a low value = high toxicity	Did not enhance toxicity of No. 2 fuel oil for shrimp; slight increase in toxicity for silversides			Slight increase in toxicity of No. 2 fuel oil for shrimp; Did not enhance toxicity for silversides	
Inland silversides 96 h	738	66	1.2	160.7	13
Mysid shrimp 48 h	124	288	21	329.9	20

	CytoSol	Do All #18	F-500	FM-186-2	Gold Crew SW
Solubility in water	14 ppm in fresh water; 7 ppm in sea water	100% soluble	100% soluble	100% soluble	100% soluble
Other Information	Product tested on spills on mussel beds, gravel beach, and on stream vegetation, with good results Used during *New Carissa,* 1999.	pH: 13.1	Effective on both polar and non-polar hydrocarbons hctgreiner@aol.com	greierson@ecschem.com	pH: 9.76 www.GOLDCREW.net Vapor suppression Boom cleaning Bioaugmentation
Is Treated Oil Recoverable?	Yes; released oil can be skimmed. Remaining oil is biodegraded in 6-12 weeks	No, the oil is dispersed	NP	Yes	Yes
Application Assistance Information*	CytoCulture International, Inc. 510-233-0102	Studin & Associates 305-623-6379	Hazard Control Technologies, Inc. 770-719-5112 hctgreiner@aol.com	Environmental Chemical Solutions, Inc. 916-372-9140	Ara Chem, Inc. 619-286-4131 Gold Crew products and Services 888-414-8384
Unit Cost**	Unit cost = $6-$12 per gal	$13 per gallon	NP	NP	$28-$34 per gallon
Photograph of Product (photos are added as they become available)					

* For additional technical assistance on product application, contact the supplier listed on the NCP Product Schedule Notebook.

** Unit costs are based on 2002 information supplied by the vendors, where provided. For a more up-to-date cost estimate, contact the supplier listed in the NCP Product Schedule. Generally, product prices decrease as purchase volume increase, and may also vary between distributors. Product application rates often vary greatly depending on use.

NP Not provided

NSFCC National Strike Force Coordination Center

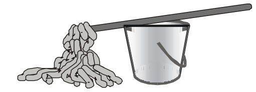

Table 24. Continued.

	Nale It	Nature's Way Power Clean	PES-51	PX-700
General Description	NP	Aqueous blend of surfactants/emulsifiers, and select, aerobic microbes. No VOC's.	Clear liquid containing biosurfactants and d-limonene as a solvent	Liquid with surfactant and citric acid
Availability (amount per location)	Distributor in Elemore City, OK	660 gal immediately; 6,000 gal/day, Houston, TX, national distribution	2,000 gal, San Antonio, TX; 1,000 gal, Seattle, WA; 7 day lead time	+800 gal Cocoa, Fl; 48 hour production lead time
Application Rate	1:20 product:water	1:2.5 product to oil, applied as 1 gal (neat)/100 ft2 or 2-12oz./gallon of water	1:5 product to oil, applied as 1 gal per 150-200 ft2	1:1 (undiluted) for removal of oily sheen; 1:25 product to oil for equipment cleaning; 1:50 for immersing wildlife to remove oil
Application Method	May be applied with a pressure washer	Spray, pressure wash, mop, agitate and rinse; Hot water should not be used with this product.	Spray neat product on oiled area, then rinse with high-pressure, ambient water	Spray neat product on oiled area, then rinse with high-pressure, ambient water
Soak Time	NP	5minutes to overnight	2-5 minutes	N/A; may need to reapply with heavy oils
Temperature Limitations	None	32°F to 120°F	None	None
Effectiveness in Environment Canada lab test	NP	Not tested	Fresh water: 23% Salt water: 21%	Not tested
Use in Fresh Water?	Yes	Yes	Yes	NP
Use in Salt Water?	Yes	Yes	Yes	Yes
Toxicity (LC-50, ppm) **Note: a low value = high toxicity**	Toxicity of No.2 fuel oil is slightly increased for shrimp and silversides	Did not enhance toxicity of No. 2 fuel oil	Mummichug 1,425 (96h); Fathead minnow 810 (96h); Rainbow trout 14 (96h); Brine shrimp 665 (48h); Pacific oyster larvae 19 (48h); Bay mussel larvae 10 (48h) Did not enhance toxicity of No. 2 fuel oil	Toxicity data derived for concentrated (undiluted) product

	Nale It	Nature's Way Power Clean	PES-51	PX-700
Inland silversides 96 h	273.3	152	137	380
Mysid shrimp 48 h	69	193	54	297
Solubility in water	100% soluble	100% soluble	Insoluble	Soluble
Other Information	NP	Other Nature's Way products have microbes, and biocatalysts, but are not listed on the NCP. In TX is listed as a bioremediation enhancement agent	Extensive use in decon of response equipment On NCP Product Schedule as Miscellaneous Spill Control Agent	pH: 3.5 to 4.0 On NCP Product Schedule as Miscellaneous Spill Control Agent
Is Treated Oil Recoverable?	NP	No; the oil is dispersed	Yes; the treated oil readily floats	Yes; the treated oil readily floats
Application Assistance Information*	SPL Control LLC 580-788-2187	Integra Environmental, Ltd. 713-680-1234 877-866-9197 www.integraenvironmental.com	Practical Environmental Solutions, Inc. 210-822-4205 or 410-659-1699	Natural Resource Protection Corp. 888-633-6773 954-565-6148
Unit Cost**	NP	Unit cost = $8-$15 per gal.	$24.50-$28.60 per gal.	Unit cost = $42 per gal.
Photograph of Product (photos are added as they become available)				

* For additional technical assistance on product application, contact the supplier listed on the NCP Product Schedule Notebook.

** Unit costs are based on 2002 information supplied by the vendors, where provided. For a more up-to-date cost estimate, contact the supplier listed in the NCP Product Schedule. Generally, product prices decrease as purchase volume increase, and may also vary between distributors. Product application rates often vary greatly depending on use.

NP Not provided

NSFCC National Strike Force Coordination Center

Table 24. Continued.

	Petro-Clean	Petro-Green ADP-7	Petrotech 25	Premier 99	SC-1000
General Description	Light yellow liquid	Viscous, water-based detergent concentrate, amber colored	Viscous, green, water-based concentrate	Alkaline, red water-based detergent concentrate. Foamy	Highly concentrated liquid
Availability (amount per location)	NP	1,100 gal, Dallas, TX; can produce 550 gal/day	5-10,000 gal, Charlotte, NC; 10 day lead time for production	10,000 gal, Pembroke, FL; 14 days lead time for production	20 drums in Phoenix, AZ; 2 week lead time
Application Rate	Varies; 0.5% to 6% solution	25 gallons of product per 1 ton of oil applied as 2-3% solution at 100 barrels/acre	1:10 product to oil as a 3-10% solution or undiluted	Dilution of concentrate with water ranges from 1:5 product to water to as little as 1:50.	1:1 to 1:350 product to water depending on application method and surface type
Application Method	Spray, power washers, or with eductor	Spray neat or diluted product on contaminated area, then rinse with high-pressure water	Spray 10-40% solution, using either hot or cold water, on contaminated area, then rinse with hot or cold water; or spray neat product, then wipe or scrub before rinse	Spray/mop 5-20% solution on contaminated area, scrub, then rinse well	Spray solution on oiled area, let soak, then rinse with water
Soak Time	NP	None	None	None	1-10 minutes
Temperature Limitations	Above 35°F	None	None	Above 32^{o}F	28^{o}-280^{o}F
Effectiveness in Environment Canada lab test	Not tested	Not tested	Not tested	Not tested	Not tested
Use in Fresh Water?	Yes	Yes	Yes	Yes	Yes
Use in Salt Water?	Yes	Yes	Yes	Yes	Yes
Toxicity (LC-50, ppm) **Note: a low value = high toxicity**	Did not enhance toxicity of No. 2 fuel oil	Slightly enhanced toxicity of No. 2 fuel oil	Mummichug 4,830 (96h); Rainbow trout 1,460 (96h) Brine shrimp 2,480 (48h) Slightly enhanced toxicity of No. 2 fuel oil for mysid shrimp	Did not enhance toxicity of No. 2 fuel oil	
Inland silversides 96 h	100	11.6	601	566	26

	Petro-Clean	Petro-Green ADP-7	Petrotech 25	Premier 99	SC-1000
Mysid shrimp 48 h	110	10.6	350	95	15
Solubility in water	100% soluble	100% soluble	100% soluble	100% soluble	99.9% soluble
Other Information	pH = 8.05 (10% solution) www.alabastercorp.com	pH = 10.5	Approved in France as a dispersant	pH = 12.5 www.goldcoastchem.com	pH: 10.2-10.5
Is Treated Oil Recoverable?	No; the oil is dispersed.	No; the oil is dispersed	No; the oil is dispersed	No; the oil is dispersed	Yes
Application Assistance Information*	Alabaster Corp. 281-487-5482 800-609-2728	Petro-Green, Inc. 972-484-7336	Petrotech America Corp. 617-491-6660	Gold Coast Chemical Products 954-893-0044 954-893-8884 fax	Gemtek Products 602-265-8586 800-331-7022
Unit Cost**	NP	Unit cost = $10.64 per gal.	Unit cost = $7.50 per gal.	Unit cost = $7.95 per gal.	$316.25 per drum (55 gal)
Photograph of Product (photos are added as they become available)					

* For additional technical assistance on product application, contact the supplier listed on the NCP Product Schedule Notebook.

** Unit costs are based on 2002 information supplied by the vendors, where provided. For a more up-to-date cost estimate, contact the supplier listed in the NCP Product Schedule. Generally, product prices decrease as purchase volume increase, and may also vary between distributors. Product application rates often vary greatly depending on use.

NP Not Provided

Table 24. Continued.

	SX-100	Simple Green	Split Decision	Topsall #30
General Description	NP	Green water-based detergent concentrate	Water-based concentrate	Alkaline, pink water-based detergent concentrate
Availability (amount per location)	Distributor in Colorado Springs, CO	Distributor- Sunshine Makers; Huntington Harbor, CA	3 Distributors in Texas	Distributors in FL and LA
Application Rate	Up to 1:200 product to water, contact manufacturer for specific rates	1:4 product to oil; Dilution of concentrate with water ranges from 1:50 to full strength	Dilution of concentrate with water ranges from 1:3 product to water to as little as 1:50.	1:5 product to oil
Application Method	Contact manufacturer for specific application methods	Spray solution on oiled area, let soak for 5-10 minutes, then rinse with water	Spray diluted concentration (with water) on oiled surface or water	Spray/mop .2-20% solution on oiled area, scrub, then rinse well
Soak Time	NP	5-10 minutes	None	3 minutes
Temperature Limitations	32^{o}-130^{o}F	Keep from freezing	Keep from freezing	Air and water temp above freezing
Effectiveness in Environment Canada lab test	NP	Not tested	Not tested	Fresh water: not tested Salt water: 14%
Use in Fresh Water?	Yes	Yes	Yes	Yes
Use in Salt Water?	Yes	Yes	Yes	Yes
Toxicity (LC-50, ppm) **Note: a low value = high toxicity**	Did not enhance toxicity of No.2 fuel oil for shrimp of silversides	Mummichug 1,690 (48h); Brine shrimp 610 (48h); Grass shrimp 270 (48h); Green lipped mussel 220 (48h); Mud snail 410 (48h) Did not enhance toxicity of No. 2 fuel oil		Rainbow trout 354 (96h) Did not enhance toxicity of No. 2 fuel oil
Inland silversides 96 h	32	28	8.3	157
Mysid shrimp 48 h	32	78	8.2	116

	SX-100	Simple Green	Split Decision	Topsall #30
Solubility in water	100% soluble	100% soluble	100% soluble	100% soluble
Other Information	Effective on spills where landfall has occurred or for soil remediation efforts	Extensive use on ships, boats, boom, pilings, survival gear, breathing apparatus, tools, shoreline flora and fauna, etc.	Works best when applied with pressure washing equipment. Can be diluted up to 1 oz per gallon of water. Mild agitation is usually necessary if applied without pressure.	pH = 12.6 Product is not recommended for open-water oil dispersant use.
Is Treated Oil Recoverable?	NP	No; the oil is dispersed	Yes, forms a loose emulsion with oil that separates within seconds; treated oil can be skimmed from the rinse water or absorbed with an oil sorbent	No; the oil is dispersed
Application Assistance Information*	X Products and Services 719-576-8047	Sunshine Makers, Inc. 800-228-0709 562-795-6000	Mantek 972-438-0202	Stutton North Corporation 504-626-3900
Unit Cost**	NP	$8-$12 per gallon	$27.50 - $32.50 per gal.	$13.95 - $16.95 per gal
Photograph of Product (photos are added as they become available)				

* For additional technical assistance on product application, contact the supplier listed on the NCP Product Schedule Notebook.

** Unit costs are based on 2002 information supplied by the vendors, where provided. For a more up-to-date cost estimate, contact the supplier listed in the NCP Product Schedule. Generally, product prices decrease as purchase volume increase, and may also vary between distributors. Product application rates often vary greatly depending on use.

NP Not Provided

PART C: IMPLEMENTATION, MONITORING AND REPORTING REQUIREMENTS FOR SPILL COUNTERMEASURES TECHNOLOGIES

Introduction

This section of the Selection Guide provides the decision-maker with a basic review of developing monitoring plans for evaluating effectiveness of the strategy or product being used for the incident-specific response as well as information about capturing lessons learned when any of the products reviewed in this guide are used or are reviewed for a response.

Purpose

Implementation and Monitoring

The Region III and IV policy requires that spill countermeasures technologies be monitored to determine and document their effectiveness and to obtain data that can be used to consider the environmental effects of their use. In both Region III and IV, the Special Monitoring of Applied Response Technologies (SMART) protocol will be used to monitor optional technologies. "The SMART protocol has been developed to provide general guidance on establishing a monitoring system for rapid collection and reporting of real-time, scientifically-based information, in order to assist the Unified Command with decision-making [when using these countermeasure technologies]":

Dispersants
In situ Burning

ART protocol is located under the tab for Monitoring Plans within Volume II of this Selection Guide.

Continued on Next Page

PART C: IMPLEMENTATION, MONITORING AND REPORTING REQUIREMENTS FOR SPILL COUNTERMEASURES TECHNOLOGIES (CONTINUED)

Purpose (Cont'd)

As this Selection Guide discusses other spill countermeasures technologies and strategies outside of the scope of the existing SMART protocols (dispersants, and *in situ* burning), the following guidelines for implementation and monitoring have been developed to provide OSCs with guidance strategies for:

Sorbents
Elasticity Modifiers
Emulsion Treating Agents
Shoreline Pre-treatment Agents
Solidifiers
Surface Collecting Agents
Surface Washing Agents

Tools Needed

- Worksheet 3
- Testing Procedures
- Monitoring Procedures
- Lessons Learned

Reporting Lessons Learned

Sharing information within and among the regions whenever spill countermeasures technologies are used is of vital interest and benefit to the response community. To assure this information is captured, OSCs/users are requested to complete the information questionnaire displayed at the end of this section (Part C) .

The information obtained in this process will be used to continually refine the data presented in Parts A and B of this Selection Guide. It is the RRT's intention that this information be maintained on a web-accessible site that will allow OSCs and other spill response decision-makers to evaluate the lessons learned by other OSCs using the individual spill countermeasure technologies.

INSTRUCTIONS: Follow the step action table below for part C: Implementation, Monitoring, and Reporting Requirements for Spill Countermeasures Technologies

Step Action Table

STEP	ACTION
1.	Obtain a blank copy of the Testing and Monitoring Worksheet (Worksheet 3) to record information for each product category or strategy. Worksheet 3 is follows these instructions. Another copy is in Appendix H for photocopying. ***Note***: If more than one product category/strategy is being evaluated for an incident, fill out a separate Testing & Monitoring Worksheet for each category/strategy. ***Note:*** The use of this worksheet is required for product use and highly recommended for strategy use.
2.	Identify up to three products in a category or up to three strategies to be reviewed. Record a product name or strategy in each column on Line A. *Use another copy of the worksheet if more than three products or strategies are being evaluated for a product category.*
3.	Complete Line B. Conduct/Record tailgate test to determine whether or not the product is effective on the oil type and at its present conditions and weathering. ***Note:*** A tailgate test may not be applicable for certain strategies such as booming,
4.	After it has been determined that a product or strategy will work on the oil in this situation, record the products or strategies in Line C.

Continued on Next Page

Step Action Table Continued.

5.	Have either Field Effectiveness or Effects testing been conducted to determine if the product or strategy will work under realistic field conditions? Record Yes or No in Line D.
6.	If Field Effectiveness or Effects testing has been conducted, record the test protocols in the applicable areas under Line E. . Record your expected outcomes from a Field Effectiveness or Effects test for the products being tested. You need to determine what is considered effective for your given incident conditions as well as when a product is not considered effective.
7	Record the recommended level of monitoring in Line F.
8.	Review product-specific information recorded and compare and contrast products. Rank the products or strategies in terms of value to the incident-specific response conditions. Identify those products that are not suitable at this time. Record this information in Line G.
9.	Record any additional comments or information that is pertinent to this decision in Line H.
10.	This worksheet is designed to assist in the decision-making as well as implementation process. In Line I, if a product(s) appears to add value to the response or be suitable for the incident, the completed worksheets can be used to demonstrate consensus and can be FAXed to the incident-specific RRT for review and/or approval.

Note: Upon completing Worksheet 3, responders will then decide whether or not to recommend the implementation of a product or strategy to the On Scene Coordinator. This evaluation does not determine the best product or strategy to use for the response. Rather the evaluations and worksheets should help to narrow down these options as well as promote discussion between all decision makers and stakeholders to help determine the most beneficial response action for the incident specific conditions.

WORKSHEET 3: TESTING & MONITORING WORKSHEET

This worksheet is intended to be photocopied for each product category evaluated and used during drills and incidents and Faxed to the Incident Specific RRT for review. Use additional paper if needed to record information.

Name(s):

Date:

Incident:

Products of Interest:		Product 1	Product 2	Product 3
A:	Product Name:			
B:	Has a tailgate test proven that product is effective on oil type at this state of weathering? (Y/N)			
Products to Consider for Additional Testing:		**Product 1**	**Product 2**	**Product 3**
C:	Products still being considered:			
D:	Has a Field Effectiveness test or Effects Test been carried out? (Y/N)			
E:	Describe test protocols:			
	Test site specifics (environment):			
	Natural resources at risk:			
	Volume of oil to be treated:			
	Application rate(s)/volume used:			
	Application equipment:			
	Other logistical considerations:			
	Physical impacts expected:			
	Is the oil recoverable?:			
	Expected outcomes of test:			
F:	Recommended Level of Monitoring for this test (Refer to Part D to Determine)			
G:	Mark as 1st, 2nd, 3rd Choice or Not Applicable for use during this incident			

H: Additional Comments/Recommendations on the use of product(s):

I: Initials/Date of Incident-Specific RRT Review of Information:

Initial Box and Include Date Upon Review

USEPA: ☐	Date:	**STATE:** ☐	Date:____________________
USCG: ☐	Date:	**STATE:** ☐	Date:____________________
NOAA: ☐	Date:	**OTHER:** ☐	Date:____________________
USDOI: ☐	Date:	**OTHER:** ☐	Date:____________________

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OPERATIONAL RESPONSE TECHNIQUES
MONITORING PLANS & STRATEGIES

> **NOTE:** Operational Monitoring concludes at the end of the response and is based on the removal criteria developed by the incident command.

During oil spill response, there is a need to monitor the use, effectiveness, and effects of response techniques to support decisions on whether or not the techniques are appropriate for use. The objective of field testing and monitoring is to validate, for the spill-specific conditions, the findings and claims from laboratory tests and previous field use. The two primary measures of field monitoring are: 1) effectiveness, as indicated by the amount of oil removed, recovered, or degraded, and 2) effects, as indicated by impacts to organisms, habitats, and property during use of the response techniques. Monitoring protocols for dispersants use and *In Situ* burning have already been developed and are provided by the Special Monitoring of Applied Response Technologies (SMART) program that is contained in Monitoring Tab of Volume II of this Selection Guide. Detailed protocols for long-term monitoring of use of bioremediation agents are not covered in this guidance as monitoring protocols have previously been developed by the USEPA/NETAC (1993). The following guidelines for monitoring protocols have been developed to address the following optional response countermeasures and strategies:

- Elasticity Modifiers
- Emulsion Treating Agents
- Shoreline Pre-treatment Agents
- Solidifiers
- Sorbents
- Surface Collecting Agents
- Surface Washing Agents

ELEMENTS OF A GOOD TESTING AND MONITORING PROGRAM

A good operational testing and monitoring program should include the following elements (Mearns, 1995):

Clear Objectives

Define the question(s) to be answered from the testing and monitoring program. They must be able to support decisions on further use of the technique. The conclusion of any monitoring program is at the discretion of the Unified Command members based on the response and the extent of damages.

Meaningful Exposures

Test sites and conditions should use real, operational conditions to the extent practical. It may be difficult to simulate all real conditions in test plots, so evaluators should consider additional impacts from full-scale operations. At a minimum, use samples of the oil in its current weathering stage and application rates and methods as proposed for full-scale use.

Experimental Design

At a minimum, testing should involve replicate observations or sampling at both treated and untreated (control) areas, before and after treatment. Controls should be similar to the treated area in all ways except the treatment. If the testing program includes comparison of different products, then it is even more important to have similar test sites for each product. In some cases, it may be appropriate to use a site (before treatment) as its own control for comparing effectiveness and effects after treatment.

Trained Team for Preparation and Observation

Product testing and monitoring at spills relies heavily on visual observations and an understanding of the products' mechanism of action, chemical components, environmental concerns, and expected or desired results. Thus, it is critical that the team members be skilled in both the design and implementation of field tests and trained in how to observe and monitor. They should be experienced with a broad range of countermeasure technologies. It is usually a complex and difficult task to conduct field tests during an oil spill emergency that offer any real value to decision making. Such tests usually require experienced staff with technical backgrounds in:

- Chemistry
- Biology
- Physical processes
- Environmental engineering

Untrained team members without a background in spill response countermeasure technology will not be able to provide the Unified Command with appropriate test protocols and meaningful evaluations of the products' operational use and results. OSCs are strongly encouraged to use the specialized teams available to them, such as the Trustees, EPA Environmental Response Team (ERT), the USCG Strike Teams, the NOAA Scientific Support Coordinator (SSC), or Superfund Technical Assessment and Response Teams (START), when they consider evaluating, testing, and monitoring specialized response strategies during spill.

TESTING AND MONITORING PROCEDURES

Five levels of testing and monitoring are outlined below. Depending on the questions to be answered, any level can be used at a spill. Testing is not always progressive; some products or types of products have been shown to have little toxicity and thus the primary question is whether the product is effective on a particular oil type or under unique spill conditions. Table 25 at the end of this section is a matrix of the types of questions to be answered by each level of testing and monitoring, for specific product categories.

Testing

Level T-1: "Tail-gate Testing"

The objective is to determine if the product or technology works to some minimum degree with the oil under the current spill conditions. Use existing information, from laboratory tests or previous field applications, to select the most promising product(s). Then conduct on-scene tests to evaluate product effectiveness for the specific oil type, temperature, substrate, etc. Often, the tests are conducted on samples of oil from the spill site and placed in buckets, aquaria, etc. The test platform can be the tail-gate of a truck. The tests can be used to compare product effectiveness, but be aware that such tests are highly qualitative, have low reproducibility, and there are no standard field test protocols to follow. Use common sense in interpreting the results, and repeat the tests if the results are not clear.

An example of the approach for "tail-gate" testing for solidifiers is listed below.

Objective: To ascertain the ability of solidifiers to solidify the spilled oil under current field conditions.

1. For on-water applications, use containers of at least 1 liter volume. Fill half-full with water from the spill site.
2. Collect a large bucket of the oil to be solidified. Add a measured amount of oil to each 1 liter container, enough to cover the water surface in the container (create a surface slick).
3. Measure out the recommended amount of solidifier for the oil volume in the 1 liter containers. While stirring vigorously, add 1/5 of the recommended amount of solidifier, stir for 1 minute, then repeat for a total of 5 additions, or until there is no more visible free oil.
4. Record the total amount of solidifier added at this point.

5. Leave the solidified oil in the water for up to 1 hour before making observations. Leave it longer if necessary, recording the time needed to finish curing.
6. Describe the solidified oil, using the one of each of the following visual descriptors in each column. Also note if free oil remains.

Extent of Solidification	Texture	Tackiness	Other
Solidified	Firm mass	Sticky	Holds together when lifted
Cohesive	Elastic	Non-sticky	Breaks apart when lifted
Non-cohesive	Weak	Crumbly	

Level T-2: Field Effectiveness Testing

The objective is to determine if the product(s) or technology works on the oil under realistic field conditions. Write out a detailed testing protocol that is reviewed and approved by both agency representatives and operations staff. The response operations will usually have to conduct the tests, and they can suggest changes that will make the test more realistic. They also need a list of equipment that they are expected to provide.

Use small areas or test plots in the physical setting and under actual field conditions. Follow the manufacturer's recommendations for application rate and methods. Always have a comparison, which can be other products, other technologies, or no action. Measures of effectiveness can be visual, as long as they are objective and well defined (e.g., change in percent cover of oil on the substrate), or based on sampling and chemical analysis (e.g., change in oil content of samples collected before and after treatment). Be sure to evaluate:

- Application equipment, whether it is effective and produces the specified application rate.
- What logistics are required (and thus potential problems for full-scale operations).
- Physical impacts from use, such as trampling.
- Undesirable changes in treated oil behavior (e.g., a surface washing agent that disperses the oil).
- Recoverability of the treated oil, effectiveness of removal methods.
- The amount and nature of residual treated oil and free product remaining.

Level T-3: Effects Testing

The objective is to determine if the product(s) or technology results in impacts to natural resources that are likely to cause more harm than other techniques, including natural recovery. Write out a detailed testing protocol for agency review and approval. Points to consider include:

- Use resident organisms as identified by applicable agencies that are characteristic of, or important to, the spill location.
- The results should be measurable in a short time, within 1-2 days.
- Include "oil only" and "treatment, no oil" controls where appropriate.
- Physical changes to the treated substrate or habitat may be the most significant impact.
- It is difficult to conduct controlled experiments under emergency field conditions, and the results will be only semi-quantitative at best.

As an example, during the evaluation of the use of surface washing agents at the *Morris J. Berman* spill in Puerto Rico, the biological effects monitoring program consisted of:

- descriptive nearshore survey of the first treatment site, recording general biota condition and behavior before and after treatment;
- transplant studies using sea urchins, snails, and mussels suspended in the water immediately adjacent to three sites: 1) oiled and treated with the product; 2) oiled and untreated; and 3) unoiled and untreated. The animals were recovered after 1 tidal cycle and observed for differences in behavior.
- water sampling to measure concentrations of oil and product.

Monitoring

Level M-1: Operational First-Use Monitoring

The objective is to determine if full-scale operational use of the product or technology is effective and does not have unacceptable impacts. Again, it is necessary to have a detailed monitoring plan for approval by agency representatives. Operations will need to know that monitoring will be conducted, so plans can be made to give monitoring staff site access and notification as needed.

Level M-2: Continued Operational Monitoring

The objective is to routinely monitor the progress of cleanup using the approved technologies and assess the need for modifying cleanup methods. Field monitors should visit cleanup sites to ensure that the approved methods are being properly implemented. Oil weathering, temperature changes, or other physical processes, may render approved methods ineffective, requiring either termination of cleanup or testing of other methods.

Reporting Lessons Learned

Sharing information within and among the regions whenever spill countermeasures technologies are used is of vital interest and benefit to the response community. To assure this information is captured, OSCs/users are requested to complete the information questionnaire displayed at the end of this section (Part C) .

The information obtained in this process will be used to continually refine the data presented in Parts A and B of this Selection Guide. It is the RRT's intention that this information be maintained on a web-accessible site that will allow OSCs and other spill response decision-makers to evaluate the lessons learned by other OSCs using the individual spill countermeasure technologies.

Table 25. The types of questions to be answered by different levels of testing and monitoring for specific types of oil-spill treating agents.

	"TAIL-GATE" TESTING	EFFECTIVENESS FIELD TESTS	EFFECTS FIELD TESTS	OPERATIONAL FIRST USE MONITORING
Sorbents	Does product sorb the oil? Does the oil/sorbent float? What is the actual application rate? Does the oil drip out of the sorbent?	Application equipment effective? What is the field-scale application rate? Are the actual recovery and removal methods efficient?	Does the oil/sorbent float or sink on water? What is the amount and risk of product overspray?	Is the product still effective? Does the oil/sorbent remain floating during typical operational periods? Can the teams contain and recover the oil/sorbent?
Elasticity Modifiers	Does the product make the oil more visco-elastic?	Can the product be applied at the proper dosage under field conditions? Is recovery of the treated oil improved?	Does the treated oil stick more to vegetation/debris?	Can all of the treated oil be recovered so there is little risk of exposure to animals and habitats? Can application rates be controlled?
Emulsion Treating Agents	Does the product break the emulsion? How long does it take?	Does the product break the emulsion under field conditions?	What is the toxicity of the separated water? Can it be released without treatment?	Are there any immediate impacts to fish, shellfish, insects, etc. in the treatment areas?
Solidifiers	Does product solidify spilled oil? What are properties of solidified oil in small containers?	Is the application equipment effective? What are properties of solidified oil in the field? Is recovery and removal efficient?	What are the risks of treated oil residues? What are risks of overspray product?	Observe that product is still effective. Is there excessive substrate disturbance during retrieval?
Surface Collecting Agents	Does the product herd the oil? Does the product quickly dissolve or evaporate?	Does the product herd the oil under field conditions? How often is it necessary to re-apply the product?	Are there any immediate impacts to fish, shellfish, insects, etc. in the test area?	Are there any immediate impacts to fish, shellfish, insects, etc. in the treatment areas?
Surface Washing Agents	Does the product improve the rate of oil removal from samples of the substrate? Is the treated oil dispersed?	Is oil removal from the substrate improved under field conditions? Can the flushing pressure and temperature be reduced? What fraction of the treated oil is recoverable?	Is there a change in the condition of biota before and after product use? Are animals in the adjacent water affected after treatment, either lethally or sub lethally?	What are the oil concentrations in water adjacent to treated areas? Is there any change in biota condition over the course of product use?

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SELECTION GUIDE REVIEW

Please complete form in its entirety and **FAX** to: (301-713-4387). Attach additional pages if more space is required.

Dear Selection Guide User:

We need your assistance in both assessing the overall usefulness of the Guide and to increase the quality of the information contained in the Guide.

Sharing information within and among the regions whenever spill countermeasures technologies are used is of vital interest and benefit to the response community. To assure this information is captured, Selection Guide users are requested to complete the information questionnaire on both sides of this form.

Please take the time to rate and express your view with regard to the following questions. Circle the number that best describes your answer to each question and include your remarks. *Use an additional sheet if more space is needed.*

Scale: 5 = EXCELLENT 4 3 2 1 = POOR

1) Were the components of the Selection Guide understandable and applicable to the spill response/emergency-related aspects of your job?

5 4 3 2 1

a. What subjects or portions of the Selection Guide are of greatest benefit or interest?

b. What subjects or portions of the Selection Guide are of least benefit or interest?

2) How would you rate the overall utility of the information contained in the Selection Guide?

5 4 3 2 1

3) How would you change the Selection Guide to improve its content and/or usefulness?

4) Do you currently make the Selection Guide a regular part of your spill response decision-making? Why/Why Not?

5) Your overall evaluation of the Selection Guide is rated as:

5 4 3 2 1

6) Please list any additional suggestions or comments regarding any aspect of the Selection Guide that are not covered in the above questions:

Thank you for your assistance in this matter. Please send your completed forms to:

Debra Scholz
Scientific and Environmental Associates, Inc., 109 Wappoo Creek Drive, Suite 4B, Charleston, SC 29412
Phone: 843-766-31186 **FAX**: 843-766-3115 **Email**: dscholz@seaconsulting.com

History	**Name of Spill/Vessel/Location:** **Date of Spill (mm/dd/yy):** **Location of Spill:** **Latitude:** **Longitude:** **Oil Product:** **Oil Type (USCG Classification code):** **Barrels:** **Source of Spill:**
Technical Information	**Source of Spill:** **Resources at Risk:** **Applied Technologies/Optional Response Countermeasure(s) Used:** **How This Countermeasure Was Used (*purpose, application quantity, date, method*):** **Shoreline Types Impacted:** **Incident Summary (*specifics*):** **Behavior of Oil Before and/or After Treatment:** **Other Countermeasures and Mitigation:** **Lessons Learned from Optional Response Countermeasure Use:** **Recommendations for future Optional Response Countermeasure Use:** ***Please attach any necessary data and/or reports to this form.***
Contact Information	**Contact Name:**____________________ **Position:** ____________________ **Agency:** ____________________ **Address:**____________________ **Phone:** **FAX:**
Questions?/Submittal	Contact 843-766-3118 for additional assistance/questions. Submit this form via FAX to 843-766-3115, email dscholz@seaconsulting.com or mail it to Debra Scholz, SEA, Inc. 109 Wappoo Creek Drive, Suite 4B, Charleston, SC 29412. Thank you for your assistance in this matter.

APPENDICES

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Appendix A
Glossary

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GLOSSARY

This glossary was partially developed using definitions found in the following:

- Using Oil Spill Dispersants on the Sea, Committee on Effectiveness of Oil Spill Dispersants, National Academy Press, Washington, D.C., 1989.
- Spill Response Glossary, Compiled by: National Oceanic and Atmospheric Administration, Hazardous Materials Response and Assessment Division, Scientific Support Coordination Branch.
- Glossary of Terms Related to Health, Exposure, and Risk Assessment, Air Risk Information Support Center (Air RISK), USEPA, 1989.
- Oil Spill Response: Products and Technology Reference Guide, USEPA, Scientific and Environmental Associates, Research Planning, Inc., Ecosystem Management & Associates, Inc., 1998.

absorb / absorption The take up of a substance *into* another substance.

accelerant An agent used to promote ignition or spreading of a fire, such as gelled gasoline, diesel/gasoline mixes, and fuel-soaked rags.

acute toxicity The inherent potential or capacity of a material (e.g., oil, chemicals) to cause adverse effects in a living organism after only a short period of exposure (generally less than 4 days).

ADDS Airborne Dispersant Delivery System

adjacent lands for the purpose of this document, adjacent lands are described as land that can or does affect surface waters, including marsh, wetlands, manmade structures, storm drains, beaches, creeks, ditches, or ponds.

adsorb / adsorption The take-up of a liquid *at the surface* of a substance. Involves molecular attraction at the surface of the substance.

aerobic Air breathing; aerobic organisms require free oxygen to breathe.

sorbents These are true sorbents that act in the same manner as other sorbents do. They are only referred to as being 'alternative' because they are not made of the materials typically associated with sorbents. (i.e., not made of polypropylene, cotton, etc.).

ambient Surrounding. Ambient conditions are those in the surrounding environment, such as ambient temperature, humidity, etc.

anaerobic Refers to the absence of molecular oxygen. Anaerobic organisms are able to live and grow where there is no air or free oxygen.

API Gravity A scale of specific gravities for petroleum fluids. Based on a simple inverse relationship with specific gravity. API Gravity = (141.5/Specific Gravity)-131.5

aromatic Aromatic hydrocarbons are composed solely of carbon and hydrogen atoms in various arrangements that include at least one benzene ring. Aromatic hydrocarbons are generally considered to include compounds that can be toxic, carcinogenic, or both, and give oil its smell.

ARTES Applied Response Tool Evaluation System

barrel Equal to 42 United States gallons at 60° F.

benthic Pertaining to the bottom of a body of water.

biodegradation The process by which bacteria and other living organisms break down oil. The ultimate end products from biodegradation are carbon dioxide and water.

biological additive Microbiological cultures, enzymes, or nutrient additives that are deliberately introduced into an oil discharge for the specific purpose of encouraging biodegradation to mitigate the effects of the discharge.

bioremediation Acceleration of natural microbial degradation of a material by adding or enhancing one or more of the key rate-controlling factors, such as nutrients, oxygen, temperature, surface area, and moisture.

bioremediation agents means microbiological cultures, enzyme additives, or nutrient additives that are deliberately introduced into an oil discharge and that will significantly increase the rate of biodegradation to mitigate the effects of the discharge.

biosurfactant A naturally occurring surfactant.

booms Floating barriers used for the collection, diversion, deflection, and containment of spreading liquids.

brackish Intermediate in salinity (0.50 to 17.00 parts per thousand) between fresh water and seawater.

burning agents means those additives that, through physical or chemical means, improve the combustibility of the materials to which they are applied.

centipoise (cP) a unit of measurement for dynamic viscosity.

centistoke (cSt) a unit of measurement for kinematic viscosity.

CERCLA The Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986.

chemical agents means those elements, compounds, or mixtures that coagulate, disperse, dissolve, emulsify, foam, neutralize, precipitate, reduce, solubilize, oxidize, concentrate, congeal, entrap, fix, make the pollutant mass more rigid or viscous, or otherwise facilitate the mitigation of deleterious effects or the removal of the pollutant from the water. Chemical agents include biological additives, dispersants, miscellaneous oil spill control agents, and burning agents, but do not include sorbents.

chemical treating agents Products used in treating oil spills, including dispersants, bioremediation agents (nutrient additions), herding agents, emulsion treating agents, solidifiers, elasticity modifiers, surface washing agents, and miscellaneous oil spill control agents.

chronic / chronic toxicity An effect in which the organism of interest is exposed to the contaminant for a significant stage of its life cycle, generally weeks to years.

coastal waters for the purpose of this document is defined as water in the open ocean.

contact angle The angle that the liquid makes when it is at equilibrium with the other phases in contact with it, which is related to the interfacial free energies per unit area of those phases.

countermeasure An action implemented to counter the effects of an oil or hazardous material spill.

CWA Clean Water Act.

deadmen a buried anchor point on the shoreline.

desorb To remove a sorbed substance. Infers an active process, such as high-temperature thermal desorption.

discharge Any emission (other than natural seepage), intentional or unintentional, and includes, but is not limited to, spilling, leaking, pumping, pouring, emitting, emptying, or dumping. Discharge as defined by section 311(a)(2) of the CWA, includes, but is not limited to, any spilling, leaking, pumping, pouring, emitting, emptying, or dumping of oil, but excludes discharges in compliance with an NPDES permit under section 402 of the CWA, discharges resulting from circumstances identified and reviewed and made a part of the public record with respect to a permit issued or modified under section 402 of the CWA, and subject to a condition in such permit, or continuous or anticipated intermittent discharges from a point source, identified in a permit or permit application under section 402 of the CWA, that are caused by events occurring within the scope of relevant operating or treatment systems. For purposes of the NCP, discharge also means substantial threat of discharge.

dispersant Those chemical agents that disperse, emulsify (oil-in-water emulsions), or solubilize oil into the water column or promote the surface spreading of oil slicks to facilitate dispersal of the oil into the water column.

dispersant:oil ratio The amount of dispersant required to treat the oil in question. A 1:20 ratio would mean one gallon of is dispersant needed for each 20 gallons of oil to be treated.

disperse To break oil into small particles that are then mixed into the water column.

dissolution The process of dissolving into water. Petroleum hydrocarbons dissolve slowly due to their low solubility and mineral salts present in the oil.

eduction using a flow of air or water to pick up another liquid in a sort of vacuum (e.g., a way of pumping using the Venturi Principal). Eduction equipment is often used with dispersants; a process that mixes the neat dispersant with water or seawater for application.

effectiveness / efficacy The ability to produce the desired effect.

effluent: washwaters, runoff, outflow.

elasticity modifier A product which imparts elasticity to the oil. Although the viscosity of the oil is increased, it remains a liquid.

emulsion A suspension of oil in water or water in oil. Water-in-oil emulsions may contain 20% - 80% water. Emulsions may be temporary or permanent.

emulsion breaker An emulsion treating agent that breaks an emulsion into separate oil and water phases.

emulsion inhibitor An emulsion treating agent that, if applied to spilled oil before emulsification occurs, prevents emulsion formation.

emulsion treating agent A product that breaks or prevents water-in-oil emulsions by modifying the properties of the oil-water interface to inhibit or destabilize water-in-oil emulsions.

encapsulate To surround an oil droplet with a surfactant which prevents the droplet from re-coalescing. This term is often used by vendors in describing how their products work, meaning the same process as chemical dispersion.

environment As defined by section 101(8) of CERCLA, means the navigable waters, the waters of the contiguous zone, and the ocean waters of which the natural resources are under the exclusive management authority of the United States under the Magnuson Fishery, Conservation and Management Act; and any surface water, ground water, drinking water supply, land surface or subsurface strata, or ambient air within the United States or under the jurisdiction off the United States.

enzyme Natural or man-made proteins which are used to speed up the rate of chemical reactions, such as the chemical breakup of oil into final products of carbon dioxide and water.

ETA Emulsion treating agents

exposure The contact reaction between a chemical or physical agent and a biological system (plant, animal, bacteria, etc.).

fertilizer A substance or agent used to promote the growth of plants, bacteria, and other organisms. Nitrogen and phosphorous are common constituents fertilizers.

fresh / freshwater salinity or salt content less than 0.5 parts per thousand (ppt).

gelling agent A two-component product which, when mixed together, turns into a solid.

habitat The chemical, physical, and biological setting in which a plant or animal lives.

herding agent A product that pushes or compresses an liquid on the surface of the water column by exerting a higher spreading pressure than the liquid.

hydrophilic "water loving": attracted to water, mixes easily with water.

hydrophobic "water hating": separates from water, does not mix well with water. Oil is typically hydrophobic.

imbibe To take in, as moisture into a sponge.

immiscible Describing liquids that will not mix with each other, such as oil and water.

***in situ* burning** The burning of spilled oil in place.

incident Any occurrence or series of occurrences having the same origin, involving one or more vessels, facilities, or any combination thereof, resulting in the discharge or substantial threat of discharge of oil.

indigenous Existing or growing naturally in a region; native.

inland waters For the purposes of this document, inland waters is defined as water in a Bay, Harbor, Inlet, Estuary, Slough, River, or Lake.

inland zone The environment inland of the coastal zone, excluding the Great Lakes and specified ports and harbors on inland rivers. The term inland zone delineates an area of federal responsibility for response action. Precise boundaries are determined by USEPA/USCG agreements and identified in Federal regional contingency plans (RCP).

interfacial tension The tendency of a liquid surface, in contact with an immiscible liquid, to contract. The imbalance of forces at the liquid-liquid interface is due to the difference in molecular forces in the two immiscible liquids.

intertidal The part of the shoreline that lies between the highest and lowest tide levels.

IPIECA International Petroleum Industry Environmental Conservation Association

ITOPF International Tanker Owners Pollution Federation Limited

LC50 or LC_{50} Lethal concentration of a product that causes 50 percent mortality to the test organism over a stated period of time. Length of exposure is usually 24 to 96 hours.

lipophilic "lipid loving": a substance that is attracted to oil, lipids and fats.

marine Of, or on, the sea. Waters with a salinity above 17 parts per thousand and typically connected to the sea.

mechanism of action The fundamental physical and/or chemical processes involved in, or responsible for, the interaction between a chemical treating agent and spilled oil.

metric ton a metric unit of weight =1000 kg (2,204 lbs)

micelle / micellization Micellization is the formation of micelles, which are ordered aggregates of surfactant molecules, with the hydrophobic (water hating) portion of the molecule facing inward, away from the water, and the hydrophilic (water loving) portion facing outward towards the water. For purposes here, these are essentially tiny drops of oil surrounded by dispersant or surfactant and in an aqueous medium.

microbe A single-cell organism such as a bacterium.

miscellaneous oil spill control agent is any product, other than a dispersant, surface washing agent, surface collecting agent, bioremediation agent, burning agent, or sorbent that can be used to enhance oil spill cleanup, removal, treatment, or mitigation.

miscible capable of being mixed at any ratio without separation of the two liquids.

mobile oil Oil on the land or water that is not contained.

National Strike Force Coordination Center (NSFCC), authorized as the National Response Unit by CWA sections 311(a)(23) and (j)(2) and amended by the section 4201 of the Oil Pollution Act of 1990 (OPA), means the entity established by the Secretary of the department in which the USCG is operating at Elizabeth City, North Carolina with responsibilities that include administration of the USCG Strike Teams, maintenance of response equipment inventories and logistic networks, and conducting a national exercise program.

natural resources Includes land, fish, air, wildlife, biota, drinking water supplies, and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States (including the resources of the exclusive economic zone), any State or local government or Indian Tribe, or any foreign government.

NCP National Oil and Hazardous Substances Pollution Contingency Plan 40 CFR Parts 9 and 300.

neat to apply without dilution.

non-persistent Non-persistent oils are those refined oil products that will be completely removed from the affected environment through natural weathering processes.

non-surfactant-based solvents A sub-class of shoreline cleaners that lower the viscosity of the oil and are primarily petroleum distillates similar to kerosene.

OHMSETT a US national oil spill response test facility in Atlantic Highlands, NJ. Currently operated and maintained by MAR, Incorporated under contract to the US Department of Interior, Minerals Management Service (MMS). This facility is a dedicated to testing full-scale oil spill response equipment; conducting research on innovated spill response technology; and conducting training sessions with oil.

oil as defined by section 311(a)(1) of the CWA, means oil of any kind or in any form, including, but not limited to, petroleum, fuel oil, sludge, oil refuse, and oil mixed with wastes other than dredged spoil. Oil, as defined by section 1001 of the OPA means oil of any kind or in any form, including, but not limited to, petroleum, fuel oil, sludge, oil refuse, and oil mixed with wastes other than dredged spoil, but does not include petroleum, including crude oil or any fraction thereof, which is specifically listed or designated as a hazardous substance under subparagraphs (A) through (F) of section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. 9601) and which is subject to the provisions of that Act.

oleophilic “oil loving”: a substance that is attracted to, or mixes well with, oil.

on-scene coordinator (OSC) The Federal OSC is predesignated by EPA or the USCG to coordinate and direct Federal responses under Subpart D, or the official designated by the lead agency to coordinate and direct removal actions under Subpart E, of the NCP. The state OSC is predesignated by state statues.

operational monitoring A real-time evaluation process which provides measurement or observation activity (using trained observers) to ensure the success of a response and, in particular, to direct or redirect the response decision.

Orimulsion a fuel developed in Venezuela from an emulsification technique, which leaves microscopic bitumen particles suspended as an oil-in-water emulsion, has its origin in Venezuela's Orinoco district. Natural bitumen is very challenging to handle due to its extremely high viscosity. Orimulsion, has the viscosity of a light fuel oil and therefore is relatively easy to pump, and can be transported via pipelines and tankers like oil.

ORSANCO Ohio River Valley Water Sanitation Commission

oxidation agent A product which enhances photo-oxidative degradation of a material.

parts per billion Parts per billion (ppb) unit of concentration. One ppb is roughly equivalent to one teaspoon in 1,300,000 gallons.

parts per million Parts per million (ppm) unit of concentration. One ppm is roughly equivalent to one teaspoon in 1,300 gallons.

parts per thousand Parts per thousand (ppt) unit of concentration. One ppt is roughly equivalent to one teaspoon in 1.3 gallons.

penetration For purposes here, penetration refers to the ability of a substance, such as a chemical product, to work through thick oil, or seep into oil coated substrate.

photo-oxidation The process by which the components in oil are chemically transformed through a photo-chemical reaction (in the presence of oxygen) to produce compounds which tend to be both more water soluble and toxic (in the short term) than the parent compounds.

ppb See parts per billion.

ppm See parts per million.

ppt See parts per thousand.

release as defined by section 101(22) of CERCLA, means any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles containing any hazardous substance or pollutant or contaminant). See NCP for list of exclusions.

remove / removal As defined by section 311(a)(8) of the CWA, refers to the removal of oil or hazardous substances from the water and shorelines or the taking of such other actions as may be necessary to minimize or mitigate damage to the public health or welfare or to the environment. As defined by section 101(23) of CERCLA, remove or removal means the cleanup or removal of hazardous substances from the environment; such actions as may be necessary taken in the event of the threat of release of hazardous substances into the environment; such actions as may be necessary to monitor, assess and evaluate the release or threat of release of hazardous substances; the disposal of removed material; or the taking of such other actions as may be necessary to prevent, minimize, or mitigate damage to the public health or welfare or to the environment, which may otherwise result from a release or threat of release. The term includes, in addition, without being limited to, security fencing or other measures to limit access, provision of alternate water supplies, temporary evacuation and housing of threatened individuals not otherwise provided for, action taken under section 104(b) of CERCLA, post-removal site control, where appropriate, and any emergency assistance which may be provided under the Disaster Relief Act of 1974. For the purpose of the NCP, the term also includes enforcement activities related thereto.

response niche Application for which a countermeasure is best suited. The appropriate application is determined by considering: the type and volume of oil spilled; spill location; habitats affected; weather/time of year; and other factors.

risk characterization Final phase of a risk assessment – risks are estimated and interpreted, and the strengths, limitations, assumptions, and major uncertainties are summarized.

saline Containing salt; e.g., saline water.

salinity The concentration of salt in a solution, such as water. Usually measured as Parts per thousand (ppt). Ocean water is typically 35-36 ppt.

sheen A thin layer of floating oil. May appear as silver (0.00007 mm), rainbow (0.00015 mm) or gray (0.001 mm), depending on thickness.

shoreline pre-treatment agent A product which prevents oil from adhering to the shoreline by reducing the oil adherence (a wetting agent) and penetration (a film-forming agent).

sinking agents means those additives applied to oil discharges to sink floating pollutants below the water surface, as described in 40 CFR Part 300.910(e).

slick / oil slick A smooth area on the water due to a thin layer of floating oil.

SMART Special Monitoring of Applied Response Technologies

solidifier A product which mixes with oil to turn it into a rubber-like solid.

soluble / solubility A product is considered “quite soluble” in water if its solubility is greater than 1 ppt. A product is considered “sparingly soluble” in water if its solubility is between 1 ppt and 1 ppm. A product is considered “very sparingly soluble” in water if its solubility is between 1 ppm and 1 ppb. A product is considered “essentially insoluble” in water if its solubility is 1 ppb or less.

solvent Any substance into which another substance will dissolve (e.g., sugar will dissolve in water, which is a common solvent). For purposes here, a solvent is generally any chemical agent that will dissolve oil.

sorbent Any oleophilic material which is used to take up oil through absorption or adsorption. Essentially made from inert and insoluble materials that are used to remove oil and hazardous substances from water through adsorption, in which the oil or hazardous substance is attracted to the sorbent surface and then adheres to it; or by absorption, in which the oil or hazardous substance penetrates the pores of the sorbent material; or a combination of the two.

specific gravity The ratio of the mass of a liquid compared to the mass of an equal volume of pure water, at the same temperature.

spreading pressure The force exerted against a fixed barrier as a liquid is compressed into a smaller surface area.

substrate The substance or base on which, or the medium in which, an organism lives and grows, or the surface to which a fixed organism is attached; e.g., soil or rocks.

subtidal The part of the coastal zone that lies below the lowest low tide level, so that it is always underwater.

surface collecting agent Those chemical agents that form a surface film to control the layer thickness of oil.

surface tension The tendency of a liquid surface, in contact with air, to contract. This is because of the imbalance of forces on the molecules in the bulk liquid as opposed to those at the liquid surface in contact with air.

surface washing agent any product that removes oil from solid natural and man-made surfaces, such as beaches, rocks, concrete, and asphalt, through a detergency mechanism and does not involve dispersing or solubilizing the oil into the water column. This product is normally applied as a soaking treatment during low tide so that it has time to work prior to flushing as the tide rises.

surface collecting agent means those chemical agents that form a surface film to control the layer thickness of oil.

surfactant Also referred to as surface-active agents, this is a chemical compound that contains both an oil-soluble and water-soluble ends on the molecule. Both naturally occurring and chemically manufactured varieties exist.

toxic Poisonous.

toxicity The inherent potential or capacity of a material (e.g., oil, chemicals) to cause adverse effects in a living organism.

vapor suppression For oil spills; the light weight components of oil evaporate and if confined in an enclosed space could cause an explosion. Certain chemical products can reduce the evaporation (suppress the vapors) of light-weight components (e.g., fire fighting foams).

varsol commercial degreaser, cleaner product.

viscosity Flow resistance; viscosity may be reported in one of two ways for oil spill related issues. **dynamic viscosity (μ)** referring to internal friction of a substance (e.g., oil) that is a function of the oil type and temperature and is measured in Centipoise units (cP). The lower the viscosity, the thinner the fluid (e.g., water = 1 cP, molasses = 100,000 cP). **Kinematic viscosity (ν)** the fluids dynamic viscosity divided by its density which is measured in stoke (St) units and is often reported as centistoke (cSt). Since the density of oil is not too different from that of water, rough calculations of oil viscosity are not very sensitive, numerically, to interchanging values between dynamic and kinematic viscosities.

volatility The tendency for the components in a liquid to vaporize.

weathering Alteration of the physical and chemical properties of a material through natural processes, including evaporation, dissolution, photo-oxidation, emulsification, and biodegradation.

wetting agent A shoreline pre-treatment agent that causes the oil not to adhere to the shoreline.

window of opportunity An interval of time during which conditions are favorable and an opportunity exists for the countermeasure to be implemented effectively.

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Appendix B

Request Form Template to the RRT for Product Use

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DATE: _____________________

TO: Region __________ Regional Response Team Members
FROM: Federal On-Scene Coordinator, ___________________________
SUBJECT: Request for Use of ____________________________________ Product(s) on the NCP Product Schedule

The purpose of this letter is to solicit approval from the Region ___ Regional Response Team (RRT) for the use of _____________________ product or technology in treating the oil from the _________________________ spill in _______________________. The proposed use of this product or technology is outlined below, including conditions of use:

1. Description of the cleanup problem to be addressed by use of the product:

2. Outline why the product(s) or technology was selected:

3. Summary of any toxicological or environmental data on the product, to assist in evaluation of its toxicity:

4. Description of the general areas where the product will be used: *[also describe areas where use of the product will be prohibited (attach lists and/or maps with more details on specific areas proposed for product use)]*:

5. Estimate of the amount of product to be used, either in each area or in total:

6. Description of actions to be taken to minimize environmental impact:

7. Description of any testing or monitoring programs that will be implemented during product evaluation and use:

8. Is it believed that the use of this product in the environments selected will provide a net environmental benefit over other cleanup strategies?
   Yes. No.

9. Other pertinent information:

Signed:

________________________________	USCG	________________________________	USEPA
________________________________	(state)	________________________________	DOI
________________________________	NOAA	________________________________	(other)

Official	Agency/Dept.	Official	Agency/Dept.
Official	Agency/Dept.	Official	Agency/Dept.

Appendix C

Example of Certification Letter from USEPA for an
Applied Sorbent Product's Exclusion from the NCP Product Schedule

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Example of Certification Letter from USEPA for an Applied Sorbent Product's Exclusion from the NCP Product Schedule. *(DRAFT)*

NOTE: Any certification letter provided by the vendor for any product, must be on official USEPA Oil Program Center Letterhead and have a valid signature of the NCP Product Schedule Coordinator. If there is any question on any document, contact the Oil Program Center.

Dear ____________:

We have received and reviewed the information you submitted on your company's sorbent ______(product name)________. Our review indicates that this product meets the definition of a "sorbent" as specified in Title 40 of the Code of Federal Regulations (CFR), sections 300.5 and 300.915(g) of the National Contingency Plan (NCP). Based on this review, ___(product name)_________ is not required to be listed on the NCP Product Schedule.

So that you may be prepared to provide On-Scene Coordinators with a certification as referenced in section 300.915(g)(4) of the NCP, the following statement should be reproduced, dated, and signed on your corporate letterhead:

> [SORBENT NAME] is a sorbent material and consists solely of the materials listed in section 300.915(g)(1) of the NCP.

Enclosed for your review is a copy of section 300.915(g) from the NCP. Should you have questions, please contact me at (703) 603-9918.

Sincerely,

William Nichols
EPA Oil Program Center (5203G)

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Appendix D
History and Status of Applied Technologies

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History and Status of Non-Floating Oil Tracking and Recovery

Most of the world's oil spill response strategies are based on the principal that oil primarily floats in water (fresh or saline). However, the utilization/transportation of heavier fuel oils (Group V fuels) and other non-floating oils (e.g., burn residue and heavy oils that have incorporated sediments) have forced responders to rethink their basic strategies for dealing with spilled oil that travels in the water column or moves/settles along the bottom. Beginning with the *Torrey Canyon* spill in March of 1967 off of England, on through the early 1980's, incidents where oil sank, due to its density or other factors, responders could only wait until the unaccounted for oil mysteriously appeared, was tracked by divers after the spill, or was presumed lost to the environment.

In December 1976, the Tanker SS *Sansinena* exploded while berthed at Pier 46 in Los Angeles, CA while loading a bunker fuel oil with an API gravity between 7.9º to 8.8º and a viscosity of approximately 180 at 60 ºF (refer to Table 22 for relative viscosity comparison). Nearly 1.4 million gallons of bunker fuel oil was released and recovered over a sixteen-month period. The majority of the oil sank (reported by diver surveys) and collected in depressions as pooled oil up to three meters deep. Initial recovery operations used vacuum trucks and separation tanks mounted on a barge. This method was abandoned because the divers were having difficulty moving the suction along the bottom. Next, diver-guided hydraulic pumps were used; however, the divers were immediately covered in oil after reaching the bottom, so they had to direct the pumps by "feel." This method was terminated after the thick, pooled oil close to the pier was removed. The next step involved the designing of special pumping units that were mounted on a barge that could move to collect the oil from various depressions that were out of reach of the diver-guided hydraulic pumps. This method was determined to only be marginally successful once the large pockets of pooled oil had been recovered. In total, nearly 675,000 gallons of the sunken oil had been recovered to this point. However, finally a suction head and pump device was designed on-site to address recovery of the remaining oil. This pump had to be operated using directions from a diver because some of the oil pools had become silted over, making the oil difficult to locate.

In March 1984, the tanker *Mobiloil* spilled 168,000 gallons of a heavy No. 6 fuel oil (API gravity of 5.5º and a pour point of 30ºF) into the Columbia River. Due to the density of the river water (freshwater), the majority of the oil was incorporated into the water column and along the riverbed, being transported by the river currents, often within one meter of the river bottom. The mid-water oil rose to the surface once the salinity of the water increased near the river mouth. However, in the lower sections of the river (near the salt wedge), the bottom oil slowed as it became caught up in the salt wedge circulation pattern (Scholz *et al.*, 1994). This was the first spill when oil tracking techniques were focused on non-floating oil. During this incident, the location and subsequent transport of the missing oil was attempted by lowering weighted sorbents (sorbent pads wrapped around anchors) to the river bottom (NOAA, 1992).

In January 1988, the tank Barge *MCN-5* capsized and eventually sank in 120 feet of water in Puget Sound, WA near the Rosario Straits. The *MCN-5* carried heavy cycle gas oil with a specific gravity of 1.086 and a pour point of 40ºF. During the incident, 91,500 gallons of the heavy cycle oil was released and sank. Due to heavy currents and tidal changes in the area, initial response efforts focused on the sunken barge and its remaining cargo. NOAA staff conducted experiments to observe the oil behavior in the water column and predict its fate (Scholz *et al*., 1994). Using disposable diapers attached to a cannonball weight, responders were able to detect the presence of the heavy oil on the bottom (NOAA, 1992).

In September, 1988, the ESSO *Puerto Rico* released 23,000 barrels of carbon black feedstock (API gravity of 2.0º to –1.5º) while traveling along the Mississippi River toward the Gulf of Mexico. The carbon black feedstock rapidly emptied out of the cargo tank and into the river. The oil appeared to be churned into tiny globules and droplets by the action of the vessel's propwash. The oil quickly dissipated with the river currents. Hand leadlines wrapped with a cotton rag were lowered onto the river bottom in an attempt to locate the oil. Additionally, absorbent pads attached to the underside of clump weights on the end of a winch wire determined that there were no major oil pockets along the river. Except for small traces of material found in deep locations along the riverbed, the intensive investigations found no recoverable quantities of the spilled product except for one 10 barrel pool of oil directly below the vessel at anchorage (NOAA, 1992).

In June 1989, the M/V *Presidente Riviera* ran aground on the Delaware River near Claymont, DE south of Marcus Hook, PA. Approximately 7,300 barrels of a No. 6 fuel oil (API gravity between 7º to 14º) was released. The heavy oil congealed into pancake-like, tar globs that floated with the river currents. The thick, sticky nature of the product made it very hard to physically remove from both the water and the shorelines. Vacuum trucks and conventional skimmers were ineffective because of the oil's viscosity. Supersucker trucks were only able to pick up small chunks of oil, but were a slow process and cleanup/ maintenance of the equipment was difficult. One of the most effective methods of oil recovery was through the use of a fishing vessel with a stern trawl net. The net became so fouled that it could not be used again, but it recovered 8 tons of oil and oiled debris along the river (NOAA, 1992).

In August 1993, three vessels collided at the entrance to Tampa Bay, FL, releasing an estimated 325,000 gallons of No. 6 fuel oil. The API gravity of the oil was between 10º and 11º. The oil weathered on the water surface for nearly 5 days before it came ashore during a storm. Surface oil and shoreline oiling were successfully removed; however, thick mats of submerged oil were found in the nearshore subtidal habitats. In several areas, the submerged oil was removed using vacuum transfer units mounted on barges and grounded on the flat at low tide. Diver/aerial surveys found numerous mobile tarballs and pancakes ranging in density as well as a three mats of submerged oil ranging in size from 150-200 feet long, 10-20 feet wide, and two inches thick. These mats had picked up sediments in the water column or after being stranded onshore. The submerged oil remained on the bottom and had the consistency similar to peanut butter. Attempts to remove the submerged oil included various vacuum-pumping strategies, which failed due to the viscous nature of the oil. After careful study and evaluation, it was determined that manual removal by divers was the most feasible option for certain areas. However, the offshore mats were not removed, and oil continued to wash ashore for at least six months following the spill (NOAA, 1993; Scholz *et al*, 1994).

In January 1994, the *Morris J Berman* barge grounded off San Juan, Puerto Rico, releasing 750,000 gallons of a group V fuel oil (API gravity of 9.5º). Although much of the oil floated, extensive quantities of submerged oil were found in both offshore areas and in sheltered bays because the affected areas had clear, shallow waters. The submerged oil did not emulsify and remained fluid enough to flow with a consistency described as similar to maple syrup. Over time the oil became more viscous and mixed with sediments in some areas. This oil also tended to refloat every afternoon, when the winds picked up and "re-melted" the oil. This submerged oil complicated the cleanup response. Three different methods were used to recover the submerged oil: diver-directed vacuuming of the more liquid oil; manual pickup by divers for the more viscous patches; and dredging. The diver-directed strategy was effective, but slow. Due to the need to open the re-open the beaches, dredging was finally used to recover the remaining submerged oil (Scholz et al, 1994; Petrae, 1995).

In October 1998, the Fleming Environmental Co successfully used sonar for the underwater detection of spilled Orimulsion (a heavy bitumen fuel source that is mined from the Orinoco district of Venezuela). The bitumen is emulsified as an oil-in-water emulsion that has the viscosity of a light fuel oil and is easy to pump, can be transported via pipelines and tankers like liquid oils. The accidental release of Orimulsion in salt water results in the Orimulsion going into suspension in the upper 2-3 meters below the sea surface offering a significant challenge in terms of spill detection. Being able to use sonar to detect this Orimulsion suspension provides a significant response strategy. In the spring of 1999, a small-scale tank test of a spilled Orimulsion was conducted. The results of this test were very encouraging. The Orimulsion cloud in the tank could be detected up to 17 meters away; due to the confinement of the tank, the sonar could only be used as 6% of its full power due to disturbing tank side- and bottom-reflections. It was therefore concluded that sonar in open water will be operational at the 100 to 200 m range, making Orimulsion tracking much easier.

History and Status of Bioremediation Use

Bioremediation is the addition of adding fertilizers or other materials to contaminated environments, to accelerate the natural biodegradation process. On land, the practice of bioremediation has been used extensively and successfully for many years to treat wastes and wastewater in controlled facilities. The use of bioremediation to treat hazardous waste on land (in-situ treatment or land farming), including petroleum products, has only been the focus of research and study over the last two decades. In the coastal zone, bioremediation of spilled oil has primarily been considered a spill response tool over the last 10 years ever since the demonstration in the 1989 *Exxon Valdez* spill in Alaska. Today there are numerous application methods and products available for use in the US. Numerous laboratory, field, and spills of opportunity tests have be conducted using bioremediation agents in the form of nutrient addition, microbe additions, and using a combination of nutrients and microbes.

In June 1990, the M/V *Mega Borg* released large quantities of Angolan crude into the Gulf of Mexico following an explosion. An open-water application of a microbial product on a portion of the slick was conducted by the Texas Water Commission. The product was applied twice, six and nine days following the initial release. Results were inconclusive on the affect of bioremediation agents on surface slicks on the open water.

In August 1990, a collision between three APEX barges and the tanker *Shinoussa* spilled nearly 700,000 gallons of partially refined oil into Galveston Bay. A trial application of a microbial product to impacted marsh habitat was conducted where mechanical recovery was not feasible. No statistically significant differences in degradation rates were found in samples of the treated and the untreated sites. It was theorized that as the test area is subject to chronic oil pollution, the introduction of microbes would not be beneficial over the short time period for this study and would not be measurable relative to indigenous populations.

In November, 1990, a well blowout offshore of Seal Beach, CA, released 400 gallons of crude oil into the atmosphere, oiling 2-3 acres of marshes in the Sea Beach National Wildlife Refuge. The oiled marshes were treated with a microbial product plus fertilizer one week after oiling, followed by an application of additional fertilizer two weeks later. Measures of degradation showed no differences between oiled and treated grasses and oiled grasses with no treatment.

In 1994, the USEPA funded and conducted a full-scale field experiment on a sandy beach in Delaware using nutrient addition to treat weathered Prudhoe Bay crude oil. Product application was determined to be effective (although not significantly). In January 1990, a pipeline break in Linden, New Jersey resulted in the use of a slow-release fertilizer (nutrient addition) to a gravel beach as a final cleanup measure. This study demonstrated that biodegradation was occurring, but that differences were not significantly different due to the high variability in the background levels of petroleum hydrocarbons in the environment.

Even with the inconclusive results of many previous tests, the long history of bioremediation on land continues to drive the use of bioremediation for oil contaminated sediments as a polishing tool or where other recovery options are not feasible. Testing methodology continues to develop. Researchers continue to develop tests that more accurately determine the extent of biodegradation as well as refine products.

History and Status of Dispersant Use

Since 1967, when solvent-based degreasing agents were used in an attempt to clean up the *Torrey Canyon* oil spill, the use of chemicals, especially dispersants, to control marine oil spills, has elicited debate among government, industry and other interest groups. Dispersant composition has evolved significantly since then. Today, dispersants are composed of chemicals that are much less toxic than the *Torrey Canyon* degreasers and generally less toxic than the spilled oil itself. Consequently, the potential for adverse impacts on biota has been significantly reduced, while the potential for net environmental benefit has been substantially increased.

A great deal of our dispersant information comes from numerous laboratory research, field testing, and actual application, but only a handful of studies from actual spills or field tests can be found in the literature documenting the effects of dispersed oil. Boyd *et al.* (in press) summarized the field test results from several studies that evaluated the toxic effects of the spilled oil relative to the chemically/naturally dispersed oils, including:

The Searsport study of 1981

Baffin Island Oil Spill Project (BIOS) of 1981

The TROPICS study of 1984 and again in 1994

The *North Cape* oil spill in 1996

Sea Empress oil spill of 1996

In general, the majority of these test/trials reported adequate mixing and dilution of the dispersed oil in the water column with fewer toxic effects than if the oil had been cleaned up using conventional response options. The one exception was the *North Cape* oil spill when heavy seas naturally dispersed more than 80 percent of a number 2 fuel oil into the water column. High mortalities of benthic organisms and birds were recorded.

In another case of natural dispersion the entire cargo of Gullfaks crude oil spilled from the Braer in 1993 and was quickly dispersed into the water column in very heavy seas. Very few impacts on the marine environment were noted. (Kingston 1999)

History and Status of Elasticity Modifiers Use

Elasticity modifiers have been tested and used extensively since the 1980's. Two forms of elasticity modifiers, Elastol slurry and Elastol liquid, have been extensively tested by Environment Canada (Bobra *et al.,* 1987; Bobra *et al*., 1988; Seakem Oceanography, Ltd., 1990) and recently used during several oil spills in the US (Michel *et al.,* 1993; DESA, Inc. and ERR, Inc., 1993). In field tests, Elastol was applied to ten test slicks of Alberta Sweet Crude and a mixture of the crude oil and Bunker A oil (Bunker C cut with 20 percent diesel fuel) off the coast of Nova Scotia. Based on observations taken at various time intervals after application of the agent as well as laboratory measurements of the treated slicks, the researchers concluded that Elastol increased the viscoelasticity of the oil to a greater extent than found in previous laboratory tests (Seakem Oceanography, Ltd., 1990).

During a 1993 spill of diesel oil into Sugarland Run in Virginia, Elastol was used to increase the recovery rates of drum skimmers without additional water. It also appeared to reduce emulsification of the oil (DESA, Inc. and ERR, Inc., 1993).

Elastol slurry was also tested on a spill of Kuwaiti crude oil in Port Neches, Texas in 1993 (Michel *et al.,* 1993). The agent was applied to small pockets of floating oil in shallow areas adjacent to marshes where workers could not reach the oil, even with small boats. It was hoped that once Elastol was applied, it would modify the viscosity of the oil enough that the treated oil could be pulled out with rakes. Three hours after application, the treated oil, which had drifted away from the shoreline, appeared thicker, more viscous and stickier compared to untreated oil; however it was not possible to physically "pull" the treated oil as a coherent mass or sheet. It was found that Elastol had been over applied, at about 75 times the recommended rate; it is not known what effect over-application had on the changes in oil property, such as the formation of a sticky gel-like material. The treated oil was recovered with a small, double drum skimmer specially designed for use with Elastol-treated oil (Michel *et al*., 1993).

Elastol was used to recover a chronic oil discharge from an underground source in the Port of New York (Levine, 1993). The treated oil was rapidly recovered with skimmers, whereas the untreated oil was spread too thin to skim, requiring recovery with sorbent material. The treated oil was reprocessed, in comparison with sorbent use that generated a large amount of waste. Elastol is not currently listed on the NCP Product Schedule.

History and Status of Emulsion Treating Agents Use

Emulsion inhibitors have been used for many years to prevent the formation of an emulsion when crude oil is produced from the well, especially for crude oils that have a relatively high paraffin content and are known to quickly form water-in-oil emulsions. To prevent emulsification during production and pipeline transportation, demulsifiers are added to the oil at the wellhead, at concentrations of about 20 ppm (Walker *et al*., 1993). Manufacture of emulsion treating agents for use in petroleum production and transportation is a mature industry with many established companies in the market.

A more recent proposed use of emulsion inhibitors is aerial application to slicks on the water to prevent emulsion formation, thus extending the window of opportunity for dispersant use (Buist and Ross, 1987), and possibly in-situ burning. During field trials in the North Sea in 1992, on slicks treated with an emulsion treating agent (at a rate between 1:100 and 1:200, agent to oil) from spray aircraft, emulsion formation slowed or reversed and the oil dispersed faster than control slicks (Lunel and Lewis, 1993).

Oil spill applications of emulsion breakers include breaking water-in-oil emulsions during the final stages of treatment or recovery, after free water has separated, using both heat and chemicals. However, there has been little documentation of the actual use of emulsion breakers during oil spills, except for the *Amoco Cadiz* spill where they were used on shore in pumping chains and storage tanks. They were found to be successful in breaking the emulsions, thereby allowing for more effective storage and transport of the recovered oil. However, emulsion breakers were only used in several limited locations during this spill (Bocard *et al*., 1979). Application rates of emulsion breakers are very low, in the range of 0.01 percent.

The latest proposed use of emulsion breakers is injection of the agent into the emulsion early in the recovery process while at sea, such as in the containment boom, skimmer pump, skimmer reservoir, settling tank, or storage barge. Injection at the skimmer pump head could improve pumping as well as increase mixing and subsequent separation of the water. The objective is to decrease the on-scene storage requirements for recovered oil. There are commercially available skimmers with injection systems capable of using emulsion treating agents. Breaking of emulsions and decanting of the released water in skimmers could be extremely important during large spills, since storage of recovered product can be a limiting factor in the rate of oil recovery. A high-volume skimmer (e.g., GT-185 or DESMI) can exceed its on-board storage capacity for recovered product within the first few hours of operations. Operationally, the critical issue is the time needed to break the emulsion in the skimmer, which should be accomplished within minutes, rather than hours. Environmentally, the critical issue is whether regulatory agencies would allow the discharge of the released water back into the sea without treatment. Specific permits may be required if the water contains regulated chemicals.

History and Status of Fire-Fighting Foams Use

The use of fire fighting foams has become increasingly widespread, as they have evolved since their development in the 1960's. Foams are most commonly used by city/county fire departments, wildfire responders, airport fire teams, and the military. Their ability to control fire better than water by the combined mechanisms of cooling, separating the flame source from the product surface, suppressing vapors, and smothering is what has made them so popular. Their use originated with the military, being used on liquid fires resulting from aviation vehicles and water vessel engine rooms.

The original formula for these fire-fighting foams contained the chemical perfluoro-octanyl sulfonate (PFOS), which later was found to be harmful to the environment. Today the U.S. Military is still one of the largest consumers of fire fighting foams and has specifically taken notice to the environmental impacts foams have on the environment. 3M, previously one of the largest producers of fire fighting foams with PFOS, has decided to discontinue production. Also, the EPA will prevent any company form marketing products containing PFOS in the Unites States under the proposed Significant New Use Rule (SNUR) and is currently assessing the foams being manufactured by other companies. With approximately a dozen fire fighting foam manufacturing companies and over a dozen types of foam today, PFOS foams will continue to exist. However, as the concern increases, companies are developing new formulas that will better suit the environment. Although, fire fighting foams should always be recovered and disposed of properly, this is not always the case. Therefore, the biodegradation of foams is an aspect that is considered in the new development. Not only is complete biodegradation essential but also quick biodegradation is important as well. This prevents the spreading of runoff and prevents oxygen consumption as a result of the biodegradation process.

History and Status of *In Situ* Burning on Land

In situ burning (ISB) of oil spilled on land occurs quite regularly in inland areas of the country, particularly in remote areas along oil transport pipelines. ISB on land is considered a viable option because it can effectively prevent spilled oil from further impacting local resources and help reduce the impacts to groundwater and riverine systems. Long-term studies of actual ISB uses on land are not often reported in the public literature; therefore many of the lessons learned are lost.

In March 1995, a pipeline break occurred spilling gas-condensate across a brackish marsh at the Rockefeller Wildlife Refuge on the Louisiana coast (Pahl *et al,* 1999). The decision was made to conduct an ISB on the product spill and a 3-year investigation was started. The authors compared the extent of vegetative cover, stem density, and biomass for three growing seasons between a control (no ISB) and the treated area. After 3 growing seasons, little difference could be determined between the control and test area. The authors concluded that the results of this test support the conclusion that ISB can be relied upon as an effective cleanup response to hydrocarbon spills in wetlands (Pahl *et al.,* 1999).

Zengel *et al.* (1999) studied the effects of ISB on inland and upland habitats as an alternative to more injurious techniques commonly practiced to date. Thirty-one case histories were studied and summarized for evaluation. The ISB case histories examined show that ISB is environmentally feasible and acceptable, and is clearly suited for use in certain environmental settings/habitats.

History and Status of *In Situ* Burning on Water

(*The majority of this information is taken from USCG, 1999*)

Following the *Torrey Canyon* spill, the spill response community devoted considerable effort for the development and evaluation of safe and effective *in situ* burn (ISB) technology. This research resulted in various products to support open-water burning of oil, including fire-resistant booms and ignition devices which are still part of the spill responders' took kit when considering in situ burning on water (USCG, 1999).

Since 1967, ISB has been employed as a response option for various oil spills with varying degrees of success. ISB was considered an alternate spill countermeasure in the 1980s, especially in Arctic regions where isolation, extreme conditions and the presence of ice would hinder the use of conventional technologies. In nearshore and offshore areas of the US lower 48, ISB was not considered as an alternative technology until 1989 when fire-resistant booms were used during the initial stages of the *Exxon Valdez* to effectively burn nearly 15,000 gallons of the spilled oil in Prince William Sound, AK (Allen, 1991).

Following the *Exxon Valdez* spill, research efforts were revitalized to "improve the fire-resistant boom designs, refine operational procedures, and resolve issues associated with air contamination from burning." These research efforts culminated in an international, multi-agency test burn in 1993 offshore of St. Johns, Newfoundland known as the Newfoundland Offshore Burn Experiment or NOBE" (USCG, 1999). NOBE provided the proof that ISB operations could be safely conducted and provide an effective means for removing oil from the water surface.

This progression in ISB technology and use has resulted in a general trend by US decision-makers for a growing acceptance of this option as a standard countermeasure for larger, offshore spills and certain inland, on-water spills in isolated locations.

History and Status of Shoreline Pre-treatment Agent Use

The idea of a product that could coat the shore and protect it from oiling prior to landfall was the focus of an API series of three studies in the 1970s. The initial study used a three-phased program to evaluate the technique of applying sprayable coatings to protect shorelines against oil spills. Of the nine products identified in the effort, four were tested in simulated field tests of which one showed considerable promise. Then in 1978, Woodward-Clyde Consultants and subcontractors conducted additional research efforts under a joint EPA/API sponsored project to evaluate under field conditions, the effectiveness of selected products in protecting beaches and salt marshes from oil spills and their value in assisting in the cleanup of shorelines previously contaminated by a slick. Of the eight products identified during this research effort, only three products were actually tested in the field. All three products were seen as effective to some degree. In 1979, Woodward-Clyde did a continuation of the 1978 project using additional laboratory and field tests of shoreline pre-treatment agents to determine product effectiveness. No products were ever commercialized and none are available for use.

History and Status of Solidifier Use

In the early 1970s, the USEPA and Exxon conducted research on the potential use of solidifiers in a scenario where a vessel was in imminent danger of sinking or breaking up, but still contained most of its oil. The strategy was to solidify the oil in the vessel holds to prevent its release to the water.

These products are contained in pillows and booms and provide the sorbent-type of oil encounter area. The polymer capsules have a very high internal surface area, much like a sponge, which is extremely oil-selective and water-avoidant; oil is wicked inside the internal pore space where the polymer and the oil chemically interact. This interaction causes the oil to dissolve into the polymer, which locks up the oil into the structure and precludes water from interacting with the oil. However, unlike a sponge, this chemical interaction prevents the oil from being squeezed back out, even under pressure; recovered oil does not rub off upon contact or drop-off the material when the product is removed from water as is the case with sorbents. The recovered oil/polymer capsules, which over time can become a gelatinous mass inside the bags or blankets, are recyclable using a low-temperature catalytic distillation.

Solidifiers are most commonly used during very small oil spills on land or restricted waterways. There has been little documented use of solidifiers on large spills or open water. Based on laboratory tests and limited field tests, solidifiers may be useful in situations when all oil, including sheens, needs to be recovered and where the product can be easily collected similar to sorbent materials. The oil must be fairly non-viscous to be wicked up by the product. Consequently, heavy oils or heavily weathered oils may not lend themselves to effective recovery with this countermeasure.

History and Status of Surface Collecting Agents Use

The use of surface-active agents to control oil slicks on the water surface was first reported by Zisman (1942) who studied their use during World War II to push burning oil away from tankers. Surface collecting agents were used in Hawaii in the 1970s on diesel spills in harbors (Benson, 1993) and have been tested by researchers at Warren Spring Laboratory (Nightingale and Nichols, 1973). In laboratory tests, Surface collecting agents were evaluated for their effectiveness in concentrating Alaskan North Slope Crude Oil at various temperatures. The agents were found to be equally effective in concentrating the thin films of oil by as much as 95 percent within one minute. The efficiency of the agents decreased only slightly with air temperatures below 0°C (Pope *et al,*. 1985). Surface collecting agents have also been used to prevent oil from contacting a marsh where the water was too shallow to deploy conventional boom (Goodman, 1993). No commercial products are currently listed on the NCP Product Schedule.

History and Status of Surface Washing Agents Use

Early attempts to use chemicals to increase the effectiveness of shoreline cleanup consisted of applying chemical dispersants on the shoreline. In the 1970s, water-based surface cleaner and a non-aromatic, hydrocarbon-based surface cleaner were used to clean Bunker C oil off the seawall following the grounding of the *Delian Appollon* in Tampa Bay (Canevari, 1979).

In 1989, Corexit 9580 was applied as a surface washing agent in large-scale field tests following the *Exxon Valdez* spill in Alaska (Fiocco *et al*., 1991). Many operational tests were conducted and the results indicated that the products were effective in removing the oil while minimizing dispersion of the oil into the water column (Fiocco *et al.,* 1991). Concurrently, Lees *et al.* (1993) evaluated the short-term biological effects of various shoreline treatment methods, including the use of Corexit 9580, on the intertidal biota in Prince William Sound following the *Exxon Valdez* spill. The Corexit 9580 treatments appeared to be accompanied by the smallest number of significant changes in abundance.

Since 1990, several laboratory and field studies, as well as spills of opportunity have been used to evaluate Corexit 9580 (Teas *et al.,* 1992), PES-51 (Benggio, 1993; Tesoro, 1993; Hoff, 1994) or both (NOAA, 1994) to determine their effectiveness as surface washing agents. Various tests were done using cold water flushing, air knives, or high-pressure, heated water for rinsing the treated shorelines. In general, these tests found that the agents were more effective than if water alone was used to flush the oil from the affected substrates. Dispersion of the treated oil occurred at high water temperatures and pressure rates. Based on the study conducted by NOAA (1994), the Caribbean RRT approved the operational use of Corexit 9580 based on effectiveness, toxicity, and cost considerations, but required an ecological effects monitoring plan to be conducted during the initial applications.

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Appendix E
Understanding Toxicity, Exposure, and Effects
Related to Spill Response Countermeasures
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UNDERSTANDING TOXICITY, EXPOSURE, AND EFFECTS RELATED TO SPILL RESPONSE COUNTERMEASURES

INTRODUCTION

This brief guidance information was developed to assist the decision-maker in determining the potential impacts/injuries to resources from the spilled oil and from oil treated with various spill countermeasure products. This is an overview on toxicity, exposure, and effects from contact with spilled oil. Due to the nature and breadth of this topic, only generalities are provided for exposure effects. Decision-makers will need to coordinate with resource specialists to gather and evaluate species-specific information on toxicity, exposure, and effects.

Determining adverse impacts consists of a three-step process:

1. Evaluate the toxicity of the spilled substance and how the toxicity may change when spill response countermeasures (products) are used to combat the spilled oil,
2. Determine the resources at risk, routes of exposure to the oil and/or the oil mixed with the spill countermeasures products; and
3. Determine and document potential toxic effects exhibited by the resources of concern.

Decision-makers need to have a clear understanding of what toxicity is, potential routes of exposure, and potential toxic effects from exposure to understand how adverse effects can occur during oil spills. The reader is reminded that adverse effects can occur both from spilled oil and the countermeasures used to control the oil. To determine the options that result in the optimal environmental benefit, the toxicities of various control options must be compared to each other and the toxicity of the spilled oil.

The following information in this overview was developed from Boyd *et al*., (2001).

WHAT IS TOXICITY?

Rand and Petrocelli (1985) define toxicity as the “inherent potential or capacity of a material [e.g., oil or chemically treated oil] to cause adverse effects in a living organism.” Adverse effects are responses outside the “normal” range for healthy organisms and can include behavioral, reproductive, or physiological changes, such as slowed movements, reduced fertility, or death. Toxic effects are a function of both the duration of exposure to the chemical and the concentration of the chemical. In the aquatic environment, the concentration of a chemical, as well as its transport, transformation, and fate, is controlled by:

Physical and chemical properties of the compound (such as a compound’s solubility or vapor pressure);

Physical, chemical, and biological properties of the ecosystem (such as salinity, temperature, or water depth); and

Sources and rate of input of the chemical into the environment (Rand and Petrocelli, 1985; Capuzzo, 1987; Gilfillan, 1992).

How is Toxicity Measured?

To determine the toxic impact of a chemical on a living resource, an estimate of the range of chemical concentrations that produce some selected, readily observable, and quantifiable response during a given time of exposure needs to be defined (Rand and Petrocelli, 1985). This is referred to as a dose-response relationship and is usually measured in parts per million (ppm) or parts per billion (ppb).

Often, toxicity data are expressed as the **L**ethal **C**oncentration required to kill **50** percent of the test species (LC50) or the **E**ffective **C**oncentration required to adversely affect **50** percent of the test species (EC50) in some specified way. LD50 is the **L**ethal **D**ose of a toxicant (through direct ingestion) required to kill **50** percent of the animals tested.

LC50 vs. EC50

For LC50, the endpoint is mortality over a specified time. Length of exposure is usually 24 to 96 hours. In some tests, the endpoint is not mortality, but a non-lethal response such as immobility, developmental abnormality, etc. In these cases, results are expressed as EC50, where a significant, defined, effect is seen in 50% of the population over a specified time period, usually 24 or 48 hours (Rand and Petrocelli, 1985). Table E-1 provides some generalities on rating toxicity data for various generic categories of resources.

Toxicity testing provides us with important information about the effects of oil; however there are some complicating factors that one should keep in mind when looking at toxicity data. Markarian *et al.* (1993) cautions that use of the term "Lethal Concentration" is inappropriate for testing with oil products. This is because an LC50, for example, should measure the lethal concentration of a single compound. However, oil is a mix of compounds and often the exact mixture is not known. Seeing an LC50 result for oil does not immediately indicate how the measured concentration was developed. This can make comparisons of oils difficult, because various approaches can provide different results, which are of different scientific relevance (Markarian *et al.*, 1993). Although experts concur that LC50 data are not the best suited measure of toxicity for oil, it is very often the only type of measurement available.

Another complicating factor for those reading toxicity tests with oil products is how the concentration is expressed. Concentrations expressed as the total oil per unit volume (nominal concentration) are misleading because much of the oil is not soluble in the water and, therefore, not available to water column organisms. Using this nominal concentration will produce overestimates of exposure concentrations and toxicities (NRC, 1989; Lewis and Aurand, 1997). More realistic testing methods measure concentration based on the water-accommodated fraction (WAF) of the oil, which is the fraction of an oil product that remains in the water phase after mixing and settling (CONCAWE, 1983; Singer and Tjeerdema, 1994).

Table E-1. Relative toxicity of substances (adapted from USFWS, 1984; Hunn and Schnick, 1990).

Toxicity Rating	Aquatic 96-hour LC50	Avian Oral 96-hour LD50 ($mg_{substance}/Kg_{bird}$)	Mammalian Oral 96-hour LD50 ($mg_{substance}/Kg_{animal}$)
Practically Non-toxic	100 – 1,000 mg/L	> 5,000	>15,000
Slightly Toxic	10-100 mg/L	1,000-5,000	5,000-15,000
Moderately Toxic	1-10 mg/L	200-1,000	500-5,000
Highly Toxic	0.1-1.0 mg/L	40-200	50-500
Extremely Toxic	<0.1 mg/L	<40	5-50

WHAT IS EXPOSURE?

Exposure refers to the amount of contact an organism has with a chemical, physical, or biological agent. When assessing toxicity, it is necessary to know the exposure. The most significant factors are the kind, duration, and frequency of exposure, as well as the concentration of the chemical (Rand and Petrocelli, 1985). NOAA’s Damage Assessment Center summarized the factors to be considered when assessing exposure to subtidal and intertidal organisms along shorelines (NOAA, 1996):

Oil type – physical and chemical characteristics of the oil.

Spill volume – size of the discharge or amount in shoreline area.

Duration and frequency – how often and for how long organisms are exposed to oil and or chemical countermeasures.

Shoreline type – high-energy shorelines may reduce the chance for long-term aquatic exposure, but may also result in the oil being deposited along or above the high tide line. Sediment grain size will also affect exposure, with coarse-grained sediments allowing for more rapid and deeper penetration.

Tide stage – subtidal organisms are at less risk than intertidal organisms, since they won’t come in contact with the floating oil.

Weather conditions – floods or storm-driven tides may strand oil in places it would not normally go. Weather conditions can also accelerate or retard oil weathering.

Toxic effects can be produced by acute (short-term) or chronic (long-term) exposures. Acute exposures occur when an organism is in contact with a chemical for a brief time period. Toxicity testing for acute effects usually involves effects that occur within a four-day period (96 hr) or less. In the case of oil spills, negative effects from acute exposure are usually seen early in the spill. This is because the oil, including the light and medium-weight components that may evaporate, is most concentrated during the first few days. Alternatively, chronic exposures are longer duration (weeks to years), and generally involve daily exposure to smaller amounts of oil or residual weathering compounds from oil.

Routes of Exposure

Following a spill on water or on land, resources can be exposed to oil through four different routes:

1. **Direct contact** – This is the most visible route of exposure to an observer. When a plant or animal comes into direct contact with oil, it may only become lightly oiled. However, it could also become completely coated with oil, making it unable to move, function, or survive. Once an organism is physically coated with oil, the chances of exposure through the other three methods described below will increase dramatically.

2. **Ingestion** – Both direct and indirect. Direct ingestion occurs when an organism eats food coated with oil or even ingests the oil itself. Direct ingestion of oil may occur accidentally, such as when a bird attempts to clean oil from its feathers. Indirect ingestion occurs when an organism eats prey or food tainted with oil. This food is not necessarily coated with oil itself, but has been exposed to it previously. For example, an eagle could ingest oil indirectly by eating an animal that swallowed oil during a spill the week before.

3. **Inhalation** – Inhalation may occur when animals breathe in evaporating oil components or oil mists created from storm and wave action. Inhalation usually occurs when animals on the surface (e.g., seabirds, otters, and seals) breathe while swimming in/through a slick.

4. **Absorption** – This occurs when an organism absorbs the oil, or toxins from the oil, directly through its skin or outer membranes. Typical examples of organisms to which this could apply are benthic or intertidal mollusks, worms, fish, and plants.

ADVERSE EFFECTS

Potential Effects

NOTE: *The information presented in this section is very general and should only be viewed as a starting point in your understanding of how adverse effects can occur. Specific impacts are very species- and situation-dependent. For spill preparedness and incident response, experts on the local resources must always be consulted and consider the implications of scenario- or incident-specific conditions.*

As mentioned previously, adverse effects are responses outside the "normal" range for healthy organisms and can include behavioral, reproductive, or physiological changes, such as slowed movements, reduced fertility, or death. Table E2 provides general guidance on potential effects experienced by various resource categories that are typically affected by spills of oil.

Often, toxicity is viewed as the ability of a substance to kill an organism. **It is important to keep in mind that toxic substances usually cause effects other than death in most organisms.** Actual effects depend on a number of variables. Sublethal effects are often difficult to quantify or even observe and may, or may not, be important to the future survival of the organism. Mackay and Wells (1981), NRC (1985), and Mielke (1990) summarize factors that determine the severity of ecological impacts from an oil spill. These include:

- Concentration of oil and the duration of the exposure;
- Type of oil involved;
- Whether the oil is fresh, weathered, or emulsified;
- Whether a coastal, estuarine, or open ocean area is involved and whether it is a nesting, wintering, or migratory ground for sea birds;
- Season of the year with respect to bird migration and whether organisms are dormant or actively feeding and reproducing;
- Oceanographic conditions such as currents, sea state, coastal topography, and tidal action;
- Whether adult or juvenile life forms are present;
- Whether the oil is in solution, suspension, or adsorbed onto suspended particulates or sediment;
- Distribution of oil in the water column;

- Effects of oil on competing biota;
- An ecosystem's previous history of exposure to oil or other pollutants; and
- Cleanup procedures used.

Table E-2. Generalized list of effects, by resource category and route of exposure. Adapted from Scholz *et al.*, (1992) and RPI (1991).

		Routes of Exposure			
Resource Category	**Examples**	**Direct Contact**	**Ingestion**	**Inhalation**	**Absorption**
Birds	Seabirds Gulls and terns Raptors Shorebirds Wading birds Waterfowl	• Fouling of plumage / matting • Hypothermia • Loss of buoyancy • Reduced egg survival • Nest abandonment • Reduced reproductive success • Death	Preening, consuming oiled prey can result in: • Anemia • Pneumonia • Intestinal irritation • Kidney damage • Altered blood chemistry • Decreased growth • Impaired osmoregulation • Decreased production and viability of eggs • Death		
Fish	Anadromous Marine pelagic Demersal groundfish Reef fish Estuarine fish	Changes in: • Feeding • Growth • Development • Recruitment	• Adults ingesting oil metabolized into water-soluble compounds that are excreted as feces or urine • Tumor production and other abnormalities • Death		• Chemosensory ability may be reduced • Changes in feeding, avoidance behavior, reproduction • Elevated respiration, decreased respiration • Reduction in activity in larvae • Reduced schooling behavior • Reduced growth with long-term exposure • Death
Marine	Whales	• Irritation to eyes and skin	• Direct Consumption can result in:	• Absorption into the circulatory system	

		Routes of Exposure			
Resource Category	**Resource Examples**	**Direct Contact**	**Ingestion**	**Inhalation**	**Absorption**
Mammals	Dolphins Porpoises Seals Sea lions Walruses Sea otter	• Increased metabolism • Inhibition of thermoregulation • Temporary reduction in feeding efficiency • Loss of insulative property for fur bearers • Death	• Irritation/destruction of intestinal linings • Organ damage • Neurological disorders • Bioaccumulation of toxins • Death • Indirect Consumption can result in: • Transfer of toxins to young via lactation • Obsessive grooming behavior • Degenerative liver lesions, kidney failure • Endocrine imbalances • Diarrhea • Death	• Mild irritation/permanent damage to respiratory surfaces and mucosal membranes • Death May also affect: • Lungs and other organs • Nervous system	
Reptiles	Sea turtles Alligators Marine Lizards	• Increased number of eggs remaining unhatched • Hatchling morphology (weight, size) • Reddening and sloughing off of skin • Reduced viability • Increased chance for infection • Coated flippers • Contaminated mouthparts • Death	• Reduction in feeding efficiency • Starvation • Death •	• Increased dive time and diving deeper in young turtles • Increased respiratory rates • Decreased blood glucose levels • Death	• Impairment of immune system can result in increased production of white blood cells • Interference of salt gland can result in water imbalance and internal ion regulation • Death
Shellfish	Shrimp Lobster Crab Oyster Clam Mussel	• Decreased or abnormal growth • Increased mucous production • Damage to soft tissues • Decreased respiration • Death	• Tainting • Decreased Feeding • Death		

		Routes of Exposure			
Resource Category	**Resource Examples**	**Direct Contact**	**Ingestion**	**Inhalation**	**Absorption**
	Scallop Squid Octopus				
Other Invertebrates	Corals Annelid Worms Polychaetes Urchin Starfish	• Impaired larval settlement • Growth reduction • Bleaching or expulsion of Zooxanthellae (corals) • Death	• Impaired feeding response • Impaired polyp retraction (corals) • Increased mucous production • Impaired sediment clearance ability (corals) • Death		For Corals: • Reduced growth • Reduced reproduction / gonad damage • Muscle atrophy • Tissue death • Death
Plankton	Phytoplankton Bacterioplankton Zooplankton		• May exhibit an increase in abundance due to increased food supply, i.e., spilled oil (zoo) • Excretion of oil droplets as unmodified oil in fecal pellets (zoo) • Death		• Reduced photosynthetic efficiency (phyto) • Reduction in algal growth (phyto) • Decreases in biomass (zoo) • Lower feeding rates (zoo) • Lower reproduction rates (zoo) • Death
Marine Plants	Algae Kelp Seagrasses	• Smothering • Bleaching			• Sloughing off of leaves • Death of plant

		Routes of Exposure			
Resource Category	**Resource Examples**	**Direct Contact**	**Ingestion**	**Inhalation**	**Absorption**
	Wetland plants	• Sloughing off of leaves • Death of plant			

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Some biological species produce large numbers of young to overcome natural losses (e.g., most invertebrates) making it less likely that any localized impacts will have a discernible effect on the adult population (ITOPF, 1987). Although most vertebrates of concern during a spill do not do this (e.g., seabirds, marine mammals), it is still unlikely that there will be serious effects on the overall population in most spill situations. However, it must be emphasized that this is not always the case, especially with threatened and endangered species. The loss of only a few individuals of a threatened or endangered species could have a large impact on the entire population. Also, early life stages (larvae and juveniles) of most resources are generally more sensitive to the effects of oiling than adults (ITOPF, 1987). This increased sensitivity may be related to life stage-specific or seasonal dependency on metabolic processes that are not critical functions in the adult forms (Capuzzo, 1987; Lewis and Aurand, 1997).

Changes in Effects From Exposure to Oil Treated with Spill Countermeasure Products

Table E3 provides a visual summary of the changes in potential routes of exposure following the addition of spill countermeasure products.

Bioremediation Agents

Bioremediation agents are seldom used during the emergency phase of a spill, and are typically used as a polishing tool after other techniques have been used to remove free product or when further response options are likely to be destructive, ineffective or cost-prohibitive. Therefore, the addition of these products to the spilled oil is only likely to occur after extensive weathering of the product has occurred. Exposures are assumed to remain unchanged when oil is treated with bioremediation agents relative to oil that is left untreated.

Dispersants

When dispersants are applied during a spill, they act to break up the oil into droplets, removing it from the surface and downward into the water column. Dispersants can be used as an isolated response option for a particular portion of the spill or as the response option of choice to deal with the spill as a whole. In either case, dispersants will increase oil exposure to some organisms while reducing exposure for others. When dispersants are applied, exposure to oil will typically decrease for surface-dwelling and intertidal resources, but increase for water column and bottom-dwelling resources. This is one reason that dispersants are not usually applied to a spill directly over a shallow coral reef. Without dispersant application the oil may stay on the surface and not contact the reef, whereas with dispersant application the reef may be showered with droplets of oil.

Elasticity Modifiers and Solidifiers

Both elasticity modifiers and solidifiers, when added to spilled oil, are designed to change the viscosity of the oil, allowing for easier pick up/removal. These products are only used for contained oil and all product/oil mixtures are to be recovered; therefore their potential for altering exposure to resources is limited to small spill volumes. The product/oil mixture is designed to remain floating and reject any products that might cause the oil to sink. When applied, these products will not alter the routes of exposure; surface dwelling and intertidal resources could still be affected by the spilled oil/mixture. Elasticity modifiers make the oil more sticky and the treated oil is more likely to adhere to fur, feathers, vegetation, and dry shorelines, thus potentially increasing exposure to resources.
Solidifiers can reduce the vapor pressure of volatile oils and transform the spilled oil into a coherent mass. The potential for physical disturbance of habitats, as well as smothering may be an additional factor when determining potential exposures to the oil/product mixtures.

Emulsion Treating Agents

Emulsion treating agents (ETAs) are used to prevent emulsification of the oil on the water surface and to increase the window of opportunity for other response options (e.g., dispersants, *in situ* burning, skimming). Most are composed of water-soluble surfactants that modify the properties of the oil/water interface, thus inhibiting/neutralizing the emulsification process. Over time (rate undetermined) ETAs will leach out of the oil/product mixtures and emulsions may form. It is speculated that the ETAs may enhance the solubility of the oil into the water. The potential for exposure is not likely to change for surface-dwelling or intertidal species as the ETAs do not displace the oil within the water column. However, water column resources may be exposed if the ETA enhances the solubility of the oil into the water.

In situ Burning

In situ burn technology is designed to remove oil from the water surface or on land by burning the oil in place. When used effectively, *in situ* burns can achieve removal rates of 50,000 gal/hour for a burn area of 10,000 ft^2 and removal efficiencies can exceed 90%. This makes *in situ* burning a response option for further consideration when you want to prevent the spread of oil to sensitive sites or over large areas. However, burning oil generates large volumes of black smoke. Site conditions (particularly wind speed and direction) will determine whether the smoke plume poses a threat to the public, thus each spill has been evaluated on a case-by-case basis. In general *in situ* burning removes the threat from the oil slick from the water surface through combustion of the oil product; effectively removing the oil from the water surface to the atmosphere. However, *in situ* burns are not 100% effective, and can form a semi-solid, tar-like layer that may need to be recovered from the water surface. Also, some of the burn residue from crude oil burns may sink, thus exposing water column and bottom-dwelling resources to the oil in a new form.

Shoreline Pre-treatment Agents

Shoreline pre-treatment agents are designed to be utilized when oil is heading towards a sensitive shoreline resource (e.g., marsh, sheltered tidal flat) or a resource of historical/archaeological importance. Pre-treatment agents are applied to the substrate prior to oil landfall to prevent oil from adhering to or penetrating the substrate. Because of the nature of these products, there is a narrow window of opportunity for their use. Timing of an application is critical; products need to be applied to the oil/shoreline interface just prior to stranding of oil for effective use. As these products are not directly applied to the oil, they do not change the exposure of resources to the oil. They do however, work to reduce impacts to shoreline habitats from the surface slicks. Exposure to surface dwelling resources is not likely to change, except that these products may reduce potential exposures to isolated resources and intertidal resources if applied effectively.

Surface Collecting Agents

Surface collecting agents are designed to push or compress the oil on the water surface into a smaller area to form thicker slicks that are more readily recovered. Surface collecting agents are applied to the water, not the oil. These products are not used as the sole response option and are designed to be used to protect a specific, finite resource. As these products are not directly applied to the oil, they do not change the exposure of resources to the oil. They do however, work to reduce the area exposed by the surface slick. Exposure to surface dwelling and intertidal resources within the slick is not likely to change, except that these products may reduce the *potential* for exposures to isolated resources.

Surface Washing Agents

Surface washing agents are designed to clean the oil from substrates using a combination of surfactants, solvents and/or other additives. They are not applied to surface slicks on the water; they are applied to assist in the removal of weathered oil and for oil that is trapped in inaccessible areas where wash waters can be recovered and treated. Surface washing agents come in two forms: “lift and float” products and “lift and disperse” products. Surface coatings treated with lift and float products will reintroduce oil to the surface dwelling resources in the treatment area as the treated substrates are washed off; these products should be used in conjunction with sorbent booms to recapture the oil. Lift and disperse products would change exposures from surface dwelling resources to potentially include intertidal, water column, and bottom-dwelling resources.

Table E-3. Generalizations on the changes in routes of exposure from spilled oil* for resources before and after spill countermeasures products are applied.

	Surface-dwelling	**Water Column**	**Bottom-dwelling**	**Intertidal**
Generic Resource Exposure to Spilled Oil*, by Location	High	Low	NE	High
Changes in Resource Exposure With Treated Oil, by Response Countermeasure				
Bioremediation Agents	—	—	—	—
Dispersants	⬇⬇	⬆⬆	⬆	⬇
Elasticity Modifier	↑	—	—	↑
Emulsion Treating Agents	—	↑	—	—
***In situ* Burning (on water)**	⬇⬇	⬆	↑ to ⬆	⬇
***In situ* Burning (on land)**	⬇	—	—	⬇
Shoreline Pre-treatment Agents	—	—	—	↓ to ⬇
Solidifiers	↑	—	—	↑
Surface Collecting Agents	↓	—	—	↓ to ⬇
Surface Washing Agents	↑a; —b	—a; ↑b	—a,b	↑a,b

* This exposure rating assumes a spill of a medium crude oil from a tanker in offshore waters, with the potential for shoreline impacts, likely.

a –"lift and float" products; **b** –"lift and disperse" products

Key to Table

NE — minimal to no potential exposure expected

— — not likely to change potential exposure

↓ — small reduction in potential exposure possible

⬇ — moderate reduction in potential exposure likely

⬇⬇ — dramatic reduction in potential exposure likely

↑ — small increase in potential exposure possible

⬆ — moderate increase in potential exposure likely

⬆⬆ — dramatic increase in potential exposure likely

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Appendix F
40 CFR 300.900;
Subpart J – Use of Dispersants and Other Chemicals

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Subpart J-Use of Dispersants and Other Chemicals

Source: 59 FR 47453, Sept. 15, 1994, unless otherwise noted.

§ 300.900 General.

(a) Section 311(d)(2)(G) of the CWA requires that EPA prepare a schedule of dispersants, other chemicals, and other spill mitigating devices and substances, if any, that may be used in carrying out the NCP. This subpart makes provisions for such a schedule.

(b) This subpart applies to the navigable waters of the United States and adjoining shorelines, the waters of the contiguous zone, and the high seas beyond the contiguous zone in connection with activities under the Outer Continental Shelf Lands Act, activities under the Deepwater Port Act of 1974, or activities that may affect natural resources belonging to, appertaining to, or under the exclusive management authority of the United States, including resources under the Magnuson Fishery Conservation and Management Act of 1976.

(c) This subpart applies to the use of any chemical agents or other additives as defined in subpart A of this part that may be used to remove or control oil discharges.

§ 300.905 NCP Product Schedule.

(a) Oil Discharges.

(1) EPA shall maintain a schedule of dispersants and other chemical or bioremediation products that may be authorized for use on oil discharges in accordance with the procedures set forth in §300.910. This schedule, called the NCP Product Schedule, may be obtained from the U.S. Environmental Protection Agency, Oil Program Center, 1200 Pennsylvania Avenue, NW, Washington, DC 20460. The telephone number is 1-202-260-2342.

(2) Products may be added to the NCP Product Schedule by the process specified in §300.920.

(b) Hazardous Substance Releases. [Reserved]

§ 300.910 Authorization of use.

(a) RRTs and Area Committees shall address, as part of their planning activities, the desirability of using appropriate dispersants, surface washing agents, surface collecting agents, bioremediation agents, or miscellaneous oil spill control agents listed on the NCP Product Schedule, and the desirability of using appropriate burning agents. RCPs and ACPs shall, as appropriate, include applicable preauthorization plans and address the specific contexts in which such products should and should not be used. In meeting the provisions of this paragraph, preauthorization plans may address factors such as the potential sources and types of oil that might be spilled, the existence and location of environmentally sensitive resources that might be impacted by spilled oil, available product and storage locations, available equipment and adequately trained operators, and the available means to monitor product application and effectiveness. The RRT representatives from EPA and the states with jurisdiction over the waters of the area to which a preauthorization plan applies and the DOC and DOI natural resource trustees shall review and either approve, disapprove, or approve with modification the preauthorization plans developed by Area Committees, as appropriate. Approved preauthorization plans shall be included in the appropriate RCPs and ACPs. If the RRT representatives from EPA and the states with jurisdiction over the waters of the area to which a preauthorization plan applies and the DOC and DOI natural resource trustees approve in advance the use of certain products under specified circumstances as described in the preauthorization plan, the OSC may authorize the use of the products without obtaining the specific concurrences described in paragraphs (b) and (c) of this section.

(b) For spill situations that are not addressed by the preauthorization plans developed pursuant to paragraph (a) of this section, the OSC, with the concurrence of the EPA representative to the RRT and, as appropriate, the concurrence of the RRT representatives from the states with jurisdiction over the navigable waters threatened by the release or discharge, and in consultation with the DOC and DOI natural resource trustees, when practicable, may authorize the use of dispersants, surface washing agents, surface collecting agents, bioremediation agents, or miscellaneous oil spill control agents on the oil discharge, provided that the products are listed on the NCP Product Schedule.

(c) The OSC, with the concurrence of the EPA representative to the RRT and, as appropriate, the concurrence of the RRT representatives from the states with jurisdiction over the navigable waters threatened by the release or discharge, and in consultation with the DOC and DOI natural resource trustees, when practicable, may authorize the use of burning agents on a case-by-case basis.

(d) The OSC may authorize the use of any dispersant, surface washing agent, surface collecting agent, other chemical agent, burning agent, bioremediation agent, or miscellaneous oil spill control agent, including products not listed on the NCP Product Schedule, without obtaining the concurrence of the EPA representative to the RRT and, as appropriate, the RRT representatives from the states with jurisdiction over the navigable waters threatened by the release or discharge, when, in the judgment of the OSC, the use of the product is necessary to prevent or substantially reduce a hazard to human life. Whenever the OSC authorizes the use of a product pursuant to this paragraph, the OSC is to inform the EPA RRT representative and, as appropriate, the RRT representatives from the affected states and, when practicable, the DOC/DOI natural resources trustees of the use of a product, including products not on the Schedule, as soon as possible. Once the threat to human life has subsided, the continued use of a product shall be in accordance with paragraphs (a), (b), and (c) of this section.

(e) Sinking agents shall not be authorized for application to oil discharges.

(f) When developing preauthorization plans, RRTs may require the performance of supplementary toxicity and effectiveness testing of products, in addition to the test methods specified in §300.915 and described in appendix C to part 300, due to existing site-specific or area-specific concerns.

§ 300.915 Data requirements.

(a) Dispersants.

(1) Name, brand, or trademark, if any, under which the dispersant is sold.

(2) Name, address, and telephone number of the manufacturer, importer, or vendor.

(3) Name, address, and telephone number of primary distributors or sales outlets.

(4) Special handling and worker precautions for storage and field application. Maximum and minimum storage temperatures, to include optimum ranges as well as temperatures that will cause phase separations, chemical changes, or other alterations to the effectiveness of the product.

(5) Shelf life.

(6) Recommended application procedures, concentrations, and conditions for use depending upon water salinity, water temperature, types and ages of the pollutants, and any other application restrictions.

(7) Effectiveness. Use the Swirling Flask effectiveness test methods described in appendix C to part 300. Manufacturers shall submit test results and supporting data, along with a certification signed by responsible corporate officials of the manufacturer and laboratory stating that the test was conducted on a representative product sample, the testing was conducted using generally accepted laboratory practices, and they believe the results to be accurate. A dispersant must attain an effectiveness value of 45 percent or greater to be added to the NCP Product Schedule. Manufacturers are encouraged to provide data on product performance under conditions other than those captured by these tests.

(8) Dispersant Toxicity. For those dispersants that meet the effectiveness threshold described in paragraph (a)(7) above, use the standard toxicity test methods described in appendix C to part 300. Manufacturers shall submit test results and supporting data, along with a certification signed by responsible corporate officials of the manufacturer and laboratory stating that the test was conducted on a representative product sample, the testing was conducted using generally accepted laboratory practices, and they believe the results to be accurate.

(9) The following data requirements incorporate by reference standards from the 1991 or 1992 Annual Books of ASTM Standards. American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103. This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51.1

(i) Flash Point-Select appropriate method from the following:

(A) ASTM-D 56-87, "Standard Test Method for Flash Point by Tag Closed Tester;"

(B) ASTM-D 92-90, "Standard Test Method for Flash and Fire Points by Cleveland Open Cup;"

(C) ASTM-D 93-90, "Standard Test Methods for Flash Point by Pensky-Martens Closed Tester;"

(D) ASTM-D 1310-86, "Standard Test Method for Flash Point and Fire Point of Liquids by Tag Open-Cup Apparatus;" or

(E) ASTM-D 3278-89, "Standard Test Methods for Flash Point of Liquids by Setaflash Closed-Cup Apparatus."

(ii) Pour Point-Use ASTM-D 97-87, "Standard Test Method for Pour Point of Petroleum Oils."

(iii) Viscosity-Use ASTM-D 445-88, "Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity)."

(iv) Specific Gravity-Use ASTM-D 1298-85(90), "Standard Test Method for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method."

(v) pH-Use ASTM-D 1293-84(90), "Standard Test Methods for pH of Water."

(10) Dispersing Agent Components. Itemize by chemical name and percentage by weight each component of the total formulation. The percentages will include maximum, minimum, and average weights in order to reflect quality control variations in manufacture or formulation. In addition to the chemical information provided in response to the first two sentences, identify the major components in at least the following categories: surface active agents, solvents, and additives.

(11) Heavy Metals, Cyanide, and Chlorinated Hydrocarbons. Using standard test procedures, state the concentrations or upper limits of the following materials:

(i) Arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc, plus any other metals that may be reasonably expected to be in the sample. Atomic absorption methods should be used and the detailed analytical methods and sample preparation shall be fully described.

(ii) Cyanide. Standard calorimetric procedures should be used.

(iii) Chlorinated hydrocarbons. Gas chromatography should be used and the detailed analytical methods and sample preparation shall be fully described. At a minimum, the following test methods shall be used for chlorinated hydrocarbon analyses: EPA Method 601-Purgeable halocarbons (Standard Method 6230 B) and EPA Method 608-Organochlorine pesticides and PCBs (Standard Method 6630 C).2103

(12) The technical product data submission shall include the identity of the laboratory that performed the required tests, the qualifications of the laboratory staff, including professional biographical information for individuals responsible for any tests, and laboratory experience with similar tests. Laboratories performing toxicity tests for dispersant toxicity must demonstrate previous toxicity test experience in order for their results to be accepted. It is the responsibility of the submitter to select competent analytical laboratories based on the guidelines contained herein. EPA reserves the right to refuse to accept a submission of technical product data because of lack of qualification of the analytical laboratory, significant variance between submitted data and any laboratory confirmation performed by EPA, or other circumstances that would result in inadequate or inaccurate information on the dispersing agent.

(b) Surface washing agents.

(1) Name, brand, or trademark, if any, under which the surface washing agent is sold.

(2) Name, address, and telephone number of the manufacturer, importer, or vendor.

(3) Name, address, and telephone number of primary distributors or sales outlets.
(4) Special handling and worker precautions for storage and field application. Maximum and minimum storage temperatures, to include optimum ranges as well as temperatures that will cause phase separations, chemical changes, or other alterations to the effectiveness of the product.
(5) Shelf life.
(6) Recommended application procedures, concentrations, and conditions for use depending upon water salinity, water temperature, types and ages of the pollutants, and any other application restrictions.
(7) Toxicity. Use standard toxicity test methods described in appendix C to part 300.
(8) Follow the data requirement specifications in paragraph (a)(9) of this section.
(9) Surface Washing Agent Components. Itemize by chemical name and percentage by weight each component of the total formulation. The percentages will include maximum, minimum, and average weights in order to reflect quality control variations in manufacture or formulation. In addition to the chemical information provided in response to the first two sentences, identify the major components in at least the following categories: surface active agents, solvents, and additives.
(10) Heavy Metals, Cyanide, and Chlorinated Hydrocarbons. Follow specifications in paragraph (a)(11) of this section.
(11) Analytical Laboratory Requirements for Technical Product Data. Follow specifications in paragraph (a)(12) of this section.

(c) Surface collecting agents.
(1) Name, brand, or trademark, if any, under which the product is sold.
(2) Name, address, and telephone number of the manufacturer, importer, or vendor.
(3) Name, address, and telephone number of primary distributors or sales outlets.
(4) Special handling and worker precautions for storage and field application. Maximum and minimum storage temperatures, to include optimum ranges as well as temperatures that will cause phase separations, chemical changes, or other alterations to the effectiveness of the product.
(5) Shelf life.
(6) Recommended application procedures, concentrations, and conditions for use depending upon water salinity, water temperature, types and ages of the pollutants, and any other application restrictions.
(7) Toxicity. Use standard toxicity test methods described in appendix C to part 300.
(8) Follow the data requirement specifications in paragraph (a)(9) of this section.
(9) Test to Distinguish Between Surface Collecting Agents and Other Chemical Agents.
(i) Method Summary-Five milliliters of the chemical under test are mixed with 95 milliliters of distilled water and allowed to stand undisturbed for one hour. Then the volume of the upper phase is determined to the nearest one milliliter.
(ii) Apparatus.
(A) Mixing Cylinder: 100 milliliter subdivisions and fitted with a glass stopper.
(B) Pipettes: Volumetric pipette, 5.0 milliliter.
(C) Timers.

(iii) Procedure-Add 95 milliliters of distilled water at 22 °C, plus or minus 3 °C, to a 100 milliliter mixing cylinder. To the surface of the water in the mixing cylinder, add 5.0 milliliters of the chemical under test. Insert the stopper and invert the cylinder five times in ten seconds. Set upright for one hour at 22 °C, plus or minus 3 °C, and then measure the chemical layer at the surface of the water. If the major portion of the chemical added (75 percent) is at the water surface as a separate and easily distinguished layer, the product is a surface collecting agent.

(10) Surface Collecting Agent Components. Itemize by chemical name and percentage by weight each component of the total formulation. The percentages should include maximum, minimum, and average weights in order to reflect quality control variations in manufacture or formulation. In addition to the chemical information provided in response to the first two sentences, identify the major components in at least the following categories: surface action agents, solvents, and additives.

(11) Heavy Metals, Cyanide, and Chlorinated Hydrocarbons. Follow specifications in paragraph (a)(11) of this section.

(12) Analytical Laboratory Requirements for Technical Product Data. Follow specifications in paragraph (a)(12) of this section.

(d) Bioremediation Agents.

(1) Name, brand, or trademark, if any, under which the agent is sold.

(2) Name, address, and telephone number of the manufacturer, importer, or vendor.

(3) Name, address, and telephone number of primary distributors or sales outlets.

(4) Special handling and worker precautions for storage and field application. Maximum and minimum storage temperatures.

(5) Shelf life.

(6) Recommended application procedures, concentrations, and conditions for use depending upon water salinity, water temperature, types and ages of the pollutants, and any other application restrictions.

(7) Bioremediation Agent Effectiveness. Use bioremediation agent effectiveness test methods described in appendix C to part 300.

(8) Bioremediation Agent Toxicity [Reserved].

(9) Biological additives.

(i) For microbiological cultures, furnish the following information:

(A) Listing of each component of the total formulation, other than microorganisms, by chemical name and percentage by weight.

(B) Listing of all microorganisms by species.

(C) Percentage of each species in the composition of the additive.

(D) Optimum pH, temperature, and salinity ranges for use of the additive, and maximum and minimum pH, temperature, and salinity levels above or below which the effectiveness of the additive is reduced to half its optimum capacity.

(E) Special nutrient requirements, if any.

(F) Separate listing of the following, and test methods for such determinations: Salmonella, fecal coliform, Shigella, Staphylococcus Coagulase positive, and Beta Hemolytic Streptococci.

(ii) For enzyme additives, furnish the following information:

(A) Listing of each component of the total formulation, other than enzymes, by chemical name and percentage by weight.

(B) Enzyme name(s).

(C) International Union of Biochemistry (I.U.B.) number(s).

(D) Source of the enzyme.

(E) Units.

(F) Specific Activity.

(G) Optimum pH, temperature, and salinity ranges for use of the additive, and maximum and minimum pH, temperature, and salinity levels above or 105 below which the effectiveness of the additive is reduced to half its optimum capacity.

(H) Enzyme shelf life.

(I) Enzyme optimum storage conditions.

(10) For nutrient additives, furnish the following information:

(i) Listing of each component of the total formulation by chemical name and percentage by weight.

(ii) Nutrient additive optimum storage conditions.

(11) Analytical Laboratory Requirements for Technical Product Data. Follow specifications in paragraph (a)(12) of this section.

(e) Burning Agents. EPA does not require technical product data submissions for burning agents and does not include burning agents on the NCP Product Schedule.

(f) Miscellaneous Oil Spill Control Agents.

(1) Name, brand, or trademark, if any, under which the miscellaneous oil spill control agent is sold.

(2) Name, address, and telephone number of the manufacturer, importer, or vendor.

(3) Name, address, and telephone number of primary distributors or sales outlets.

(4) Brief description of recommended uses of the product and how the product works.

(5) Special handling and worker precautions for storage and field application. Maximum and minimum storage temperatures, to include optimum ranges as well as temperatures that will cause phase separations, chemical changes, or other alternatives to the effectiveness of the product.

(6) Shelf life.

(7) Recommended application procedures, concentrations, and conditions for use depending upon water salinity, water temperature, types and ages of the pollutants, and any other application restrictions.

(8) Toxicity. Use standard toxicity test methods described in appendix C to part 300.

(9) Follow the data requirement specifications in paragraph (a)(9) of this section.

(10) Miscellaneous Oil Spill Control Agent Components. Itemize by chemical name and percentage by weight each component of the total formulation. The percentages should include maximum, minimum, and average weights in order to

reflect quality control variations in manufacture or formulation. In addition to the chemical information provided in response to the first two sentences, identify the major components in at least the following categories: surface active agents, solvents, and additives.

(11) Heavy Metals, Cyanide, and Chlorinated Hydrocarbons. Follow specifications in paragraph (a)(11) of this section.

(12) For any miscellaneous oil spill control agent that contains microbiological cultures, enzyme additives, or nutrient additives, furnish the information specified in paragraphs (d)(9) and (d)(10) of this section, as appropriate.

(13) Analytical Laboratory Requirements for Technical Product Data. Follow specifications in paragraph (a)(12) of this section.

(g) Sorbents.

(1) Sorbent material may consist of, but is not limited to, the following materials:

(i) Organic products-

(A) Peat moss or straw;

(B) Cellulose fibers or cork;

(C) Corn cobs;

(D) Chicken, duck, or other bird feathers.

(ii) Mineral compounds-

(A) Volcanic ash or perlite;

(B) Vermiculite or zeolite.

(iii) Synthetic products-

(A) Polypropylene;

(B) Polyethylene;

(C) Polyurethane;

(D) Polyester.

(2) EPA does not require technical product data submissions for sorbents and does not include sorbents on the NCP Product Schedule.

(3) Manufacturers that produce sorbent materials that consist of materials other than those listed in paragraph (g)(1) of this section shall submit to EPA the technical product data specified for miscellaneous oil spill control agents in paragraph (f) of this section and EPA will consider listing those products on the NCP Product Schedule under the miscellaneous oil spill control agent category. EPA will inform the submitter in writing, within 60 days of the receipt of technical product data, of its decision on adding the product to the Schedule.

(4) Certification. OSCs may request a written certification from manufacturers that produce sorbent materials that consist solely of the materials listed in paragraph (g)(1) of this section prior to making a decision on the use of a particular sorbent material. The certification at a minimum shall state that the sorbent consists solely of the materials listed in §300.915(g)(1) of the NCP. The following statement, when completed, dated, and signed by a sorbent manufacturer, is sufficient to meet the written certification requirement:

[SORBENT NAME] is a sorbent material and consists solely of the materials listed in §300.915(g)(1) of the NCP.

(h) Mixed products. Manufacturers of products that consist of materials that meet the definitions of two or more of the product categories contained on the NCP Product Schedule shall submit to EPA the technical product data specified in this section for each of those product categories. After review of the submitted technical product data, and the performance of required dispersant effectiveness and toxicity tests, if appropriate, EPA will make a determination on whether and under which category the mixed product should be listed on the Schedule.

§ 300.920 Addition of products to Schedule.

(a) Dispersants.

(1) To add a dispersant to the NCP Product Schedule, submit the technical product data specified in §300.915(a) to the U.S. Environmental Protection Agency, Oil Program Center, 1200 Pennsylvania Avenue, NW, Washington, DC 20460. The telephone number is 1-202-260-2342. A dispersant must attain an effectiveness value of 45 percent or greater in order to be added to the Schedule.

(2) EPA reserves the right to request further documentation of the manufacturers' test results. EPA also reserves the right to verify test results and consider the results of EPA's verification testing in determining whether the dispersant meets listing criteria. EPA will, within 60 days of receiving a complete application as specified in §300.915(a) of this part, notify the manufacturer of its decision to list the product on the Schedule, or request additional information and/or a sample of the product in order to review and/or conduct validation sampling. If EPA requests additional information and/or a product sample, within 60 days of receiving such additional information or sample, EPA will then notify the manufacturer in writing of its decision to list or not list the product.

(3) Request for review of decision. (i) A manufacturer whose product was determined to be ineligible for listing on the NCP Product Schedule may request EPA's Administrator to review the determination. The request must be made in writing within 30 days of receiving notification of EPA's decision to not list the dispersant on the Schedule. The request shall contain a clear and concise statement with supporting facts and technical analysis demonstrating that EPA's decision was incorrect.

(ii) The Administrator or his designee may request additional information from the manufacturer, or from any other person, and may provide for a conference between EPA and the manufacturer, if appropriate. The Administrator or his designee shall render a decision within 60 days of receiving the request, or within 60 days of receiving requested additional information, if appropriate, and shall notify the manufacturer of his decision in writing.

(b) Surface washing agents, surface collecting agents, bioremediation agents, and miscellaneous oil spill control agents.

(1) To add a surface washing agent, surface collecting agent, bioremediation agent, or miscellaneous oil spill control agent to the NCP Product Schedule, the technical product data specified in §300.915 must be submitted to the U.S. Environmental Protection Agency, Oil Program Center, 1200 Pennsylvania Avenue, NW,

Washington, DC 20460. The telephone number is 1-202-260-2342. If EPA determines that the required data were submitted, EPA will add the product to the Schedule.

(2) EPA will inform the submitter in writing, within 60 days of the receipt of technical product data, of its decision on adding the product to the Schedule.

(c) The submitter may assert that certain information in the technical product data submissions, including technical product data submissions for sorbents pursuant to §300.915(g)(3), is confidential business information. EPA will handle such claims pursuant to the provisions in 40 CFR part 2, subpart B. Such information must be submitted separately from non-confidential information, clearly identified, and clearly marked "Confidential Business Information." If the submitter fails to make such a claim at the time of submittal, EPA may make the information available to the public without further notice.

(d) The submitter must notify EPA of any changes in the composition, formulation, or application of the dispersant, surface washing agent, surface collecting agent, bioremediation agent, or miscellaneous oil spill control agent. On the basis of this data, EPA may require retesting of the product if the change is likely to affect the effectiveness or toxicity of the product.

(e) The listing of a product on the NCP Product Schedule does not constitute approval of the product. To avoid possible misinterpretation or misrepresentation, any label, advertisement, or technical literature that refers to the placement of the product on the NCP Product Schedule must either reproduce in its entirety EPA's written statement that it will add the product to the NCP Product Schedule under §300.920(a)(2) or (b)(2), or include the disclaimer shown below. If the disclaimer is used, it must be conspicuous and must be fully reproduced. Failure to comply with these restrictions or any other improper attempt to demonstrate the approval of the product by any NRT or other U.S. Government agency shall constitute grounds for removing the product from the NCP Product Schedule.

DISCLAIMER

[PRODUCT NAME] is on the U.S. Environmental Protection Agency's NCP Product Schedule. This listing does NOT mean that EPA approves, recommends, licenses, certifies, or authorizes the use of [PRODUCT NAME] on an oil discharge. This listing means only that data have been submitted to EPA as required by subpart J of the National Contingency Plan, §300.915.

Appendix G
Examples of Applied Alternate Sorbent Products Not Required to be Listed on the NCP Product Schedule

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List of Sorbent Products Not Required to be Listed on the NCP Product Schedule.

Product Name	Manufacturer/Vendor	Letter Sent
Abzorbit	Abzorbit, Inc.	03/22/1999
All-Sorb 1	Nature Treat, Inc	09/09/1999
Cansorb	AVP Cansorb	11/22/1995
Cattail Down	c/o Ms. Donna Sorenson	02/21/2001
Cotton Gin Trash	c/o Dr. J.A. Pinkard	01/30/1997
Dica-Sorb	Grefco Minerals Inc.	No letter on file
ENVIRO-BOND 403	Petroleum Environmental Technologies, Inc.	05/01/1998
Envirosorb	Sammie Bonner Construction Co., Inc	
Exsorbet	Waste Solutions, Corp.	11/08/2000
FyBX Fibers	FyBX Corporation	01/05/2000
Geo-Sorb	Trade Development International	01/03/1996
HSS SORB	Hydrocarbon Spills Solution, Corp.	06/25/1999
Imbiber Beads	Imbibitive Technologies	12/11/1995
MEGA Sorbent	PTC Enterprises, Inc.	05/17/2000
Micro-Crumb Rubber	D.K.M., Inc.	01/22/2001
MOP FSC #201	Fundamental Solutions, Inc.	12/02/1998
MOP FSC #301	Fundamental Solutions, Inc.	03/19/2001
MOP FSC #401	Fundamental Solutions, Inc.	12/09/1998
Nature-Sorb	Kenex Hemp LTD	12/15/2000
OARS	AB-TECH Industries	08/05/1996
Oclansorb	Premium Supply Company Inc.	09/19/1995
Oil Gator	Product Services Marketing Group	07/08/1998
Oilik	115 Forster Ave.	No letter on file.
Peat Sorb™	Zorbit Technologies, Inc.	03/14/2000
Pristine Sea	Marine Systems	05/05/1995
RamSorb	Williams Environmental	11/23/1998
Remediator, The	Enviro-Marine	07/07/1999
Rubberizer	Haz-Mat Response Technologies, Inc.	04/07/1998
SD1	Mansfield & Alper, Inc.	04/18/1997

Product Name	Manufacturer/Vendor	Letter Sent
SeaFoam	Huntsman Polyurethanes	03/09/2001
Sea Sweep	Sea Sweep, Inc.	01/13/1995
S.O.A.K	T&H Enterprizes	No letter on file
Sphag Sorb	Environmental Cleanup Systems	05/05/2000
Spill-sorb	Moore Green	01/30/2001
Super-Buoyant Boom	Mansfield & Alper, Inc.	04/18/1997
Suprasec X1002	Brixham Environmental Laboratory	12/1997
Versipad	Mansfield & Alper, Inc.	04/18/1997
Zorbolite	Global Environmental of California	No letter on file

If you have any questions about the claims of a particular product or to verify a product's status on the NCP Product Schedule, contact the USEPA Oil Program Center at 202-260-2342 or 703-603-9918.

Appendix H
Copies of Worksheets/Forms/Templates

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WORKSHEET 1: SELECTION GUIDE DECISION TRACKING/ EVALUATION WORKSHEET

This worksheet is intended to be photocopied for use during drills and incidents

Name(s):

Date:

Incident:

	Mark Choices with an **X**	Sorbents	Bioremediation Agents	Dispersants	Elasticity Modifiers	Emulsion Treating Agents	Fast-Water Booming Strategies	Fire Fighting Foams	In-situ Burn (ISB)	Non-floating Oil Strategies	Oil Tracking	Shoreline Pre-Treatment Agents	Solidifiers	Surface Collection Agents	Surface Washing Agents	Natural Attenuation	
A.	***Technology Choices of Interest:***																Future Products
B.	***Environmental matrix used:***																
C.	***Incident-specific Information:***																
	Response Phase																
	Oil Type																
	Treatment Volume																
	Weather Conditions																
	Decision Authority **NR** - No Spec. Reg. Req.s **PS** - Must be on Prod. Schd. **PA** - Pre-Authorization in Place **CR** - RRT Concurrence Req'd. **SP** - Special permit Req'd.																
	Monitoring **SM** - SMART Monitoring **OM** - Effectiveness or Other																
D. (check)	**Considerations**																
☐	Limited Oil Handling and Storage Capacity																
☐	Oil On Fire or Potential for Fire																
☐	No Oil Containment and Recovery Options																
☐	Oil Contaminated Substrate																
☐	Light Oil Type - Difficult to Recover/Skim																
☐	Oil Will Form an Emulsion																
☐	Oil Has Formed an Emulsion																
☐	Oil Has/Is Likely to Sink																
☐	Buried Oil																
☐	Oil Likely to be Remobilized																
☐	Fast Currents Prevent Effective Booming																
☐	Need to Protect Against Significant Surface and Shoreline Impacts, Including Marshland																
☐	Need to Protect Against Significant Water Column and Benthic Impacts																
☐	Oiled Site is Access Limited																
☐	Oiled Shoreline/Substrate Needs Cleaning Without Significant Impacts																
☐	Significant Problem of Waste Generation																
☐	Vapor Suppression																
☐	Oil on Roadways																
☐	Water Intakes at Risk																
☐	Oil Trapped in Vegetation																
☐	Oil Trapped in Snow and Ice																
☐	Confined Spaces with Water/Vapors? (sewers, culverts, etc.)																
E.	***Habitat and Sensitive Resource Evaluation***																
	Habitats (refer to Table 3, pg. 29)																
	Natural Resources (refer to Table 4, pg. 33)																
F.	***Evaluation Results***																

Top Three Choices:			
Any Major Advantages:			
Any Major Disadvantages:			

Additional Comments/Decisions:

Signatures/Date of Review Team:

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WORKSHEET 2: PRODUCT SELECTION WORKSHEET

This worksheet is intended to be photocopied for each product category evaluated and used during drills and incidents and Faxed to the Incident Specific RRT for review. This worksheet may be used to evaluate 1, 2 or 3 separate products in an individual category.

Name(s):

Date:

Incident:

A:	**Product Category Being Reviewed:**			
	Products of Interest:	**Product 1**	**Product 2**	**Product 3**
B:	**Product Name:**			
C:	**RRT Approval Required? (Y/N)**			
D:	**Can Product Arrive in Time? (Y/N)**			
E:	**Can Product be Applied in Time? (Y/N)**			
F:	**Can Product be removed from the Environment? (Y/N)**			
G:	**Toxicity (Write in numbers and Toxicity Rating. See App E for more information on toxicity and Toxicity Rating)**	Inland silversides (96h): Mysid Shrimp (48h):	Inland silversides (96h): Mysid Shrimp (48h):	Inland silversides (96h): Mysid Shrimp (48h):
H:	**Mark as 1st, 2nd, or 3rd Choice or mark as Not Applicable for this incident**			

I: Additional Comments/Decisions/Recommendations:

J: Initials/Date of Incident-Specific RRT Review of Information:

Initial Box and Include Date Upon Review

USEPA:	☐	Date:	**STATE:**	☐	Date:____________________
USCG:	☐	Date:	**STATE:**	☐	Date:____________________
NOAA:	☐	Date:	**OTHER:**	☐	Date:____________________
USDOI:	☐	Date:	**OTHER:**	☐	Date:____________________

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WORKSHEET 3: TESTING & MONITORING WORKSHEET

This worksheet is intended to be photocopied for each product category evaluated and used during drills and incidents and Faxed to the Incident Specific RRT for review. Use additional paper if needed to record information.

Name(s):

Date:

Incident:

Products of Interest:		**Product 1**	**Product 2**	**Product 3**
A:	**Product Name:**			
B:	**Has a tailgate test proven that product is effective on oil type at this state of weathering? (Y/N)**			
Products to Consider for Additional Testing:		**Product 1**	**Product 2**	**Product 3**
C:	**Products still being considered:**			
D:	**Has a Field Effectiveness test or Effects Test been carried out? (Y/N)**			
E:	**Describe test protocols:**			
	Test site specifics (environment):			
	Natural resources at risk:			
	Volume of oil to be treated:			
	Application rate(s)/volume used:			
	Application equipment:			
	Other logistical considerations:			
	Physical impacts expected:			
	Is the oil recoverable?:			
	Expected outcomes of test:			
F:	**Recommended Level of Monitoring for this test (Refer to Part D to Determine)**			
G:	**Mark as 1st, 2nd, 3rd Choice or Not Applicable for use during this incident**			

H: Additional Comments/Recommendations on the use of product(s):

I: Initials/Date of Incident-Specific RRT Review of Information:

Initial Box and Include Date Upon Review

USEPA: ☐ Date:		**STATE:** ☐	Date:____________________
USCG: ☐ Date:		**STATE:** ☐	Date:____________________
NOAA: ☐ Date:		**OTHER:** ☐	Date:____________________
USDOI: ☐ Date:		**OTHER:** ☐	Date:____________________

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History	**Name of Spill/Vessel/Location:** **Date of Spill (mm/dd/yy):** **Location of Spill:** **Latitude:** **Longitude:** **Oil Product:** **Oil Type (USCG Classification code):** **Barrels:** **Source of Spill:**
Technical Information	**Source of Spill:** **Resources at Risk:** **Applied Technologies/Optional Response Countermeasure(s) Used:** **How This Countermeasure Was Used (*purpose, application quantity, date, method*):** **Shoreline Types Impacted:** **Incident Summary (*specifics*):** **Behavior of Oil Before and/or After Treatment:** **Other Countermeasures and Mitigation:** **Lessons Learned from Optional Response Countermeasure Use:** **Recommendations for future Optional Response Countermeasure Use:** ***Please attach any necessary data and/or reports to this form.***
Contact Information	**Contact Name:**____________________ **Position:** ____________________ **Agency:** ____________________ **Address:**____________________ **Phone:** **FAX:**
Questions?/ Submittal	Contact 843-766-3118 for additional assistance/questions. Submit this form via FAX to 843-766-3115, email dscholz@seaconsulting.com or mail it to Debra Scholz, SEA, Inc. 109 Wappoo Creek Drive, Suite 4B, Charleston, SC 29412. Thank you for your assistance in this matter.

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Appendix I
Draft Press Releases for Applied Technologies

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Draft Press Release
Regional Response Team ___
Date: ____________

ATTENTION:

Proposed Use of Bioremediation Agent

In response to oil spill cleanup issues associated with the _______________________ oil spill incident, the Region ___ Regional Response Team, in coordination with the Unified Command on scene, has given approval to use the bioremediation agent ___________________ as a long-term remediation mechanism for this incident under the following conditions:

The bioremediation action will be monitored by ***(list agencies; contacts if necessary)***

FAQs on Bioremediation

What is Bioremediation?

The objective of bioremediation is to accelerate the rate of hydrocarbon degradation due to natural microbial processes. Naturally occurring microbes, such as bacteria, in the soil and water can consume and digest oil products, reducing the oil to carbon dioxide and water. Bioremediation is usually performed with one, or both, of two basic methods:

Nutrient Enrichment – This is the addition of nutrients (generally nitrogen and phosphorous) to stimulate microbial growth. This method is typically used when scientists believe that natural nutrient levels are low, and that the addition of nutrients will increase microbial growth and numbers.

Natural Microbe Seeding – This is the addition of high numbers of natural oil-degrading microorganisms. This method is used when scientists determine that there are low numbers of the indigenous bacteria types that degrade oil. Typically, nutrients are also included to help support the added microbes. .

Some bioremediation products contain surfactants to break up the oil into droplets. This increases the surface area of the oil, which will increase the rate of microbial degradation.

When is Bioremediation Used?

Typically, bioremediation is used after other techniques have been used to remove free oil and gross contamination or when further oil removal is likely to be destructive, ineffective, or cost-prohibitive. On water, it may be used in small, static water bodies, such as ponds and man-made lagoons.

- Nutrient Enrichment is used when low nutrient levels are limiting the rate of natural biodegradation.
- Natural Microbe Seeding is used when indigenous oil-degrading microbes are present in low numbers (<10^6/gram sediment)

What Authority is Required to Use Bioremediation Agents?

Incident–specific Regional Response Team (RRT) approval is required; Bioremediation products must be on the USEPA National Contingency Plan (NCP) Product Schedule in order to be considered for use.

What are the Health and Safety Issues Associated with Bioremediation Agent Use During This Incident?

Health and safety concerns are typically low for bioremediation. Before being added to the NCP Product Schedule, all products are tested to ensure that they do not contain pathogens.

Are There Any Waste Generation or Disposal Issues Associated With Using Bioremediation Agents?

Effective use of bioremediation agents should significantly reduce the amount of oily wastes generated.

Draft Press Release
Regional Response Team ___
Date: ____________

ATTENTION:
Proposed Use of Chemical Dispersants

In response to oil spill cleanup issues associated with the _______________________ oil spill incident, the Region ___ Regional Response Team, in coordination with the Unified Command on scene, has given approval to use the chemical dispersant ___________________ to promote rapid oil dispersion into the surrounding water column during this incident and under the following conditions (***list any pre-approval agreements, if applicable***):

The dispersant use will be monitored by ***(list agencies; contacts if necessary)*** using the methodology specified in the USCGs (1999) Special Monitoring of Applied Response Technologies (SMART) protocols (***refer/make available the SMART fact sheet and guidance document available from: www.response.restoration.NOAA.gov/oilaids/SMART***/SMART.html) .

FAQs on Dispersants

What are Chemical Dispersants?

Chemical dispersants are chemical mixtures that are composed of chemical compounds referred to as surfactants and solvents. The solvent is the chemical carrier that allows the surfactant to penetrate the oil molecule so that it lines up to break the interfacial tension between the oil and water, allowing the oil to break up into tiny droplets that mix into the water column, thus removing the threat of the oil from the water surface to within the water column.

Dispersion is a natural process that occurs in surface slicks as wind and wave action break up the surface slick. However, naturally dispersed oil droplets tend to recoalesce and return to the water surface and reform as surface slicks. The addition of chemical dispersants allows the wind and wave action to permanently mix the oil droplets into the water column. Typically, water currents beneath the surface then carry the small oil droplets away and dilute the concentration of the droplets in the water column; these dispersed oil droplets are then targeted by indigenous oil-consuming microbes where they are broken down into their ultimate components, carbon dioxide and water.

A simple example can be seen with a bottle of oil and vinegar salad dressing. When first picked up the bottle clearly contains a layer of oil above a layer of vinegar. However, when shaken, the oil mixes in with the vinegar as tiny droplets. This is similar to both natural and chemical dispersion on a very small scale. Like natural dispersion, if over time the agitation source (shaking) is removed, the oil and vinegar will separate out. The addition of chemical dispersants to the oil and vinegar would act to permanently mix the oil into the vinegar.

Draft Press Release
Regional Response Team ___
Date: ____________

Why are Chemical Dispersants Used?

Chemical dispersants are typically used because oil dispersion does the following:

- Decreases the size of, or largely removes, the oil slick. As a result of this:
  - Less, or no oil will be blown onto shore to impact beaches and other sensitive areas.
  - Impacts to seabirds and marine mammals living on the surface of the water will be reduced.
  - The hazard to shipping lanes and private boaters from the slick will be reduced.
- Oil is broken into tiny droplets, making it easier for naturally occurring microbes to digest it, thereby transforming the oil into carbon dioxide and water.

When are Chemical Dispersants Used?

- When an oil spill is in the ocean and offshore.
- When dispersing the oil will cause less environmental impact than surface slicks that will strand on shore or impact sensitive water-surface resources, such as sea birds.
- When other response techniques, such as mechanical recovery, are inappropriate due to high seas or other conditions.
- Dispersants are sometimes applied to only part of a large slick in order to allow the available resources to handle the large volume of oil, or to disperse a part of the slick that is posing an imminent threat to a sensitive resource.
- Although dispersants can be an important part of a response, it should be noted that dispersants are not likely to be 100% effective. As a result, the need for mechanical recovery and shoreline cleanup may not be eliminated with their use.

What Authority is Required to use Chemical Dispersants?

Incident–specific Regional Response Team (RRT) approval is required; Chemical dispersant products must be on the USEPA National Contingency Plan (NCP) Product Schedule in order to be considered for use. In many areas, pre-approval zones for chemical dispersant use have already been predefined.

What are the Health and Safety Issues Associated with the Use of Chemical Dispersants During This Incident?

Response workers must be careful to ensure that personnel do not get sprayed by the dispersants, or come in contact with any of the overspray. Vessels must only be deployed under safe sea conditions.

Are There Any Waste Generation or Disposal Issues Associated With the Use of Chemical Dispersants?

Effective use of dispersant agents should significantly reduce the amount of oily wastes generated.

ATTENTION:
Proposed Use of Emulsion Treating Agents

In response to oil spill cleanup issues associated with the _______________________ oil spill incident, the Region ___ Regional Response Team, in coordination with the Unified Command on scene, has given approval to use the emulsion treating agent ___________________ to prevent and treat oil in water emulsions during this incident. Use is approved under the following conditions:

Emulsion treating agent use will be monitored by ***(list agencies; contacts if necessary)***

FAQs on Emulsion Treating Agents

What are Emulsion Treating Agents?

When oil is spilled on water it typically floats on, or near, the surface. Wind and wave action can cause this layer of oil to mix with the water, creating what is known as an emulsion. This often occurs in strong seas or as waves crash against sand and rocks along the shoreline. Emulsions typically look like a heavy, frothy layer of oil. Emulsions pose a problem because they contain anywhere from 20-80% water, which will greatly reduce the efficiency of oil skimmers and pumps, which may collect more water than oil due to the emulsion. Most emulsion treating agents are made of water soluble surfactants that act to either prevent the initial formation of an emulsion or to separate, or "break", an emulsion back into its separate oil and water components.

When are Emulsion Treating Agents Used?

<u>Emulsion inhibitors</u> are typically used to increase the window of opportunity for other response options, such as dispersants or *in situ* burning. They are also used to maintain a high recovery rate for oil skimmers.

<u>Emulsion breakers</u> are often used to treat already formed emulsions, so that upcoming response efforts will be more effective. For example, lab tests showed that treatment with emulsion breakers allowed successful burning of otherwise unignitable emulsions. Emulsion breakers are also used to separate oil from water in collection tanks, so that the water can be discharged and the tanks completely filled with oil. Skimmers can quickly fill their tanks with emulsions that are more water than oil. Use of emulsion breakers can extend the operational time and efficiency of collection equipment such as skimmers.

What Authority is Required to use Emulsion Treating Agents?

Incident–specific Regional Response Team (RRT) approval is required; emulsion treating agents must be on the USEPA National Contingency Plan (NCP) Product Schedule in order to be considered for use during oil spill response operations. RRT approval is not required if they are applied in closed containers and the separated water is sent to a water treatment facility (e.g., wastewater treatment plant).

What are the Health and Safety Issues Associated with the Use of Emulsion Treating Agents during this incident?

Most products require Level D personal protection and a respirator when being handled in confined spaces (e.g., when filling aircraft spray systems).

Are There Any Waste Generation or Disposal Issues Associated With the Use of Emulsion Treating Agents?

Effective use of emulsion treating agents should reduce the amount of oily material generated for handling, transport, and disposal. In containers, separated water would likely have to be tested and/or treated prior to discharge.

ATTENTION:
Proposed Use of *In situ* Burning

In response to oil spill cleanup issues associated with the _______________________ oil spill incident, the Region ___ Regional Response Team, in coordination with the Unified Command on scene, has given approval to conduct *In situ* burning _________(***on land, inland water, coastal marine***) during this incident. Use is approved under the following conditions (***list any pre-approval agreements, if applicable***):

This *In situ* burn will be monitored by ***(list agencies; contacts if necessary)*** using the methodology specified in the USCGs (1999) Special Monitoring of Applied Response Technologies (SMART) protocols (***refer/make available the SMART factsheet and technical document available from: www.response.restoration.NOAA.gov/oilaids/SMART/SMART.html***

FAQs on *In situ* Burning

What is *In situ* Burning?

In some cases, oil spills occur in areas, or under conditions in which it is difficult to recover the spilled oil product. For example, the oil may be spilled in a field covered with brush, or a remote area without easy access, where typical recovery methods will not work or could cause further damage to the habitat. In such cases it may be more practical and safer for the environment to burn the oil where it is before it sinks deep into the ground or spreads to other areas. *In situ* burning is the controlled burning, in place, of the oil released during a spill. After careful consideration of winds, weather, and the location of populated areas, along with the notification of local fire and police departments, the oil is ignited and allowed to burn off. If the oil will not light by itself, a substance, such as diesel fuel mixed with gasoline, will be applied initially and used as an “igniter”. Although *in situ* burning typically produces a dark smoke cloud, it is a frequently used method to rapidly dispose of spills and limit impacts.

In situ burning is nearly 100 percent effective, although a burn residue often needs to be dealt with following the controlled burn. This residue is typically very easy to recovery as it is no longer in a “liquid” phase and has been recovered using manual removal equipment in past burns.

When should *In situ* Burning be Used?

- When oil needs to be removed quickly in order to prevent it from spreading to sensitive areas or over a larger area.
- To reduce the generation of oily wastes, especially when disposal or transportation options are limited.
- Where access to the spill site is limited by shallow water, soft substrates, thick vegetation, or the remoteness of the location.
- As a final removal technique, when other methods begin to lose effectiveness or become too intrusive.

What Authority is Required to Perform *In situ* Burning?

For inland burns, approval from the appropriate state agencies (including the agency regulating air quality) is required.

Incident–specific Regional Response Team (RRT) approval is not required unless an accelerant (burning agent) is used. Trustee notification is recommended and required in Region IV.

What are the Health and Safety Issues Associated with the Use of *In situ* Burning during this incident?

Wind and weather conditions must be watched carefully to ensure that the smoke plume will not impact the public. Human health and safety is always of primary concern.

Are There Any Waste Generation or Disposal Issues Associated With the Use of *In situ* Burning?

Effective use of *in situ* burning should significantly reduce the amount of oily wastes generated.

Draft Press Release
Regional Response Team ___
Date: ____________

ATTENTION:
Proposed Use of Solidifiers

In response to oil spill cleanup issues associated with the ______________________ oil spill incident, the Region ___ Regional Response Team, in coordination with the Unified Command on scene, has given approval to use the solidifier ______________ during this incident. Use is approved under the following conditions (*also* ***list any pre-approval agreements, if applicable***):

The solidifier use will be monitored by ***(list agencies; contacts if necessary)***

FAQs on Solidifiers

What are Solidifiers?

Technically, most solidifiers are synthetic polymers that either physically or chemically bond with organic liquids. What this means for an oil spill responder is that when solidifiers are mixed with liquid oil, they will turn it into a coherent mass. This action can have many benefits when cleaning up an oil spill. However, the primary benefit that solidifiers usually offer is that they can help to prevent the rapid spreading of liquid oil, in order to protect the surrounding environment and containing the oil for cleanup.

When should Solidifiers be used?

- When oils are volatile. Solidification can reduce the vapor pressure of oil. This means that the spilled oil will emit fewer fumes that may be highly flammable or dangerous to humans and other animals.
- When oil needs to be immobilized so that it does not spread out or sink into the soil. Solidifiers can be applied to all of the spilled oil, or only applied the edges of a spill in order to form a barrier, or dam, to contain the oil.
- To block oil that may be running off into drains or sewers.

What Authority is required to Use Solidifiers?

Incident–specific Regional Response Team (RRT) approval is required; solidifiers must be on the USEPA National Contingency Plan (NCP) Product Schedule in order to be considered for use during oil spill response operations.

What are the Health and Safety Issues Associated with the Use of Solidifiers during this incident?

Human health and safety is always of primary concern. Typically, solidifiers pose little or no risk for health and safety, as long as they are used with care and as directed.

Are There Any Waste Generation or Disposal Issues Associated With the Use of Solidifiers?

Most solidifiers are not reversible, so disposal options always have to be considered carefully. In some cases, solidified oils can be safely disposed of in non-hazardous landfills after passing leachate tests. In other cases, solidified oils may be used as fuel for cement kilns, incinerators, etc. Disposal options will vary, depending on the oil type and solidifier used.

Draft Press Release
Regional Response Team ___
Date: ____________

ATTENTION:
Proposed Use of Surface Collecting Agents

In response to oil spill cleanup issues associated with the _______________________ oil spill incident, the Region ___ Regional Response Team, in coordination with the Unified Command on scene, has given approval to use the surface collecting agent ______________ during this incident. Use is approved under the following conditions (*also* ***list any pre-approval agreements, if applicable***):

The surface collecting agent use will be monitored by ***(list agencies; contacts if necessary)***

FAQs on Surface Collecting Agents

What are Surface Collecting Agents?

Surface collecting agents are chemicals that "push" or "compress" oil on the water surface, to form thicker slicks that are more readily collected. For example, if a surface collecting agent was applied around the edges of a swimming pool, and some oil was then poured into the center of the pool, the agents would "push" the oil away from the edges and keep it contained in the center. The oil would not come in contact with the sides of the swimming pool. Because of the way they work, these products are also known as "herders". Surface collecting agents do this because they exert a spreading pressure on the water surface that is greater that the oil's spreading pressure. They contain special types of surfactants that act to reduce the surface tension of water to increase their spreading pressure. Effective surface collecting agents have the following characteristics: they have a low evaporation rate, low water and oil solubility, do not disperse or emulsify, and have a high spreading pressure (>35 x 10^{-7} Newtons/m).

When should Surface Collecting Agents be used?

- To push oil out of inaccessible areas, such as underneath piers.
- To collect oil into a smaller and thicker slick to increase recovery rates
- For short term protection of areas where deploying booms is not possible, or could cause more damage
- These products are more effective when they have something to push against, like a bulkhead or inside semi-enclosed inlets.

What Authority is required to Use Surface Collecting Agents?

Incident–specific Regional Response Team (RRT) approval is required; surface collecting agents must be on the USEPA National Contingency Plan (NCP) Product Schedule in order to be considered for use during oil spill response operations.

What are the Health and Safety Issues Associated with the Use of Surface Collecting Agents during this incident?

Human health and safety is always of primary concern. Typically, surface collecting agents pose little or no risk for health and safety, as long as they are used with care and as directed.

Are There Any Waste Generation or Disposal Issues Associated With the Use of Surface Collecting Agents?

None, the product does not change the physical condition or volume of the oil. The surface collecting agent is not recovered.

Draft Press Release
Regional Response Team ___
Date: ____________

ATTENTION:
Proposed Use of Surface Washing Agents

In response to oil spill cleanup issues associated with the _______________________ oil spill incident, the Region ___ Regional Response Team, in coordination with the Unified Command on scene, has given approval to use the surface washing agent ______________ during this incident. Use is approved under the following conditions (*also* ***list any pre-approval agreements, if applicable***):

The surface washing agent use will be monitored by ***(list agencies; contacts if necessary)***

FAQs on Surface Washing Agents

What are Surface Washing Agents?

Surface washing agents contain surfactants, solvents, and/or other additives that work to clean oil from boats, piers, rocks, etc. Many products work much like dishwashing detergent. They pull the oil off of the substrate (boat, pier, etc.) and it is broken into small droplets, where it is kept in suspension by the surfactant (soap).

When should Surface Washing Agents be used?

- On hard-surface shorelines, where there is a strong desire to remove residual oils
- When oil has weathered, so that it cannot be removed from the substrate with ambient water temperatures and low water pressures
- When oil is trapped in areas inaccessible to physical removal, but which can be flushed out. In such cases the washwaters must be contained. Examples are sewers, storm drains, and ravines.
- For vapor suppression of volatile fuel spills that have entered sewers. Also, to enhance flushing of these types of spills. Again, washwaters must be contained.

What Authority is required to Use Surface Washing Agents?

- **Incident–specific Regional Response Team (RRT) approval is required;** surface washing agents must be on the USEPA National Contingency Plan (NCP) Product Schedule in order to be considered for use during oil spill response operations.
- RRT approval is not required if they are used in a manner in which the runoff, or washwater, is not released into the environment. An example of this would be the use of surface washing agents inside of a holding tank.
- Fire departments and HAZMAT Teams have the authority to "hose down" a spill using a chemical countermeasure if they determine that the spilled oil could cause an explosion or threaten human health.

What are the Health and Safety Issues Associated with the Use of Surface Washing Agents during this incident?

- Human health and safety is always of primary concern. All products require Level D personal protection with splash protection. Care needs to be taken to avoid slips and falls while working on soapy and oily surfaces.

Are There Any Waste Generation or Disposal Issues Associated With the Use of Surface Washing Agents?

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

Appendix J
Applied Technology Case History Summaries

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Bioremediation, On Adjacent Land

Name of Spill/Vessel/Location: Houston, AK
Date of Spill (mm/dd/yy): 12/25/97
Date of Application (mm/dd/yy): 12/25/97
Location of Spill: Mat-Su Borough
Oil Product: Heating Oil
Oil Type (USCG Classification code): DF2
Barrels spilled: 23 bbls (1,000 gal)
Estimated treatment volume: 23 bbls (1,000 gal)
Source of Spill: 1,000 gallon above ground storage tank
Was Treated Oil on Land, Coastal Waters, or Inland Waters? On adjacent land

Resources at Risk: Fresh water lake approximately 300 feet down gradient

Oil Spill Applied Technology Used: UC-40 Microbes

How Countermeasure Was Used: Microbes were brewed and injected into ground

Shoreline Types Impacted: None

Incident Summary (specifics): Fuel tank line severed and drained 1,000 gallons of fuel into ground then impacted "French" drainage system. Systems effluent was approximately 150 feet from spill zone, and daylighted outside of a sloped hill.

Behavior of Oil (before and after treatment): Oil has just begun to run out effluent of French drain system, when injection began.

What problem was this technology intended to address?: Bioremediating the spill to stop threat to freshwater lake.

Lessons Learned/Recommendations from Oil Spill Applied Technology Use: Microbes reduced DRO levels to near non-detectable levels from the effluent. No impact to lake.

Additional References: N/A

Respondent Name: Bob Dreyer
Incident Contact: Bob Dreyer
Position: Environmental Specialist
Agency: ADEC
Address: 555 Cordova Street, Anchorage, AK 98501
Phone: 907-269-7688
FAX: 907-269-7648
email: not provided

Surface Washing Agent, On Adjacent Land

Name of Spill/Vessel/Location:	Bouchard 155
Date of Spill (mm/dd/yy):	08/03/93
Date of Application (mm/dd/yy):	08/31/93
Location of Spill:	St. John's Pass, Tampa Bay, Florida
Oil Product:	No. 6 fuel oil
Oil Type (USCG Classification code):	Type IV
Barrels spilled:	7,860 (325,000 gallons)
Estimated treatment volume:	Not calculated; oil coat was treated on a 50 ft^2 area of concrete walkway
Source of Spill:	Three-vessel collision

Was Treated Oil on Land, Coastal Waters, or Inland Waters? On Land

Resources at Risk: nesting loggerhead sea turtles and their nests, brown pelicans, cormorant, tern, egret, heron species, recreational beaches.

Oil Spill Applied Technology Used: PES-51 versus high-pressure, hot-water flushing

How Countermeasure Was Used: On concrete and riprap to remove oil coat; In tests to determine which process worked better

Shoreline Types Impacted: Seawalls and riprap

Incident Summary (specifics): RRT approval was given to use PES-51 to assist in cleaning rock jetties, concrete walkways, metal railings, and wooden walkways in the vicinity of John's Pass and blind Pass that were affected by the spill. However, the PES-51 was not actually used; high-pressure, hot-water was used to clean the John's Pass jetties and walkways.

Behavior of Oil (before and after treatment): Both treatment effects effectively removed the oil coat from the walkway, although slightly less stain remained on the PES-51 treated section. Brushing/scrubbing did not appear to significantly enhance PES-51 effectiveness. Wash water contained mobilized oil. Cleaning was accomplished more quickly with PES-51 than with high-pressure, hot water washing.

What problem was this technology intended to address?: During test on riprap, an over-application of the product occurred.

Lessons Learned/Recommendations from Oil Spill Applied Technology Use: Verify that the application rates specified are being used. Ensure that sufficient sorbent material is deployed to recovery all oily wash waters.

Additional References:

Respondent Name:	Not provided
Incident Contact:	Ruth Yender or Brad Benggio
Position:	Biological Assessment Team and Scientific Support Coordinator
Agency:	NOAA
Address:	7600 Sand Point Way, NE, Seattle, WA
Phone:	206-526-6317
FAX:	206-526-6329
email:	ruth_yender@noaa.gov

Surface Washing Agent, On Adjacent Land

Name of Spill/Vessel/Location: Morris J. Berman
Date of Spill (mm/dd/yy): 01/07/94
Date of Application (mm/dd/yy): not available
Location of Spill: San Juan Bay, San Juan, PR
Oil Product: No. 6 fuel oil
Oil Type (USCG Classification code): Type V
Barrels spilled: 17,000 (713,269 gallons)
Estimated treatment volume: surface oil coat/stain
Source of Spill: Grounding of barge on reef north of San Juan Bay, PR
Was Treated Oil on Land, Coastal Waters, or Inland Waters? On adjacent land

Resources at Risk: Seagrasses and its infauna
Oil Spill Applied Technology Used: Corexit 9580, PES-51, and Corexit 7664 as an after cleaning agent
How Countermeasure Was Used: Used as Surface washing agents to clean beach rock and riprap and comparing the chemical products with high-pressure, hot-water washing.
Shoreline Types Impacted: beach rock and riprap
Incident Summary (specifics): On beach rock, water alone was not effective below 175°F and 1,000 psi, the pressure at which friable rock began to chip. On riprap, water up to 1,200 psi and 175°F was effective on smooth surfaces but not on rougher pieces. Both chemical products were more effective than water alone. The Corexit 9580 plots appeared to be cleaner, but the differences were not large. There was no dispersion of the oil treated with PES-51, whereas water flushed from the Corexit 9580 plots contained muddy brown water, indicating some dispersion at the high water pressures used. The Corexit 7664 flush provided no added oil removal. The RRT approved the use of Corexit 9580 based on relative effectiveness and toxicity.
Behavior of Oil (before and after treatment): Heavy oil coated beach rock, riprap and sensitive historic structures that were not successfully cleaned through manual removal options.
What problem was this technology intended to address?: Address the heavy coat of oil on beach rock, riprap and historic structures.
Lessons Learned/Recommendations from Oil Spill Applied Technology Use: In practice, most hard substrates were cleaned with high-pressure, hot-water washing without chemical application because the water alone was effective. However, Corexit 9580 was used extensively with satisfactory results on several hundred yards of beach rock in high-use areas. Although approved for use on sensitive archaeological structures, Corexit 9580 was actually only used for a few test applications on historic masonry structures.
Additional References:
Michel, J. and B.L. Benggio. 1995. Testing and Use of Shoreline Cleaning agents during the Morris J. Berman oil spill. In: IOSC 1995. pp. 197-202.
Petrae , G. (ed.). 1995. Barge Morris J. Berman: NOAA's Scientific Response. HAZMAT Report 95-10, Seattle: Hazardous Materials Response and Assessment Division, NOAA. 63 pp.

Respondent Name: not provided
Incident Contact: Jacqueline Michel and Bradford Benggio
Position: Scientific Support
Agency: Research Planning, Inc. and NOAA
Address: PO Box 328, Columbia, SC 29201
Phone: 803-256-7322
FAX: 803-254-6445
email: jmichel@researchplanning.com

Surface Washing Agent, On Land

Name of Spill/Vessel/Location: Exxon Valdez, Prince William Sound, AK
Date of Spill (mm/dd/yy): March 1989
Date of Application (mm/dd/yy): July 1-4, 1993
Location of Spill: Sleepy Bay, Segment LA-19A), Prince William Sound, AK
Oil Product: weathered Alaska North Slope crude
Oil Type (USCG Classification code): Type III
Barrels spilled: approximately 260,000 (11,000,000 gallons)
Estimated treatment volume: unknown; oil coat and buried oil
Source of Spill: Exxon Valdez grounding
Was Treated Oil on Land, Coastal Waters, or Inland Waters? On land

Resources at Risk: Mussels, littorine snails

Oil Spill Applied Technology Used: PES-51

How Countermeasure Was Used: Field test application on aged oil (four years old) on surface substrate and subsurface through injection sites

Shoreline Types Impacted: cobble/gravel shoreline

Incident Summary (specifics): It was reported by on-site observers that the Product was quite effective at liberating oil from sediments. As long as water remained on the application area, surface sheens and free-floating brown/black oil could be seen. During and immediately after application a strong citrus smell was observed in the area.

Behavior of Oil (before and after treatment): During treatment the oil/water/PES-51 mixture adhered to the hand, although oil did not stick. The sticky mixture was easily wiped off. Similarly, the mixture did not stick or adsorb onto the rocks. By the next day, the oil did stick to rocks. Light sheens filled the inner boom area within one hour of the application. Very little brown/black oily product was in the boom area. Absorbent pads worked well in absorbing the oily mixture. For at least two hours after application, re-introduction of water liberated more oils/sheens.

What problem was this technology intended to address?: Subsurface oil and weathered oil stain on substrates

Lessons Learned/Recommendations from Oil Spill Applied Technology Use: General consensus that with more water, significantly less PES-51 would be needed. Much of the floating product acted like it had a lot of surfactant; it did not stick and made discrete small droplets

Additional References:

Respondent Name: Not provided
Incident Contact: Debbie Payton and John Whitney
Position: Scientific Support
Agency: NOAA
Address: 7600 Sand Point Way, NE Seattle, WA 98115
Phone: 206-526-6317
FAX: 206-526-6329
email: Debbie_Payton@hazmat.noaa.gov

Elasticity Modifier, On Water-Brackish

Name of Spill/Vessel/Location: UNOCAL facility, Port Neches, TX
Date of Spill (mm/dd/yy): 04/20/93
Date of Application (mm/dd/yy): 04/24/93
Location of Spill: Grays Bayou and the Neches River
Oil Product: Kuwaiti crude oil (API gravity = 33°)
Oil Type (USCG Classification code): Type III
Barrels spilled: 2,100 (88,200 gallons)
Estimated treatment volume: 15 gallons
Source of Spill: not provided
Was Treated Oil on Land, Coastal Waters, or Inland Waters? On water- brackish

Resources at Risk: not identified

Oil Spill Applied Technology Used: Elastol slurry

How Countermeasure Was Used: Applied to oil trapped in the booms adjacent to the shoreline. This patch was the largest single accumulation of oil left on the water surface.

Shoreline Types Impacted: steep clay bank fringed with trees and shrubs

Incident Summary (specifics):

Behavior of Oil (before and after treatment): After three-hour reaction time, most of the treated oil had drifted away from the shoreline and toward the center of the channel where a larger amount of oil waste trapped in the boom. All of the oil appeared as if it had been treated, leading to the conclusion that the treated and untreated oil had mixed. Physical appearance of the oil was different; oil appeared thicker, more textured looking; oil surface was irregular rather than smooth. The oil exhibited a sheeting action when pushed or pulled. It was not possible to physically pull the treated oil as a coherent mass or sheet.

What problem was this technology intended to address?: To aid in the removal of small pockets of oil floating on the water surface adjacent to the marshes and in narrow channels of open water extending into the marshes. There was no intention to apply Elastol to oil on marsh vegetation or to oil floating in the vegetation.

Lessons Learned/Recommendations from Oil Spill Applied Technology Use: Unable to get product to pour out of shipping container; had to cut top off of container to remove product. Product was hand mixed in hopper to manually break up lumps; however lumps reformed upon standing. No one on scene had previously operated the delivery system; have personnel experience with the product and equipment involved in the application. Do not over apply the product. Application concentration of 200 ppm would have been adequate. Product over applied at about 75 times the recommended application rate.

Additional References: Michel, J, C.B. Henry, and J.M Barnhill. 1993. Use of Elastol during the UNOCAL spill on the Neches River, 24 April 1993. Prepared for Regional Response Team VI. Seattle: Hazardous Materials Response and Assessment Division, NOAA. 10 pp.

Respondent Name:
Incident Contact: Jacqueline Michel
Position: Scientific Support Team
Agency: NOAA
Address: 7600 Sand Point Way, NE, Seattle, WA 98115
Phone: 206-526-6317
FAX: 206-526-6329
email: jmichel@researchplanning.com

Elasticity Modifier, On Water-Riverine

Name of Spill/Vessel/Location:	Sugarland Run pipeline spill, Reston, VA
Date of Spill (mm/dd/yy):	03/93
Date of Application (mm/dd/yy):	4/01/93 to 4/01/93
Location of Spill:	Potomac River
Oil Product:	Diesel fuel
Oil Type (USCG Classification code):	Type II
Barrels spilled:	407,000 gallons
Estimated treatment volume:	700 gallons
Source of Spill:	Pipeline break

Was Treated Oil on Land, Coastal Waters, or Inland Waters? On Water - riverine

Resources at Risk: not provided

Oil Spill Applied Technology Used: Elastol, elasticity modifier

How Countermeasure Was Used: applied to approximately 700 gallons of diesel fuel at a 1,000 ppm application rate in a slurry form. Tested elastol versus non treated oil to determine impact of Elastol addition for improving drum skimmer effectiveness.

Shoreline Types Impacted: not provided

Incident Summary (specifics): After application, a set time of 35 minutes. Treated oil showed viscoelasticity relative to untreated. Drum skimmers were activated for treated and un-treated oil slicks; treated oil skimmer was able to recover oil at twice the speed as the skimmer on the untreated oil without any gain in water collection. Clear migration of the diesel fuel towards the skimmer was visible in the treated area as the oil layer became thinner. No such migration was observed in the untreated area. RRT III authorized the deployment of Elastol to the three remaining sites in the catchment areas following this test; large scale deployment of elastol began and all skimming operations were performed normally. OSC then authorized the use of Elastol on all remaining sites in the Sugarland Run recovery sites.

Behavior of Oil (before and after treatment): tended to emulsify; the addition of the elastol changed the color of the treated oil, indicating that the degree of emulsification was being decreased.

What problem was this technology intended to address?: Wanted to assist oil recovery.

Lessons Learned/Recommendations from Oil Spill Applied Technology Use: Elastol increased recovery rates of drum skimmers without additional water. Reduced emulsification. Need trained crew to avoid over or under treatment. Application rates vary with viscosity of oil. Application requires metered application. Able to herd oil with water hoses without creating emulsions. Existing emulsions were seen to breakdown with application. Drum skimmer recovery rate doubled with application.

Additional References:
DESA. 1994. Sugarland Run Creek Spill Summary, Results and Lessons Learned. Presentation prepared form Region III RRT, Annapolis, MD.
RPI. 1993. Colonial Pipeline Company's Sugarland Run Pipeline Spill. Prepared for Damage Assessment Center, NOAA, Silver Spring, MD. 47 pp. + appendices.

Respondent Name:	not provided
Incident Contact:	not provided
Position:	not provided
Agency:	DESA
Address:	PO Box 7720, Arlington, VA 22207
Phone:	703-534-1144
FAX:	703-534-1172
email:	not provided

Surface Washing Agent, On Adjacent Land-Marsh

Name of Spill/Vessel/Location: Test Plot, Point aux Chiens Wildlife Management Area, LA
Date of Spill (mm/dd/yy): August 1995
Date of Application (mm/dd/yy): 1995 and 1996 growing seasons
Location of Spill: 12 – 8' x 8' test plots in *Spartina alterniflora* marsh
Oil Product: South Louisiana crude
Oil Type (USCG Classification code): Type III
Barrels spilled: applied at 2 L/m^{-2} onto plant canopy within plot areas
Estimated treatment volume: not provided
Source of Spill: test plot
Was Treated Oil on Land, Coastal Waters, or Inland Waters? On land, marsh grasses

Resources at Risk: marsh grasses and infauna

Oil Spill Applied Technology Used: Corexit 9580 surface washing agent

How Countermeasure Was Used: applied to oiled plant canopy two days after application at a rate of 0.33 L/m^{-2} using a portable garden sprayer and then flushed plant canopy for 5-10 minutes. Plant canopy was observed over the 1 year growing period.

Shoreline Types Impacted: *S. alterniflora* marsh grasses

Incident Summary (specifics): After application, biomass harvests conducted at the end of the growing season revealed that live biomass per unit are of marsh was significantly reduced under all treatments. In 1996, the live biomass had recovered to levels close to those of control plots. Oil can be effectively removed using Corexit 9580 in the field without any detectable adverse effects on plants. In addition, the beneficial effects of Corexit 9580 rapidly restored plant transpiration pathways under field conditions.

Behavior of Oil (before and after treatment): not provided

What problem was this technology intended to address?: This test was designed to determine the impacts to oiled marsh grasses when cleaned with Corexit 9580; particularly during the growing season, when impacts would be most severe.

Lessons Learned/Recommendations from Oil Spill Applied Technology Use: S. alterniflora if given adequate time, can recover from oiling with South Louisiana crude.

Additional References:

Pezeshki, S.R., R.D. DeLaune, J.A. Nyman, R.R. Lessard, and G.P. Canevari. 1995. Removing oil and saving oiled marsh grass using a shoreline cleaner. In IOSC 1995. pp. 203-209.

Pezeshki, S.R., R.D. DeLaune, A. Jugsujinda, G.P. Canevari, and R.R. Lessard. 1997. Major field test evaluates a shoreline cleaner to save oiled marsh grass. In IOSC 1997. pp. 397-402.

Respondent Name: not provided
Incident Contact: S.R. Pezeshki, R.D. DeLaune, A. Jugsujinda; G.P. Canevari; R.R. Lessard
Position: not provided
Agency: Department of Biology, University of Memphis
Address: U. of Memphis, Memphis, TN 38152
Phone: not provided
FAX: not provided
email: not provided

Elasticity Modifier, On Water - Riverine

Name of Spill/Vessel/Location:	St. Louis, MO storage tank fracture
Date of Spill (mm/dd/yy):	01/18/94
Date of Application (mm/dd/yy):	01/23/94
Location of Spill:	St. Louis, MO, West bank of the Mississippi River
Oil Product	unleaded gasoline
Oil Type (USCG Classification code):	Type I
Barrels spilled:	8,690 barrels (365,000 gallons)
Estimated treatment volume:	not provided
Source of Spill:	tank rupture

Was Treated Oil on Land, Coastal Waters, or Inland Waters? On water - riverine

Resources at Risk: not provided

Oil Spill Applied Technology Used: Elastol

How Countermeasure Was Used: Elasticity modifier to improve skimming

Shoreline Types Impacted: Shoreline between riprap and an ice shelf six feet out where current would pull the Elastol treated product straight to the operating Desmi 250 skimmer.

Incident Summary (specifics): Elastol was applied using the fire department's foam hoses. With no prior training, responders were given protocol test sheets, and they attempted to determine visually if the product was affecting the gasoline. This was hard to do 45 feet above the surface. The Desmi that had clearly been skimming product, did not show any real changes in efficiency. Exactly 20 minutes after application, the fire department applied foam to the area and ended the test.

Behavior of Oil (before and after treatment): No change was observed. However, at an early hand application of the product, the treated diesel fuel jammed the drum skimmer by thick strings of gelled product, evidence of an over application.

What problem was this technology intended to address?: Used as a test application since it was thought that physical effects on wildlife and habitat would be considerably lessened due to the spills' location, cold weather, and presence of ice.

Lessons Learned/Recommendations from Oil Spill Applied Technology Use: Proper application was one of the main concerns of the RRT.

Additional References:

Hartley, J.M, and D.F. Hamera. 1995. Response to a major gasoline release into the Mississippi river. In IOSC 1995. pp. 453-458.

Respondent Name:	not provided
Incident Contact:	CDR. Jane M. Hartley,
Position:	FOSC
Agency:	USCG
Address:	1222 Spruce Street, ST. Louis, MO 63103
Phone:	not provided
FAX:	not provided
email:	not provided

Name of Spill/Vessel/Location:	St. Louis, MO storage tank fracture
Date of Spill (mm/dd/yy):	01/18/94
Date of Application (mm/dd/yy):	01/20/94 and 01/23/94
Location of Spill:	St. Louis, MO, West bank of the Mississippi River
Oil Product	unleaded gasoline
Oil Type (USCG Classification code):	Type I
Barrels spilled:	8,690 barrels (365,000 gallons)
Estimated treatment volume:	6,000 gallons on river ice
Source of Spill:	tank rupture

Was Treated Oil on Land, Coastal Waters, or Inland Waters? On water - riverine

Resources at Risk: Human populations

Oil Spill Applied Technology Used: Aqueous film-forming foam (AFFF)

How Countermeasure Was Used: To suppress vapors from the gasoline that was flowing onto shoreline ice cover.

Shoreline Types Impacted: Riverine and shoreline covered in accessible and inaccessible ice with some snow cover.

Incident Summary (specifics): Fire department placed a foam blanket on the river site on two occasions and once in the tank farm during the emergency phase. Due to the weather the foam froze on the ice pack and the boom. The foam did not seem to affect the skimmers.

Behavior of Oil (before and after treatment): Oil spilled on ice underwent reduced evaporation due to extreme cold, until mid-day temperatures rose and vapor levels increased dramatically.

What problem was this technology intended to address?: oil and ice and vapor suppression

Lessons Learned/Recommendations from Oil Spill Applied Technology Use: As most foams contain surfactants, the actions of the current or boat traffic may increase the rate of dispersion of oil into the water column. BTEX levels in the river were found to be elevated 100 feet downstream. This may have been caused by the foam blocking the evaporation process and forcing higher amounts into the water column. The decision to use the foam was left to the fire chief and not challenged by responders as the fire chiefs concern was solely with the hazard posed by the gasoline vapors around the site, which increased the threat of explosion and fire.

Additional References:

Hartley, J.M, and D.F. Hamera. 1995. Response to a major gasoline release into the Mississippi river. In IOSC 1995. pp. 453-458.

Respondent Name:	not provided
Incident Contact:	CDR. Jane M. Hartley,
Position:	FOSC
Agency:	USCG
Address:	1222 Spruce Street, ST. Louis, MO 63103
Phone:	not provided
FAX:	not provided
email:	not provided

In situ Burning, On Adjacent Land - Marsh

Name of Spill/Vessel/Location: Superior Offshore Pipeline Company, Rockefeller Refuge, Cameron Parish, LA.

Date of Spill (mm/dd/yy): 03/13/95

Date of Application (mm/dd/yy): 03/17/95

Location of Spill: Rockefeller Refuge, Cameron Parish, LA

Oil Product: condensate oil

Oil Type (USCG Classification code): Type III (API Gravity = 40-42)

Barrels spilled: 40 barrels

Estimated treatment volume: approximately 30 barrels

Source of Spill: pipeline leak

Was Treated Oil on Land, Coastal Waters, or Inland Waters? On adjacent land, approx. 50 acres of brackish water marsh were affected by this release.

Resources at Risk: Marsh habitat, wildlife

Oil Spill Applied Technology Used: *In situ* burning

How Countermeasure Was Used: Ignited 20 acres of spill-affected marsh

Shoreline Types Impacted: Marsh

Incident Summary (specifics): All parties present agreed that ISB was appropriate as mechanical was ineffective and actually damaged the marsh habitat. Marsh burns are conducted annual at this site to promote vegetative vigor, remove litter, and protect against lightning fires. As water levels were approx. 2-4 inches above the marsh floor, this water would buffer the plants roots systems from heat damage. A formal burn plan was developed and approved by USCG and RRT VI. USCG strike team set up air-monitoring equipment south of the spill site; unnecessary personnel and equipment were removed from the area; and air boats spread hay along the primary spill boundary north of the leak to facilitate fire ignition. Air boats equipped with propane torches ignited the hay and condensate. Fire burned for approx. 2.5 hours and removed condensate from approx. 20 acres of marsh.

Behavior of Oil (before and after treatment): not provided

What problem was this technology intended to address?: To address the cleanup needs in an effective manner that would reduce the total environmental damage that was being caused by spill response equipment traveling within the marsh zone.

Lessons Learned/Recommendations from Oil Spill Applied Technology Use: Considered ISB as a viable response technique during early assessment phase of spill response. Booms did not make tight ground seals in dense marsh vegetation and allowed condensate migration toward environmentally sensitive wetlands. Vehicular traffic, human ingress, and mechanical cleanup techniques were causing more damage than the spill. ISB worked.

Additional References:

Hess Jr., T.J, I. Byron, H.W. Finley, and C.B. Henry, Jr. 1997. The Rockefeller Refuge oil spill: a team approach to incident response. In IOSC 1997. pp. 817-821.

Respondent Name: not provided
Incident Contact: Thomas J. Hess, Jr.
Position: not provided
Agency: Louisiana Department of Wildlife and Fisheries
Address: 5476 Grand Chenier Highway, Grand Chenier, LA 70643
Phone: not provided
FAX: not provided
email: not provided

In situ Burning, On Adjacent Land - Marsh

Name of Spill/Vessel/Location: Exxon Pipeline Company spill, Chiltipin Creek, upper Copano Bay, near Bayside, San Patricio County, TX

Date of Spill (mm/dd/yy): 01/07/92

Date of Application (mm/dd/yy): not provided

Location of Spill: high salt-marsh environment in Copano Bay, TX

Oil Product: South Texas light crude oil

Oil Type (USCG Classification code): Type III; API Gravity = 37

Barrels spilled: 2,950 barrels

Estimated treatment volume: 1,150 barrels

Source of Spill: rupture of underground oil transfer pipeline

Was Treated Oil on Land, Coastal Waters, or Inland Waters? On adjacent land – marsh grass areas.

Resources at Risk: Marsh and infauna

Oil Spill Applied Technology Used: *In situ* burning

How Countermeasure Was Used: *In situ* burn remaining oil from marsh grass

Shoreline Types Impacted: High, marsh grass

Incident Summary (specifics): Below-ground root and rhizome systems would be effectively protected against burn injury because of a layer of standing water from recent rainfalls allowing subsequent regrowth in the spring. This report lists the results of a 5-year study.

Behavior of Oil (before and after treatment): not provided

What problem was this technology intended to address?: General consensus was that mechanical removal techniques might result in total loss of the existing marsh and that non-removal might pose a continuing threat to the adjacent unimpacted marsh and Aransas River.

Lessons Learned/Recommendations from Oil Spill Applied Technology Use: Results of this study supports the hypothesis that use of in situ burning as a response tool has distinct advantages over other countermeasures.

Additional References:

Hyde, L.J, K. Withers, and J.W. Tunnell, Jr. 1999. Coastal high marsh oil spill cleanup by burning: 5-year evaluation. In IOSC 1999. pp. 1257-1260.

Respondent Name: not provided
Incident Contact: Larry J. Hyde, Kim Withers, and J.W. Tunnell, Jr.
Position: not provided
Agency: Center for Coastal Studies, Texas A&M University – Corpus Christi
Address: 6300 Ocean Drive, Corpus Christi, TX 78412
Phone: not provided
FAX: not provided
email: not provided

In situ Burning, On Adjacent Land - Marsh

Name of Spill/Vessel/Location: Koch Pipeline Company,
Date of Spill (mm/dd/yy): 05/12/97
Date of Application (mm/dd/yy): 05/14/97
Oil Product: Refugio Light crude and Giddings Stream crude
Oil Type (USCG Classification code): Type III
Barrels spilled: 500 – 1,000 barrels
Estimated treatment volume: not provided
Source of Spill: weld failure
Was Treated Oil on Land, Coastal Waters, or Inland Waters? On adjacent land –wetlands environment used as grazing field for cattle

Resources at Risk: Wetland species of sea ox-eye daisy, gulf cord grass, and Carolina wolfberry, cattle

Oil Spill Applied Technology Used: *In situ* Burning

How Countermeasure Was Used: *In situ burn* oil from field

Shoreline Types Impacted: grazing field which led to wetlands habitat

Incident Summary (specifics): This habitat had been burned for vegetation control for the cattle. Using the Region VI Guidelines for In-shore/Near-shore ISB for the burn plan, FOSC determined RRT approval was not necessary. A sample of the floating oil was recovered and put into a basin filled with water where it was successfully ignited on the first attempt. 11 acres of the 40 acre wetland were impacted. The burn was ignited in a "U" fashion using three points of ignition. The oil burned intensely for over 4 hours and continued to burn to various degrees overnight. Inspection the next morning revealed that 5-6 acres had burned with about 90% oil removal rate. Secondary burns were ignited to decrease the oil remaining in the fringe area of the original burn and increased the burn area to approximately 8 acres.

Behavior of Oil (before and after treatment): not provided

What problem was this technology intended to address?: Oil had migrated substantially farther beyond the original perimeters that were controlled by trenching. In light of the rapid migration of the oil, ISB option was selected as the tool of choice for this response.

Lessons Learned/Recommendations from Oil Spill Applied Technology Use: ISB can be conducted outside the expected window of opportunity if conditions are right. Responders should not discount burning simply because more than 24 hours have elapsed since the spill occurred. Conducting small test burns will enable responders to determine if a burn will be successful. Secondary burns are also possibilities to be considered.

Additional References:
Clark, T. and R.D. Martin, Jr. 1999. In situ burning: after-action review (successful burn 48 hours after discharge). In: IOSC 1999. pp. 1273-1274.

Respondent Name: not provided
Incident Contact: Tricia Clark and Robert D. Martin, Jr.
Position: not provided
Agency: Texas General Land Office, Oil Spill Prevention and Response Division
Address: 1700 North Congress Avenue, Austin, TX 78701-1495
Phone: not provided
FAX: not provided
email: not provided

Appendix K

Tables of Products not listed in NCP Product Schedule

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Table K-1. Bioremediation Products Removed from the Product Schedule.

	BR	ENZYT
General Description	Tan, free-flowing powder, yeast odor	Available as liquid or solid (Crystal)
Active Ingredients	Microbes, Enzymes, Nutrients, Surfactant	Microbes
Nutrient Composition	Urea, methylene urea, ammonium phosphate	None, product requires nutrient supplements
How does it change the oil behavior?	No immediate change	No immediate change
Availability (amount per location)	2,000 lbs, Stormville, NY	NP
Application Rate	0.5 lb/ton or 0.5-3 lb per 1,000 ft^2 soil; 2 lb/100,000 gal water	0.5 gal liquid or 1.5 lb solid/yd^3 soil, or /600 gal water
Application Method	Mix product into a slurry (1 lb/gal); apply immediately with low pressure, coarse spray to saturate the area.	Spray solution
Temperature Limitations	35-186°F	50-113°F
EPA Efficacy Test (Reports % reduction of components over a 28 day period)	Alkanes: 52% Aromatics: 27% Gravimetric weight decrease: 25%	Alkanes: 27% Aromatics: 0% Gravimetric weight decrease: 26%
Use in Fresh Water?	Yes	Yes
Use in Salt Water?	Yes, up to 6% salinity	Not effective where salinity is >6%
Inland Silversides 96h	NP	NP
Mysid Shrimp 48h	NP	NP
Solubility in water	NP	Liquid is miscible with water; solid is 90% soluble with water
Other Information	Dispersible	Product works at pH 5.5-9.0, optimally at 6.5-8.5
Application Assistance Information*	Product works at pH 4.5-9.5, optimally at pH 6-7	Acorn Biotechnical Corp. 713-861-6087 800-982-1187 www.acornbiotechnical.com
Unit Cost **	Enviro-Zyme International 914-878-3667 800-882-9904	$8-$13 per gal.
Photograph of Product (photos are added as they become available)	Unit cost = $30 per lb.	

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Table K-2: Solidifier Products Removed for Product Schedule.

	Nochar A650	Nochar A610	SPI Solidification Particulate
General Description	Granular material	Granular material	Sponge-like material, with appearance of ground green erasers
Listed in US?	**NO**	**NO**	**NO**
Availability within 48 h	5,000 lb stockpile, Indianapolis, IN	3,000 lb stockpile, Indianapolis, IN	4,000-5,000 lb stockpile, Windham, ME
Application Rate, % by weight of product to oil (per manufacturer)	10	10	4
Application Rate (Environment Canada, med. crude)	Not tested	Not tested	Not tested
Application Rate (PERF tests)	diesel: 45 medium crude: 45 Bunker C: 50	diesel: 45 medium crude: 45 Bunker C: 50	diesel: 31 medium crude: 42 Bunker C: 67
PERF Test Comments	Formed a firm pancake with gasoline and diesel; diesel pancake was elastic. Works slowly with the crudes taking 1-2 d to form a firm pancake. Bunker C solidified, but the pancake remained weak and broke apart when lifted.	Formed a firm pancake with gasoline and diesel; diesel pancake was elastic. Works slowly with the crudes taking 1-2 d to form a firm pancake. Bunker C solidified, but the pancake remained weak and broke apart when lifted.	All oils solidified but did not form a cohesive mass. Each had a crumbly appearance and broke apart upon lifting
Cure Time	1-2 minutes to 1 hour	1-2 minutes to 1 hour	Immediately, up to hours
Solidification Process	The bond is both chemical and physical	The bond is both chemical and physical	Total absorption into the porous and oleophilic surface of the polymer.
Use in Fresh Water?	Yes	No, use on land	Yes
Use in Salt Water?	Yes	No, use on land	Yes
Can the Oil be Returned to a Liquid	No	No	No
Disposal/Recycling Issues	NP	NP	NP

	Nochar A650	Nochar A610	SPI Solidification Particulate
Toxicity (LC-50, ppm) **Note: a low value = high toxicity**	Mummichug >500,000 (96h); Brine shrimp >500,000 (48h)	NP	NP
Solubility in water	Insoluble	Insoluble	< 1 ppm
Other Information	Preferred for use on water	Preferred for use on water	TBD
Application Assistance Information*	NP	NP	NP
**Unit Cost ** **	NP	NP	NP
Photograph of Product (photos are added as they become available)			

NP = Not provided

* For additional technical assistance on product application, contact the supplier listed on the NCP Product Schedule Notebook.

** Unit costs are based on 2002 information supplied by the vendors, where provided. For a more up-to-date cost estimate, contact the supplier listed in the NCP Product Schedule. Generally, product prices decrease as purchase volume increases, and may also vary between distributors. Product application rates often vary greatly depending on use.

Table K-3: Surface Collecting Agents Removed from Product Schedule.

	Corexit OC-5	Oil Herder
General Description	Liquid with a specific gravity of 0.918	Liquid with a specific gravity of 0.86
Is Product Listed for Use in US?	No	No
Availability within 48 h (see Note below)	Unknown at present Previously, a 3-5 day lead time for production of up to 400 drums per day was required	Unknown at present Previously, a 7 day lead time for production of 15,000 gal per day was required
Application Rate (per manufacturer)	1-2 gal per lineal mile	15 gal per lineal mile
Spreading Pressure	High (45 x 10^{-7} Newtons/m)	High (46 x 10^{-7} Newtons/m)
Solubility in water	Insoluble	40%, the solvent is the soluble fraction
Use in Fresh Water?	Yes	Yes
Use in Salt Water?	Yes	Yes
Toxicity (LC-50, ppm) **Note: a low value = high toxicity**	Fathead minnow >4,500 (96h); Zebra fish >10,000 (48h)	Zebra fish <1,000 (96h)
Mummichug 96 h	4,800	>1,000
Brine shrimp 48 h	4,800	2.5
Unit Cost	NP	NP
Photograph of Product (photos are added as they become available)		

NP = Information not provided

Note: As of December, 2002, there were no Surface Collecting Agents on the NCP Product Schedule. The two products listed above are the only two known products to have been developed specifically for and commercially marketed as surface collecting agents. The current availability of these products is not known.

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Appendix L
Synopsis of Document Preparation

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2003 Update

The Selection Guide for Oil Spill Applied Technologies could not have been updated without the dedication and assistance of the following people. The Authors' and Sponsors would like to acknowledge their invaluable assistance in this document preparation.

The 2003 Volume I –Decision-making Development Committee Members include:

John Allen, NRC
Brad Benggio, NOAA SSC Region IV
Pete Buckman, Giant
Mike Chezik, USDOI Region III
Nick Davidson, SC DHEC
CDR Mike Drieu, USCG D8
Capt. Frank Finley, City of Charleston, SC FD
Dave Fritz, BP
Dr. Eileen Gilbert, Tri-State Bird Rescue & Research
Charlie Henry, NOAA SSC Region VI
Charlie High, PA DEP
Greg Hogue, USDOI Region IV
Bela James, Shell Global Solutions
Alice Johnson, PPG/Three Rivers
Carol Ann Manen, NOAA/NOS
Pete McGowan, USFWS – Region III
Eric Mosher, USCG D7
Nick Nichols, EPA Oil Program
Lt Anne Odegaard, USCG G-MOR-3
Doug O'Donovan, MSRC
Gary Ott, NOAA SSC Region III
Janet Queisser, VA DEQ
Bill Robberson, EPA Region IX
Darrell Robertson, USDOI Region II
Fred Stroud, EPA Region IV
Dr. Heidi Stout, Tri-State Bird Rescue & Research
Doug White, FL DEP
Alan Williams, MD DOE
Vince Zenone, EPA Region III
Linda Ziegler, EPA Region III

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Initial Document Development

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Tom Brennan, Roy F. Weston (SATA Contractor)
Pete Buckman, BP/Amoco Refinery, Yorktown, VA
Dan Chadwick, USEPA OECA
CDR Paul Gugg, USCG Gulf Strike Team
Eric Mosher, USCG, District 7
MST2 Michael Moss, USCG, MSO Hampton Roads
William "Nick" Nichols, USEPA Oil Program
Gary Ott, NOAA SSC
Janet Queisser, VA Dept. Environ. Quality
Bill Robberson, USEPA, Region 9
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Fred Stroud, USEPA OSC Region IV
Ann Hayward Walker, SEA, Inc. (SATA Contractor)
Linda Ziegler, USEPA Region III

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RRT III members
RRT IV members
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Robert G. Pond, SOZA and Company, Ltd.
Brad McKitrick, SOZA and Company, Ltd.
Gerry Canevari, Exxon Research and Engineering Company
LCDR Gary Merrick, USCG Yorktown
Gary Ott, NOAA HAZMAT SSC
Ray Reid, Dierview Technologies
Lt Cdr. Mike Drieu, USCG

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Appendix M
Example Scenario for Selection Guide Evaluation

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Example Scenario

On May 12th, an aboveground pipeline discharged approximately 500 gallons of Louisiana Crude into a remote, freshwater cypress swamp area in a National Wildlife Refuge in northern Louisiana. The spill was discovered 8 hours ago. The pipeline has been shut down. The discharge area is a shallow, cypress swamp that is habitat for waterfowl, wading birds, and game fish. There are several threatened and endangered species using this habitat.

Access is limited, and the traditional countermeasures of boom and skimmers are not feasible for all areas impacted. The FOSC is on scene and has asked you to identify alternative response options to address several highly contaminated areas with approximately 200 gallons of product involved, in an area that has limited-to-no access for heavy equipment.

Step 1 & 2: Review the Oil Spill Applied Technologies Overview (Table 1) and familiarize yourself with the technology categories.

Looking over the information contained in Table 1 for the spill conditions, you find that the potential options for dealing with the shallow, highly contaminated areas of the swamp are limited to: Sorbents, Elasticity Modifiers, ISB, Natural Attenuation, and Solidifiers based on a general review of the product categories in Table 1. This is a first cut at evaluating options.

Even though Table 1 also identifies potential limitations with the use of the products or technologies you have chosen, you must evaluate each of the response options further as conventional response options have been determined to not be viable options in some areas.

Continued on Next Page

Example Scenario (Continued)

Step 3 & 4: Use Worksheet 1 to document your decision-making.

Following Steps 1 and 2, fill out the spill information on Worksheet 1 for your incident. On Line A (***Technology Choices of Interest)***, mark an "X" under each technology or strategy that you want to consider further. See Example A-1 below.

Example A-1

WORKSHEET 1: SELECTION GUIDE DECISION-TRACKING/ EVALUATION WORKSHEET

This worksheet is intended to be photocopied for use during drills and incidents

Name(s): John Smith
Date: May 12, 2001
Incident: NWR Pipeline Break, Northern Louisiana

		Sorbents	Bioremediation Agents	Dispersants	Elasticity Modifiers	Emulsion Treating Agents	Fast Water Booming Strategies	Fire Fighting Foams	In-situ Burn (ISB)	Nonfloating Oil Strategies	Oil Tracking	Shoreline Pre-Treatment Agents	Solidifiers	Surface Collection Agents	Surface Washing Agents	Natural Attenuation	Future Products
A.	*Technology Choices of Interest: (check)*	X			X				X				X			X	
B.	*Environmental Matrix Used:*																
C.	*Incident-specific Information:*																
	Response Phase:																
	Oil Type:																
	Treatment Volume:																
	Weather Conditions:																
	Decision Authority: NR - No Spec. Reg. Req.s; PS - Must be on Prod. Schd.; PA - Pre-Authorization in Place; CR - RRT Concurrence Req'd.; SP - Special permit Req'd.																
	Monitoring: SM - SMART Monitoring; OM - Effectiveness or Other Monitoring																

Step 5 & 6: Determine which environmental matrix to use in your evaluation.

In Step 5, you have to determine which environmental matrix to use to assist you in determining the appropriateness of the various applied technologies. For this scenario, we are looking at the inland waters matrix (Table 2a) because the oil is in the water in the cypress swamp at the NWR. Even though the edges of the swamp may be affected, the majority of the oil is in the shallow, still waters of the swamp.

Because we are using the Inland Waters Matrix, write in the words "Inland Waters" on Line B of Worksheet 1.

Continued on Next Page

Example Scenario (Continued)

Step 7 & 8: Incident-specific Information Needs.

Step 7 asks you to record the incident-specific information for the current response under line C of worksheet 1. You would write:

- "Emergency" for the Response Phase as the incident is still within the first 24 hours;
- "Medium Crude" for Oil type since Louisiana crude is considered a Medium oil type (Type III);
- 100-1,000 gallons for treatment volume since current scenario estimates put 200 gallons of product in the area where you are considering the use of applied technologies; and
- "Warm" because it is May in Louisiana and "Low Winds" because there is very little mixing energy in the discharge area.
- See Example A-2 below.

Example A-2

		Sorbents	Bioremediation Agents	Dispersants	Elasticity Modifiers	Emulsion Treating Agents	Fast-Water Booming Strategies	Fire Fighting Foams	Insitu Burn (ISB)	Non-floating Oil Strategies	Oil Tracking	Shoreline Pre-Treatment Agents	Solidifiers	Surface Collection Agents	Surface Washing Agents	Natural Attenuation	Future Products
A.	*Technology Choices of Interest: (check)*	X			X				X				X			X	
B.	*Environmental Matrix Used:* Inland Waters																
C.	*Incident-specific Information:*																
	Response Phase: Emergency																
	Oil Type: Medium																
	Treatment Volume: 100-1,000 gallons																
	Weather Conditions: Warm; Low winds																
	Decision Authority: NR - No Spec. Reg. Req.s; PS - Must be on Prod. Schd.; PA - Pre-Authorization in Place; CR - RRT Concurrence Req'd.; SP - Special permit Req'd.																
	Monitoring: SM - SMART Monitoring; OM - Effectiveness or Other Monitoring																

Continued on Next Page

Example Scenario (Continued)

Steps 9&10: Collect Incident-specific Information from Environmental Matrix Used.

Step 9 asks you to record the corresponding considerations identified in the Environment Specific Matrix in line C of worksheet 1 by writing an “X” in the box. For example, the Inland Waters Matrix considers Sorbents to be viable in an emergency situation, for a medium oil type, for 100 to 1,000 gallons of oil and for a low wind/warm climate. Therefore, an “X” is placed in each of the corresponding boxes. See Example A-3 below.

After this you should begin your process of eliminating any products or strategies that will not work for the conditions being evaluated. For instance, if Surface Collecting Agents were an original choice, you see that there is no “X” in the box under SCA’s and Medium Oil in the Inland Waters Matrix. Surface Collecting Agents can be ruled out since they are ineffective on medium oil. However, in this scenario, we have not been able to rule out any product categories yet. See Example A-3 below.

Example A-3

		Sorbents	Bioremediation Agents	Dispersants	Elasticity Modifiers	Emulsion Treating Agents	Fast-Water Booming Strategies	Fire Fighting Foams	In-situ Burn (ISB)	Non-floating Oil Strategies	Oil Tracking	Shoreline Pre-Treatment Agents	Solidifiers	Surface Collection Agents	Surface Washing Agents	Natural Attenuation	Future Products
A.	*Technology Choices of Interest: (check)*	X			X				X				X			X	
B.	*Environmental Matrix Used:* Inland Waters																
C.	*Incident-specific Information:*																
	Response Phase: Emergency	X			X				X				X			X	
	Oil Type: Medium	X			X				X				X			X	
	Treatment Volume: 100-1,000 gallons	X			X				X				X			X	
	Weather Conditions: Warm; Low winds	X			X				X				X			X	
	Decision Authority: NR - No Spec. Reg. Req.s; PS - Must be on Prod. Schd.; PA - Pre-Authorization in Place; CR - RRT Concurrence Req'd.; SP - Special permit Req'd.	NR			PS CR				CR				PS CR			NR	
	Monitoring: SM - SMART Monitoring; OM - Effectiveness or Other Monitoring	OM			OM				SM				OM			OM	

Continued on Next Page

Example Scenario (Continued)

Steps 11&12: Check off relevant considerations (line D) and evaluate

In step 11 you have to determine which considerations are relevant to the incident and need evaluation. There are no cultural or historic resources in danger therefore it does not need to be considered. The oil is not on fire nor is there potential for fire so it is not a consideration either. There is a need to protect against significant water column and benthic impacts so it is checked off for further evaluation.

After determining which considerations need to be evaluated further, you refer to the Environment Specific Matrix again to see if they have a "**+**"(consider for use) or a "**-**" (do not consider for use). Place a "**+**" or a "**-**" in each of the boxes for the considerations that are checked off. See example A-4 below.

NOTE: Because this scenario occurs in a swamp; the oil is in the water, but is also affecting the resources on adjacent land as defined on page 10 of this guide. Therefore, after using the Inland Waters Matrix, you are not restricted to a single environmental matrix when evaluating the considerations for an event.

Example A-4

D. (Check)		Sorbents	Bioremediation Agents	Dispersants	Elasticity Modifiers	Emulsion Treating Agents	Fast-Water Booming Strategies	Fire Fighting Foams	Insitu Burn (ISB)	Nonfloating Oil Strategies	Oil Tracking	Shoreline Pre-Treatment Agents	Solidifiers	Surface Collection Agents	Surface Washing Agents	Natural Attenuation	Future Products
	Technology Choices of Interest: (check)	X			X				X				X			X	
	Considerations																
O	Cultural or Historic Resources																
O	Limited Oil Handling and Storage Capacity																
O	Oil On Fire or Potential for Fire																
✓	No Oil Containment and Recovery Options	–			–				+				–			+	
O	Oil Contaminated Substrate																
O	Light Oil Type - Difficult to Recover/Skim																
O	Oil Will Form an Emulsion																
O	Oil Has Formed an Emulsion																
O	Oil Has/Is Likely to Sink																
O	Buried Oil																
O	Oil Likely to be Remobilized																
O	Fast Currents Prevent Effective Booming																
✓	Need to Protect Against Significant Surface and Shoreline Impacts, Including Marshland	Look at Coastal Waters to address this consideration															
✓	Need to Protect Against Significant Water Column and Benthic Impacts	+							+				+			+	
✓	Oiled Site is Access Limited	?			?				+				?			+	
✓	Oiled Shoreline/Substrate Needs Cleaning Without Significant Impacts	Look at Adjacent Land to address this consideration															
✓	Significant Problem of Waste Generation	–							+				–			+	
O	Vapor Suppression																
O	Oil on Roadways																
O	Water Intakes at Risk																
O	Oil Trapped in Vegetation																
O	Oil Trapped in Snow and Ice																
O	Confined Spaces with Water/Vapors? (sewers, culverts, etc.)																

Continued on Next Page

Example Scenario (Continued)

Steps 11&12 (continued): Check off relevant considerations (line D) and evaluate

Looking to the Adjacent Land (Table 2b) and Coastal Waters (Table 2c) matrices, we are able to determine the considerations for protecting against surface and shoreline impacts and the need to clean oiled shorelines without causing significant impacts.

The consideration, "Oiled Substrate Needs Cleaning Without Significant Habitat Impacts" on the Adjacent Land matrix rated sorbents and natural attenuation as "consider for use"; ISB and Solidifiers as "case-by-case"; and Elasticity Modifiers were rated "Do not consider for use." Under the Coastal Waters matrices, Sorbents, ISB, Solidifiers, and Natural Attenuation were listed as "consider for Use" when addressing the need to protect against impacts to surface and shorelines. Elasticity modifiers were not rated for protecting shorelines for impacts.

Steps 14-19: Evaluation of Habitat and Natural Resources

After locating the Habitat (Table 3) and Natural Resources (Table 4) matrices you need to first compare each technology with the habitat. This particular habitat is considered a Swamp under Land Habitats. As you can see (Example A-5 below), there is a "+" under sorbents for swamps so a "+" was placed under sorbents on Worksheet 1, Line E for Habitats. Continue for the other product categories.

Next you need to take into consideration the wildlife that may be affected by the response option. Wildlife that are indigenous to this habitat may include otter, muskrat, snakes, turtles, waterfowl, wading birds, and fish among others. When comparing Sorbents to these wildlife resources you see that for the majority the impact is considered minimal so a "+" was placed under Line E for Natural Resources. When evaluating Elasticity Modifiers, animals such as fish have a minimal impact where as waterfowl are likely to be impacted. Other resources such as wading birds and snakes have the potential for impact. The wide range of potential impacts resulted in a "?" for Elasticity Modifiers under Line E for Natural Resources.

NOTE: In all response situations, natural resource experts such as the NOAA Scientific Support Coordinators, State and Federal Natural Resource Trustees, etc. should be consulted for their evaluation of the options and the potential risks to their resources due to time of year, life stage, habitat requirements, mobility, etc.

Example A-5

		Sorbents	Bioremediation Agents	Dispersants	Elasticity Modifiers	Emulsion Treating Agents	Fast-Water Booming Strategies	Fire Fighting Foams	Insitu Burn (ISB)	Nonfloating Oil Strategies	Oil Tracking	Shoreline Pre-Treatment Agents	Solidifiers	Surface Collection Agents	Surface Washing Agents	Natural Attenuation	Future Products
	Technology Choices of Interest: (check)	X			X				X				X			X	
E.	*Habitat and Sensitive Resource Evaluation:*																
	Habitats (Refer to Table 3, page xx):	+			NA				NA				–			+	
	Natural Resources (Refer to Table 4, page xx):	+			?				?				+			?	

Continued on Next Page

Example Scenario (Continued)

Steps 20&21

After the evaluation of the selected products or strategies and discussion among the Incident Commander, Resource Trustees, Operations, etc., the technologies (up to 3 or more) determined to provide the best option for the given situation need to be identified. Advantages and disadvantages of each technology should be discussed thoroughly.

The incident-specific information and considerations identified in this evaluation resulted in three options: In-Situ Burning (ISB), Sorbents, and Solidifiers. Why? These three product categories were considered viable options when evaluating the product category against the spill-specific information under Steps 9 and 10 of these instructions.

Example A-6

F.	*Evaulation Results:*			
	Top Three Choices:	In Situ	Sorbents	Solidifiers
	Any Major Advantages:	No Product Recovery Minimal foot traffic	Good option for Wildlife Resources	Good option for wildlife resources
	Any Major Disadvantages:	Ignition? Wildlife resources?	Product/Oil Recovery Foot traffic required	Product/Oil Recovery Foot traffic required

Additional Comments/Decisions:

Decision-making reasoning:

- Sorbents: This option would appear to provide value to the response for the remote areas being assessed in this evaluation. However, the use of sorbents requires foot traffic (at a minimum) to utilize, monitor, and recover the sorbent materials used. Transportation of oiled sorbent material would also have to be considered.

- Elasticity Modifiers: When assessing considerations and then impacts to shorelines and natural resources, there are more negatives identified with its use and the shoreline matrix considers elasticity modifiers not applicable for use in this habitat.

- In-Situ Burning: At this point in the evaluation, ISB is the most viable applied technology because its use will solve the problem of leaving wastes behind and recovery of treated oil. If the oil has not spread and can be contained in a thickness conducive to burning, ISB would be a good option.

- Solidifiers: This technology is an option however you are still left with the problem of oil containment and recovery because the site is access limited. The use of solidifiers requires foot traffic (at a minimum) to utilize, monitor, and recover the solidifier materials used. Transportation of oiled solidifier material would also have to be considered.

Example Scenario (Continued)

Steps 20&21, continued

Decision-making reasoning, continued:

- Natural Attenuation: This is also an option for this scenario, however, due to the nature of the oil, there is a substantial risk to resources and endangered species over time. Medium oil will not completely evaporate and will remain in the habitat for an extensive amount of time, potentially affecting resources for years. There is not much mixing energy in this habitat, so burial is unlikely. Shoreline and natural resource impacts are likely.

The development of the top choices should always be a joint effort by the Incident Commander, Operations, Planning, Scientific Support Coordinators, and Natural resource trustees. No decision should be made in a vacuum.

<u>Example Scenario</u> (Continued):

Completing Part B/Worksheet 2

Step 1: Obtain the correct number of worksheets.

Here the decision maker will be evaluating specific products within a product or technology category. You will need a blank worksheet (Worksheet 2: Product Selection Worksheet) for each of the product categories you will be evaluating. If you are considering a category or strategy that does not involve the use of NCP listed products, this worksheet is not needed.

Step 2 & 3: Select individual products from each product category.

In our example, the top three product/strategy options are *in-situ* burning, sorbents, and solidifiers. *In-situ* burning is a strategy, not a product, therefore it is not listed on the NCP Product Schedule and is not evaluated with worksheet 2. However, many regions have already established *in-situ* burning pre-approval policies and zones; review your regional-specific information contained in Volume II of the Selection Guide for more on this topic. *In-situ* burning should be considered and discussed between all decision makers.

For this example, the various stakeholders reviewed the information collected in Part A and decided to do additional research on solidifiers to determine which individual product would be the most beneficial for the given incident conditions; we will continue this scenario focusing on solidifiers. In Line A of Worksheet 2, we would write in “Solidifiers” (See Example B-1 below). In a real situation, you may want to evaluate multiple categories or strategies using separate worksheets for each.

The solidifier table (Table 20) allows us to evaluate characteristics such as availability, cure time, toxicity, and cost among others. There are only four products listed (Alsocup, CI Agent, Waste Set PS 3200, and Waste Set PS 3400) on the NCP Product Schedule. Table 20 also identifies two other products as solidifiers even though they are considered to be sorbents by the EPA (Enviro-Bond 403 and Rubberizer). Additionally, there are two other products that are classified as solidifiers by the Selection Guide, but these products are no longer listed on the NCP Product Schedule (Nochar A610 and Nochar A650); the information on these two products is now maintained in Appendix K should you be interested in evaluating these non-listed products.

We now have six products to evaluate for this situation. We have chosen three products to evaluate for feasibility under these incident conditions (Refer to Line B of Worksheet 2 in example B-1). You may choose to evaluate one or all of the products in this category.

REMEMBER – the Selection Guide is not designed to provide a conclusive answer, each decision-maker and stakeholders must evaluate the technology choices identified in Part A and determine which options provide the best value for the given circumstances and conditions. It may be that after reviewing the information on a technology or product(s), the group consensus might be that none of the evaluated options would work for the existing conditions. At this point, the decision-maker can evaluate additional strategies/technologies or decide to reevaluate traditional countermeasures. The choice is yours. The Selection Guide is provided to assist you through the evaluation and determination process. The decision to use or not to use is one that should be made with input from all stakeholders.

Step 4 & 5: Answer questions C through G on worksheet 2.

After determining which products will be evaluated, Line C through F should be answered. In order to complete Line D and E, the vendor may have to be contacted for this information. Toxicity information (Line G) for each product(s) must also be collected from Table 20. Additional information on toxicity may be found in Appendix E. Two of the Solidifiers being evaluated for our scenario require RRT approval; Rubberizer does not as it is considered a sorbent by EPA. (Example B-1) We are also assuming that all vendors have been contacted and that all products are readily available.

Example B-1:

WORKSHEET 2: PRODUCT SELECTION WORKSHEET

This worksheet is intended to be photocopied for each product category evaluated and used during drills and incidents and Faxed to the Incident Specific RRT for review. This worksheet may be used to evaluate 1, 2 or 3 separate products in an individual category.

Name(s): John Smith
Date: May 12, 2001
Incident: NWR Pipeline Break, Northern Louisiana

A:	Product Category Being Reviewed:	Solidifiers		
	Products of Interest:	Product 1	Product 2	Product 3
B:	Product Name:	Alsocup	Rubberizer	Waste Set 3400
C:	RRT Approval Required? (Y/N)	Yes	Yes	Yes
D:	Can Product Arrive in Time? (Y/N)	Yes	Yes	Yes
E:	Can Product be Applied in Time? (Y/N)	Yes	Yes	Yes
F:	Can Product be removed from the Environment? (Y/N)	Yes	Yes	Yes
G:	Toxicity (Write in numbers and Toxicity Rating. See App E for more information on toxicity and Toxicity Rating)	Inland silversides (96h): >100 Mysid Shrimp (48h): >100	Inland silversides (96h): NP Mysid Shrimp (48h): NP	Inland silversides (96h): >10,000 Mysid Shrimp (48h): >10,000

Step 6, 7, & 8: Compare products, rank them (Lines H and I), and review with RRT.

Upon completing all product information needs, a discussion should be held with all decision-making stakeholders to rank and determine which product(s) will be the most beneficial for the existing conditions. Looking at Table 20 we see that:

- It will most likely take at least 24 hours to receive any of the products
- All products absorb the oil
- All products may be used in fresh or salt water situations
- Waste Set PS 3400 is clearly the least toxic
- None of the products are soluble in water

Other considerations consist of the nature of the highly sensitive environmental area and the limited access to the site. (Example B-2) Following discussion among the members of the Planning Section, we have determined Waste Set PS 3400 to be the most viable option because of its low toxicity level. Alsocup is the second choice because it is more readily available than Rubberizer.

Before using a product, remember, <u>you are not done</u>! You must continue with this evaluation and develop a testing and monitoring strategy in Part C.

This recommendation may be forwarded to the FOSC and Operations prior to developing a testing and monitoring strategy. However, it is strongly suggested that you complete this evaluation (Part C) prior to submitting your recommendation to the FOSC. It is the FOSC's decision whether or not to use your recommendation (in this example a solidifier). In the event that the FOSC decides to use the product, he can forward and discuss the information documented on worksheet 2 with the RRT.

Example B-2:

WORKSHEET 2: PRODUCT SELECTION WORKSHEET

This worksheet is intended to be photocopied for each product category evaluated and used during drills and incidents and Faxed to the Incident Specific RRT for review. This worksheet may be used to evaluate 1, 2 or 3 separate products in an individual category.

Name(s): John Smith
Date: May 12, 2001
Incident: NWR Pipeline Break, Northern Louisiana

A:	**Product Category Being Reviewed:**	Solidifiers		
	Products of Interest:	**Product 1**	**Product 2**	**Product 3**
B:	**Product Name:**	Alsocup	Rubberizer	Waste Set 3400
H:	**Mark as 1st, 2nd, or 3rd Choice or mark as Not Applicable for this incident**	2nd	3rd	1st

I: Additional Comments/Decisions/Recommendations:

- Toxicity and recovery are big issues for USFWS
- This is a highly sensitive environmental area
- Limited-to-no access for heavy equipment

J: Initials/Date of Incident-Specific RRT Review of Information:

Initial Box and Include Date Upon Review

USEPA:		Date:________________	STATE:		Date:________________
USCG:		Date:	STATE:		Date:________________
NOAA:		Date:	OTHER:		Date:
USDOI:		Date:________________	OTHER:		Date:

Note: While Solidifiers were the only product category evaluated you should not overlook Sorbents or ISB. Sorbents may be more beneficial than Solidifiers because of the many natural products that have a low toxicity level. Another thing to keep in mind is limited access, which will make cleanup and recovery of the solidified oil difficult. *In-situ* burning should be considered because it can be applied immediately and will not require as much cleanup as Solidifiers or Sorbents.

Example Scenario (Continued):

Completing Part C/Worksheet 3

Step 1&2: Obtain the correct number of copies of Worksheet 3 and identify products or strategies that are being evaluated.

Begin by obtaining a blank copy of worksheet 3 for each of the product categories being evaluated. Just one worksheet is needed for comparing strategies unless more than 3 strategies are being compared. Here, the decision maker will perform a basic review of monitoring strategies as well as compare effectiveness of the strategy or product being used for the incident-specific response through testing procedures. Also included is information about capturing lessons learned when any of the products reviewed in this guide are used or are reviewed for a response.

For this example, we will only evaluate the same three solidifiers that were evaluated in the Part B/Worksheet 2 scenario, Alsocup, Rubberizer, and Waste Set 3400.

Step 3&4: Conduct tailgate test then continue with evaluation.

Information on the first level of testing, T-1: Tailgate Testing, can be found in Part C. Tailgate testing determines if the product or technology works to some minimum degree with the oil under the current spill conditions. In our evaluation, all three of our products were effective on this oil type (Louisiana Crude). See example C-1 below. If strategies were being reviewed, it is possible that a tailgate test would not be applicable. For instance, Fast-water Booming can only be tested in the field so we would skip to the second level of testing, Field Effectiveness Test. We will now evaluate all three solidifiers further (Line C).

Example C-1

WORKSHEET 3: TESTING & MONITORING WORKSHEET

This worksheet is intended to be photocopied for each product category evaluated and used during drills and incidents and Faxed to the Incident Specific RRT for review. Use additional paper if needed to record information.

Name(s): John Smith
Date: May 12, 2001
Incident: NWR Pipeline Break, Northern Louisiana

	Products of Interest:	Product 1	Product 2	Product 3
A:	Product Name:	Alsocup	Rubberizer	Waste Set 3400
B:	Has a tailgate test proven that product is effective on oil type at this state of weathering? (Y/N)	Yes	Yes	Yes
	Products to Consider for Additional Testing:	**Product 1**	**Product 2**	**Product 3**
C:	Products still being considered:	Alsocup	Rubberizer	Waste Set 3400

Step 5&6: Conduct Field Effectiveness Test and Effects Test as well as record test protocols.

The objective of the Field Effectiveness Test is to determine if the product(s) or strategy works on the oil under realistic field conditions. The objective of the Effects Test is to determine what effects the products or strategies will have on natural resources compared to other products and strategies. A Field Effectiveness Test was conducted (Line D) and it was discovered that all three solidifier products proved to be effective. We will now describe the test protocols in Line E. See Example C-2.

- The test site is a highly sensitive fresh water marsh as was determined in the beginning of the Example Scenario.
- Natural resources at risk consist of waterfowl, other migrating birds, reptiles, fish and many species of flora.
- The spill amount is 500 gallons of Louisiana Crude from an above ground pipeline.
- The application rates were taken from Table 20 and are mass ratios of product to oil.
- The products may be applied using a broadcast spreader.
- Other logistical considerations are the limited access to the site and the difficulty of removing the solidified oil from the site.
- Solidified oil may adhere to flora and may be difficult to remove from shorelines.
- Solidified oil from these products is recoverable with a shovel or a similar tool.
- Outcomes/Expected Outcomes: If the Field Effectiveness Test or Effects Test have not been conducted, then the decision maker should predict what he/she believes the outcome and best product will be. Then the test should be conducted for confirmation. The Field Effectiveness Test has been conducted and the outcomes are as follows:
    - Alsocup – formed a cohesive mass with the oil however, remained sticky and somewhat difficult to fully recover
    - Rubberizer – solidified the oil but did not remain cohesive long enough to recover fully
    - Waste Set 3400 – Formed a cohesive and solidified mass that was more easily recoverable than the previous two

Note: These are not actual test results. They are purely fictional and created for this example only. Actual test results and product comparisons will vary. This is not an endorsement of any product.

The Effects Test is somewhat of a transition from testing to monitoring. It is difficult to test a product for effects during an emergency situation because of the length of time required to determine negative effects. This level of testing is conducted when the product or strategy is first implemented. It also ties in with the first level of monitoring, M-1: Operational First-Use Monitoring, in that it determines if full-scale operational use of the product or technology is effective and does not have unacceptable impacts.

Example C-2

	Products to Consider for Additional Testing:	Product 1	Product 2	Product 3
C:	Products still being considered:	Alsocup	Rubberizer	Waste Set 3400
D:	Has a Field Effectiveness test or Effects Test been carried out? (Y/N)	Yes	Yes	Yes
E:	Describe test protocols:			
	Test site specifics (environment):	Highly sensitive, fresh water wetlands		
	Natural resources at risk:	Waterfowl, reptiles, fish, and many species of flora		
	Volume of oil to be treated:	500 gal	500 gal	500 gal
	Application rate(s)/volume used:	10%(product:oil)	18%	17%
	Application equipment:	broadcast spreader		
	Other logistical considerations:	limited access and difficult removal of solidified oil		
	Physical impacts expected:	solidified oil may adhere to flora		
	Is the oil recoverable?:	Yes, with shovel	Yes, with shovel	Yes, with shovel
	Expected outcomes of test:	Formed cohesive mass but remained sticky	solidified oil but wasn't cohesive	solidified oil and remained cohesive

Step 7: Record the recommended level of monitoring.

Information on monitoring can be found in Part C under the section titled, "Operational Response Techniques Monitoring Plans & Strategies" as well as "Elements of a Good Testing and Monitoring Program." Monitoring is a mandatory element during an oil spill response. There are two levels of monitoring: M-1 Operational First-Use Monitoring and M-2 Continued Operational Monitoring. M-1 monitoring primarily determines if the implemented product or strategy is effective and ensures that there are no unacceptable impacts. The objective of M-2 monitoring is to routinely monitor the progress of cleanup using the approved technologies and assess the need for modifying cleanup methods. Generally, the cure time for any solidifier is from less than one minute up to one hour. The first level of monitoring should be conducted on all three products to guarantee their proficiency and to make sure there are no negative impacts to the environment. The second level of monitoring should be conducted as well to ensure that no changes take place in the physical properties of the oil and that cleanup doesn't require an alternate response. Both levels of monitoring (M-1 and M-2) are recommended for these products and are recorded in Line F. See example C-3.

Step 8: Review evaluated products, discuss options, and rank products.

When conducting a final review of the products we must also consider product and strategy characteristics that were discussed in Part B/Worksheet 2. A detailed discussion should take place between all decision makers and stakeholders to determine the best possible options. Table 25 lists questions that are of concern when dealing with product categories in various levels of testing and monitoring. This table should be integrated into the discussion and help to aid the decision making process. Summaries of each of the three products are below: **Remember,** these evaluations and results are purely fictional.

- Alsocup – Is readily available, easily recoverable, worked under the <u>Field Effectiveness</u> Test situation for the most part however, is the most toxic of the three solidifiers. Alsocup is the 3rd choice overall because of the nature of the highly sensitive environment of the spill location.
- Rubberizer – Is available although not as readily available as Alsocup, more easily recoverable than Alsocup because the solidified oil is not sticky, works under the Field Effective Test, and is slightly less toxic than Alsocup according to the vendor. Rubberizer is the 2nd choice because it is both more easily recoverable and less toxic than Alsocup.
- Waste Set 3400 – Is readily available, easily recoverable, works under the <u>Field Effectiveness</u> Test, and is much less toxic than Alsocup or Rubberizer. For all of the reasons mentioned, Waste Set is the 1st choice.

Step 9: Record any additional information on the use, review, or implementation of the product.

Limited access to the site, which, has been discussed previously, also limits removal of the oil. The review team has suggested constructing a temporary road with one vehicle access to the site. This will allow personnel, responders, and equipment to access the site as well as allow removal of the oil. The nature of the oil solidified with Waste Set 3400 allows it to be shoveled and transported away for proper disposal. See Example C-3

The use of Waste Set 3200 in addition to 3400 may be of benefit to the swamp shoreline. Waste Set 3200 is developed specifically for land use and considering the availability and low toxicity or 3400, this may protect shorelines and marsh areas where solidified oil has the potential to adhere to the ground and flora.

Example C-3

Products to Consider for Additional Testing:		Product 1	Product 2	Product 3
C:	Products still being considered:	Alsocup	Rubberizer	Waste Set 3400
F:	Recommended Level of Monitoring for this test (Refer to Part D to Determine)	M-1 & M-2	M-1 & M-2	M-1 & M-2
G:	Mark as 1st, 2nd, 3rd Choice or Not Applicable for use during this incident	3rd	2nd	1st

H: Additional Comments/Recommendations on the use of product(s):

Limited access to site
Consider Waste Set 3200 for land use
Consider RRT review

I: Initials/Date of Incident-Specific RRT Review of Information:

Initial Box and Include Date Upon Review

USEPA:	HCJ	Date: 5-14-01	STATE:		Date:
USCG:		Date:	STATE:		Date:
NOAA:		Date:	OTHER:	BRK	Date: 5-14-01 (USFWS)
USDOI:	NDP	Date: 5-14-01	OTHER:		Date:

Step 10:

The fact that the response site is a sensitive environment and a National Wildlife Refuge will draw attention from many environmental agencies. Therefore, review or approval with the RRT is most likely a mandatory step. This worksheet has been reviewed by the EPA, DOI, and USFWS, as can be seen in Example C-3.

Note: Upon completing Worksheet 3, responders will then decide whether or not to recommend the implementation of a product or strategy to the On Scene Coordinator. This evaluation does not determine the best product or strategy to use for a response. Rather the evaluations and worksheets should help to narrow down these options as well as promote discussion between all decision makers and stakeholders to help determine the most beneficial response action for the incident specific conditions.

Lessons Learned

Sharing information within and among the regions whenever spill countermeasures technologies are used is of vital interest and benefit to the response community. To assure this information is captured, OSCs/users are requested to complete the information questionnaire displayed at the end of Part C.