

USING THE SELECTION GUIDE FOR SPILL COUNTERMEASURES TECHNOLOGIES IN RESPONSE DECISION MAKING AND PLANNING

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ABSTRACT: *As part of national response priorities, On-Scene Coordinators (OSCs) and Incident Commanders should use all appropriate containment and removal tactics, including the use of products listed on the National Contingency Plan (NCP) Product Schedule, in a coordinated manner to ensure a timely, effective response that minimizes adverse impacts to the environment (40 CFR § 300.317). To facilitate greater understanding of these products and technologies, a Selection Guide was developed to evaluate their potential benefits and identify appropriate situations for their use. Although the NCP Product Schedule and Notebook provide information on regulated spill response products, the decision maker needs additional information presented clearly in a concise format that clarifies how these products can affect the spilled oil and the environment once applied.*

The Selection Guide provides a spill response tool that gives OSCs and other decision makers an easy-to-use source of technical information on spill response countermeasures that are regulated by the NCP, including alternate sorbents, bioremediation agents, dispersants, elasticity modifiers, emulsion treating agents, in situ burning on land and on water, shoreline pre-treatment agents, solidifiers, surface-collecting agents (herders), surface-washing agents, and firefighting foams, as well as potential response strategies for "unusual" spill response conditions (i.e., fast-water booming strategies, non-floating oil strategies, and water intake monitoring). The Selection Guide facilitates easy comparison among product categories, as well as aids decision makers in determining the best response strategy or product for a particular issue that "traditional" response tools do not seem to address completely.

The Selection Guide has been developed under the Work Plan of the Region III Spill Response Countermeasures Work Group, in cooperation with the Region IV Regional Response Team (RRT). This document is applicable for inland and coastal areas and is intended for use during actual spill incidents and pre-spill planning efforts. This information also assists decision makers in evaluating vendor requests to use their products.

Introduction

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. 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 (Walker *et al.*, 2000) 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 (OSCs) 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 do not work, are not worth the trouble, or could jeopardize natural resource protection. Instead, once better understood, many of the technologies or products included in this Selection 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, location of the spill, weather or sea conditions, and what resources are threatened. Because it is difficult to assess when various countermeasures will be beneficial, this Selection Guide has been designed to simplify the evaluation of options for real-time response to actual oil spills.

The Selection Guide presents information on *twelve categories of products* and *five spill response strategies*, within *two 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 use*, as well as document lessons learned. Much of the information in Volume 2 is region-specific. Only the first volume will be discussed in this paper.

Table 1 summarizes the numbers of products and strategies reviewed in the Selection Guide.

Table 1. Applied technology categories and number of products and strategies by category reviewed in the Selection Guide.

Applied technology categories in the Selection Guide	Number of products/strategies reviewed
Fast-water booming strategies	6 types
Non-floating oil strategies	13 types
Oil and ice strategies	6 approaches
Water intake monitoring strategies	3 approaches
Wildlife response strategies	6 types
Alternative sorbents	18
Bioremediation agents	14
Dispersants	5
Elasticity modifiers	2
Emulsion treating agents	1
Fire-fighting foams	5 types
<i>In situ</i> burning on land	None specifically
<i>In situ</i> burning on inland waters	None specifically
Shoreline pre-treatment agents	None Available
Solidifiers	9
Surface-collecting agents	2
Surface-washing agents	16

Content

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. Applied technologies are defined as those products and technologies that are considered outside of the mainstream of traditional response equipment and strategies. This includes the product categories regulated by the National Contingency Plan Product Schedule (40 CFR 300.900, a.k.a., Subpart J). The twelve categories covered in the guide are:

- Alternate sorbents
- Bioremediation agents
- Dispersants
- Elasticity modifiers
- Emulsion treating agents
- *In situ* burning on land
- *In situ* burning on water
- Shoreline pre-treatment agents
- Solidifiers
- Surface-collecting agents (herders)
- Surface-washing agents
- Firefighting foams

The five response strategies for “unusual” spill response conditions included in the guide are:

- Fast-water booming strategies
- Non-floating oil strategies
- Oil in ice situations

- Water intake monitoring
- Wildlife response strategies

The Selection Guide begins with basic information about the regulations and their interpretation that govern the use of these technologies in the United States. This section is designed to inform the decision maker about the regulatory basis and authority to use applied products and technologies. Topics covered in this first section include: the role of local government Incident Commanders, OSC notifications, decision input and concurrence, and pre-authorizations (also known as pre-approval). This section also contains a discussion of the National Contingency Plan (NCP) Product Schedule and Policies and Frequently Asked Questions about the Product Schedule.

The Selection Guide was organized around the decision process that the U.S. Environmental Protection Agency (EPA) and U.S. Coast Guard (USCG) OSCs in Region III would use to make a decision whether or not to use applied response technologies during a spill response. The basic sequence of logic is as follows:

- First, is the applied technology(s) likely to provide value in a particular situation?
- Does the OSC have the authority to use the technology 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?
- Is there an identified specialist (technical contact) who can provide timely advice on its effective application and use?

Step One: Screen an incident. Step One of the Selection Guide provides the information necessary for the decision maker to determine what technologies might be useful during a particular response. It begins with an overview matrix of basic information for each technology category, which orients the user on the specific technologies that are included in the Selection Guide. Environment-specific matrices and a worksheet also are found in Step One.

There are environment-specific matrices for coastal waters, adjacent land, and inland waters. The environment-specific matrices help the user screen a situation depending on whether the spilled oil is on inland or coastal waters, or on land. The matrices do not reflect zones of jurisdiction. An example of the coastal waters matrix is presented in Figure 1. Each matrix lists the different product and technology categories on the X-axis, with different environmental considerations and concerns on the Y-axis. Consideration categories on the matrix include response phase, oil type, treatment volume, weather conditions, decision authority required for use, monitoring required, and “other considerations.” Products and technologies that are applicable for those conditions are marked in the matrix. Using the selected matrix, the user examines each of the considerations on the Y-axis to determine which technologies seem to best apply to the situation being considered. A Decision Tracking/Evaluation Worksheet is used to record the screening results for the three product or technology categories of most interest. Completing the worksheet allows the user to document the decision-making process and distribute the 1-page worksheet to others. The bottom of the worksheet provides an area to collect comments and any required signatures. The worksheet can be retained as an official record of the decision-making process.

Step Two: Review and select potential options and products. Once a product or technology category has been chosen, the user moves on to Step Two. Step Two of the guide provides more detailed information about all the applied technology categories and strategies, and is designed to assist the

ENVIRONMENT-SPECIFIC MATRIX FOR COASTAL WATERS														
COASTAL WATERS														
X = consider further														
Response Phase	Alternative Sorbents	Bioremediation Agents	Dispersants	Elasticity Modifiers**	Emulsion Treating Agents	Fuel/Water Booming Agents	Fire Fighting Agents	In-situ Burn (ISB)	Non-floating Oil Strategies	Oil Tracking	Shoreline Pre-Treatment Strategies	Solidifiers	Surface Collection Agents**	Surface Washing Agents
Emergency (Days 1 to 3)	X		X	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	X
Clean up (discharged product stable)		X						X					X	X
Disposal (transportation and storage)		X		X				X						
Oil Type														
Very Light Oil / Light Oil (gasoline, diesel fuel, condensate, jet fuel)	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	X	X	X	X
Heavy Oil (bunker, No. 6 fuel oil)	X	X		X	X	X	X	X	X	X	X	X	X	X
Heavy Oil that Sinks								X						X
Treatment Volume														
less than 10 gallons	X	X									X	X		
10 to 100 gallons	X	X									X	X	X	X
100 to 1,000 gallons	X	X	X	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			X	X
10,000 to 100,000 gallons			X		X	X	X	X	X	X			X	
greater than 100,000 gallons			X		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	X	X	X
Warm (air > 75-89° F; water > 65-79° F)	X	X	X	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	X	X	X
Cold (air < 40° F; water < 54° F)	X		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
Low Winds / Seas	X	X		X		X	X	X	X	X	X	X	X	X
Decision Authority														
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							PS	PS	PS	PS
RRT Concurrence Required (CR) (but may NOT have to be on the Product Schedule)	CR	CR	CR	CR			CR				CR	CR	CR	CR
OSC Pre-Authorization in Place (PA)			PA				PA							
Special Permit(s) Required (SP)							SP	SP						
Considerations														
Limited Oil Handling and Storage Capacity	-		+	-	+		+							+
Oil On Fire or Potential for Fire			+				+	O						
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	+						?				-			
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	+		-	-	+	O	-	+	+		+			+
Oiled Site is Access Limited	?	+					+					-		+
Oiled Shoreline Needs Cleaning Without Significant Impacts	+	+					+			+			+	+
Significant Problem of Waste Generation	-	+	+	-	+		O	+		+				+
Monitoring														
Implement SMART Monitoring (SM)			SM				SM							
Implement Effectiveness or Other Monitoring (OM)	OM	OM	?	OM	OM	OM	OM	OM	OM	OM	OM	OM	OM	OM
a = If Accelerants Used (+) = Consider for Use (?) = Case-by-case b = If Released to Environment (-) = Do not consider for use *Not advs = not advised (O) = Neutral **As of this revision date, there are no products for this category listed on the NCP Product Schedule.														

Figure 1. Environment-specific matrix for coastal waters. This is one of three environment-specific matrices contained in the Selection Guide. The other two matrices cover oil on inland waters and on land.

user in identifying a single, or several, applied technologies or strategies for use. After choosing a particular category for further consideration in Step One, such as dispersants or bioremediation agents, the user will need to refine those choices to a few potential products or strategies for use. Each technology category and strategy has its own section, which begins with a brief overview of general summary information. The 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

The information in Step Two includes all of the products on the NCP Product Schedule plus others that are not required to be on the schedule, such as alternative sorbents. The product-specific information in Step Two is presented in a table format that is designed to allow easy comparison of individual products and strategies so that decision makers can quickly evaluate their potential value for a response (Table 2). The table organization for each technology category is similar, with some variation to reflect the most relevant decision issues of interest or concern. Again, the user records the results of this step on a worksheet.

Like the Decision Tracking/Evaluation Worksheet from Step One, the Product Selection Worksheet for Step Two is designed to capture the decision-making process for a specific product. This worksheet is product-specific and has spaces for recording information about Regional Response Team (RRT) approval requirements, monitoring requirements and recommendations, product delivery time, application time, toxicity, and other advantages and disadvantages of the particular product. The worksheet provides signature lines for representatives of the EPA, USCG, National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Interior (DOI), state, and other representatives so that it can be retained as the official approval sheet for a product or strategy.

Having chosen a product or technology for the conditions being investigated is not the end of the decision-making process. Many regions have policies that require monitoring of applied technologies to determine and document their effectiveness and obtain data that can be used to consider the environmental effects of their use. The user then proceeds to Step Three to develop implementation and monitoring plans for the applied technologies use.

Step Three: Implement, monitor, and report on the use of spill countermeasures technologies. Developing a plan to properly apply and/or implement these technologies is key to their successful use. Because implementation plans address area-specific details, such as who will be implementing the operation and where equipment will be used, implementation plans are developed on a region or area basis. The Region III plans will be contained in Volume Two of the Selection Guide.

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

This step refers to Specialized Monitoring of Applied Response Technologies (SMART) for dispersants and *in situ* burning, which is contained in Volume Two, and presents generic guidance for other products and strategies. The section titled Operational Response Techniques, Monitoring Plans, and Strategies includes Elements of a Good Monitoring Program, which discusses objectives, meaningful exposures, experimental design, and teams trained for preparation and observation. It also contains a section titled Testing and Monitoring Procedures, which discusses the five primary levels of testing as follows:

- Level 1: Tail-gate testing
- Level 2: Field effectiveness testing
- Level 3: Effects testing
- Level 4: Operational first-use monitoring
- Level 5: Continued operational monitoring

Step Three also contains a table that lists the types of questions answered by different levels of testing and monitoring for specific types of oil spill treating agents (Table 3).




Supplemental information. The Selection Guide also contains several appendices that contain detailed supplemental information to provide the decision maker with additional background on these technologies. The appendices include:

- Glossary
- History and Status of Applied Technologies
- 40 CFR 300.900 Subpart J, Use of Dispersants and Other Chemicals
- Examples of Products Not Required to be Listed on the NCP Product Schedule
- Example of Certification Letter from EPA for a Product's Exclusion from the NCP Product Schedule
- Applied Technology Case History Summaries
- Understanding Toxicity, Exposure, and Effects Related to Spill Response Countermeasures
- Copies of all worksheets and forms, including: Decision Tracking/Evaluation Worksheet, Product Selection Worksheet, Request Form Template to the RRT for Product Use, Lessons Learned Form
- Draft Press Releases for Applied Technologies (Bioremediation Agents, Solidifiers, Dispersants, Surface-collecting Agents, Emulsion Treating Agents, Surface-washing Agents, *In Situ* Burning)

The appendix on the History and Status of Applied Technologies explains the evolution of these technologies and the history of their use. For each technology category, the effects of their use in past incidents are discussed along with the results from laboratory tests and field trials.

The appendix on Understanding Toxicity, Exposure, and Effects Related to Spill Response gives the reader a crash course in these subjects. Understanding what the toxicity data for a product mean is an important part of the decision-making process and of determining what to expect during a response. For example, toxicity information is presented in terms of LC50, LD50, ppb, acute testing, chronic effects, etc. This appendix gives the reader the information needed to understand what these terms mean and what the results of toxicity testing suggest about the ecological safety of products. Written for the non-scientist, the appendix discusses how toxicity, exposure, and routes of exposure are related and includes a relative toxicity guide that rates product toxicities from practically non-toxic to extremely toxic, based on the results of EPA-mandated toxicity tests. It also discusses the possible effects of product use and what changes in these effects may occur when oil is treated with different countermeasure products. The application of dispersants, for example, will act to protect sea birds and other surface dwelling animals, but may increase the effects to coral reefs and bottom

Table 2. Product-specific information table.

	Aquaclean	CytoSol	Petro-Clean
General description of surface-washing agent	Alkaline, green, water-based detergent concentrate	Biosolvent containing methyl esters derived from vegetable oils and bioremediation enhancers; no surfactants or emulsifiers; amber color.	Light yellow liquid
Availability (amount per location)	As needed on demand; manufacturer in Madison, IN	Information not provided	Information not provided
Application rate	Spray 50% solution to cover contaminated area	Between 0.5:1 and 1:1 product-to-oil applied neat	Varies; 0.5% to 6% solution
Application method	Pressure spray solution on oiled area, then agitate using solid stream of rinse water	Spray neat product on contaminated area, let soak, then rinse with water	Spray, power washers, or with eductor
Soak time	3–5 minutes	At least 1 hour; longer in cold weather	
Temperature limitations	Water temperature should be > 41°F	Information not provided	Above 35°F
Effectiveness in environment canada lab test	Not tested	Not tested	Not tested
Use in fresh water?	Yes	Yes	Yes
Use in salt water?	Unclear; says to dilute and rinse with fresh water	Yes	Yes
Toxicity (lc-50, ppm)¹	Mummichug 70.7 (96h), brine shrimp 11.7 (48h); did not enhance toxicity of No. 2 fuel oil	Did not enhance toxicity of No. 2 fuel oil for shrimp; slight increase in toxicity for silversides	See toxicity data immediately below
Inland silversides 96h	70.7	738	100
Mysid shrimp 48h	32.7	124	110
Solubility in water	100%	14 ppm in fresh water; 7 ppm in sea water	100% soluble
Other information	100% solution pH = 11.8; 1% pH = 10; manufacturer recommends use as industrial cleaner, not for use in the environment	Product tested on spills on mussel beds, gravel beach, and on stream vegetation, with good results; Used on <i>New Carissa</i> , 1999	pH = 8.05 (10% solution); website: www.alabastercorp.com
Is treated oil recoverable?	No, the oil is dispersed	Yes, released oil can be skimmed	Information not provided
Application assistance information²	Madison Chemical Company, Inc., 812-273-6000	CytoCulture International, Inc., 510-233-0102	Alabaster Corp., 281-487-5482, 800-609-2728
Unit cost³	Unit cost = \$6.00/gal	Unit cost = \$6-\$12 per gal	Not calculable
Color photograph of product⁴			

Note: This information table is an example of the tables found in Step Two of the Selection Guide. It contains the information for three of the surface-washing agents covered by the guide. The Selection Guide contains separate tables for twelve categories of products. All products on the NCP Product Schedule are covered.

¹ A low value = high toxicity.

² For additional application assistance, contact the supplier listed on the NCP Product Schedule Notebook.

³ Unit costs are based on 1999 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.

⁴ Photos are added as they become available.

Table 3. Questions 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
Alternative sorbents	Does product absorb 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 product be applied at 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 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 sublethally?	What are the oil concentrations in water adjacent to treated areas? Is there any change in biota condition over the course of product use?

Note: This table is to be used by decision makers to assist in the selection of testing and monitoring procedures. Different procedures provide answers to different types of questions, and therefore should be selected carefully during a response. It is not uncommon for responders to devote a great deal of time and effort to testing and monitoring, only to discover later that the procedures being used cannot give them the types of information they require.

dwelling animals. Finally, a table is presented that clearly lists the possible effects of oil by resource category and route of exposure.

Another appendix of particular interest is the Applied Technology Case History Summaries. This appendix contains up-to-date lessons learned about technologies that are discussed in the Selection Guide. Since there is often a big difference between what is on paper and what happens in the "real world," the intent is to provide responders with information about how these technologies have worked when used in recent incidents. The Selection Guide also contains a Lessons Learned Form, which those who have used the guide to make decisions concerning products and strategies complete and return. Since the Selection Guide is a living document, lessons learned and other product use reports will be added to the guide in regular updates.

Summary

The Selection Guide is designed to provide the decision maker with the information necessary for determining whether the use of less traditional oil spill applied technologies, such as chemical and biological additives, would be beneficial for the specific conditions being evaluated. It is an information tool to assist the decision maker through this evaluation process.

In the Selection Guide, Step One assists in the selection of a suitable countermeasure technology; Step Two assists in the selection of a *specific* product or strategy; and Step Three assists in implementing and monitoring the chosen countermeasure. Besides giving technological assistance, the Selection Guide provides a way to document the decision-making process for using or not using these technologies. At the time of this writing, there are plans to have the Selection Guide stored on the Region III RRT Web site before the end of 2000. This will make the

Selection Guide a free document that anyone can easily download for updates and use.

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Biography

Debra K. Scholz is an environmental preparedness specialist for Scientific and Environmental Associates, Inc. She has expertise in spill response, natural resource damage assessment, and contingency planning. Many of her recent projects have involved the study of alternative oil spill countermeasures for spill response, particularly focusing on the potential use of oil spill applied technologies.

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