Industry Guidelines on Requesting Regulatory Concurrence for Subsea Dispersant Use

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Introduction

Subsea dispersant injection (SSDI) was used as a response method during the Deepwater Horizon oil spill of 2010. The Region VI Response Team (RRT VI) had pre-authorization plans for surface dispersant use in place, but concluded that those plans were not applicable to a subsea, relatively continuous application of dispersant. As a result, incident-specific implementation policies were developed during the course of the response. Since 2010, several command-post exercises sponsored by industry have indicated that existing policies and guidance can be enhanced for operational decisions relating to the use of subsea dispersant.

To clarify what type of information may be required by RRTs to support subsea dispersant–use decisions, the API D3 Subsea Dispersants Joint Industry Task Force developed guidelines for industry on recommended procedures for seeking FOSC authorization and RRT concurrence. These guidelines are based on lessons learned from the above-mentioned exercises and valued input from RRT VI agencies, which helped to continually improve the document to simulate the approval and concurrence of using subsea dispersants for exercise scenarios.

Dispersant use in the United States is governed by Subpart J of the National Contingency Plan (NCP), which is found at 40 CFR (Code of Federal Regulations), §300.910. This guidance offers clarification on how API has interpreted requirements of 40 CFR §300.910 as applied specifically to subsea dispersant use, but does not in any way modify the roles, requirements, and procedures contained therein. At the time of preparation of this document, the Environmental Protection Agency (EPA) had issued proposed revisions to Subpart J of the NCP. Some of the proposed revisions may alter recommendations contained in this guidance, and may be revised after publication of the EPA final rules.

Industry Guidelines on Requesting Regulatory Concurrence for Subsea Dispersant Use

1 Scope

The purpose of this document is to provide guidelines, forms, and checklists recommended for use by industry. The API guidelines describe the RRT concurrence request process, proposed information submission recommendations that are specific to subsea dispersant injection, and the use of Spill Impact Mitigation Analysis (SIMA) and other forms of tradeoff analyses as decision support tools. Also included are practical flowcharts and checklists specific to Incident Management Team (IMT) positions that are integral to subsea dispersant use, and guidance on the preparation of subsea dispersant operations and monitoring plans. This document provides operational guidelines intended for actual events or exercises and provides a basis for engagement from a range of relevant stakeholders.

This document provides guidelines for the regulatory approval in accordance with Subpart J for the use of subsea dispersants in the United States with several U.S. references since subsea dispersants were first used for one incident in the United States. The lessons learned captured by numerous companies, in addition to input from members of IPIECA and IOGP, serve as a baseline for initial guidance to share with other countries and organizations to assist in developing their own guidelines.

NOTE The main text of this document provides context, and the annexes represent the work tools and templates that can serve as part of a submission package.

2 Acronyms and Abbreviations

CERA	consensus ecological risk assessment
DOC	Department of Commerce
DOI	Department of Interior
DOR	dispersant-to-oil ratio
DWH	Deepwater Horizon
EDMU	Environmental Data Unit
EPA	Environmental Protection Agency
EFH	Essential Fish Habitats
ESA	Endangered Species Act
EU	Environmental Unit
EUL	Environmental Unit Leader
FWS	Fish and Wildlife Service
FOSC	Federal On-Scene Coordinator
GOM	Gulf of Mexico
ICS	Incident Command System
ISB	in-situ burn
IMT	Incident Management Team
LEL	lower explosive limit
LSC	Logistics Section Chief

MV	monitoring vessel
NCP	National Contingency Plan
NEBA	net environmental benefit analysis
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRC	National Response Center
NRS	National Response System
NRT	National Response Team
OSC	Operations Section Chief
OPS	Operations Section
PS	Planning Section
PSC	Planning Section Chief
QI/IC	Qualified Individual/Incident Commander
RAR	resources at risk
ROV	remotely operated vehicle
RP	Responsible Party
RRT	Region Response Team
SCB	Source Control Branch
SCS	Source Control Section
SDU	Subsea Dispersant Unit
SIMA	spill impact mitigation assessment
QAPP	Quality Assurance Project Plan
SIMOPS	simultaneous operations
SO	Safety Officer
SSDI	subsea dispersant injection
UC	Unified Command
USCG	United States Coast Guard
VOC	volatile organic compounds
WCD	worst-case discharge

3 Overview

3.1 General

The National Contingency Plan (NCP) establishes the National Response System (NRS) for oil and hazardous substances response actions. The NCP defines the roles of its major components, which include the National Response Team (NRT), the Regional Response Team (RRT), the Federal On-Scene Coordinator (FOSC), and Unified Command (UC), for managing incident-specific response actions of the federal government, state government, and the responsible party. The following section summarizes the key roles of each in authorizing and implementing subsea dispersant use, and proposes a concurrence process that is specific to subsea dispersant injection.

3.2 National Response Team

The National Response Team (NRT) is responsible for providing policy and program direction to the RRTs; evaluating methods of responding to discharges or releases; and recommending any changes needed in the response organization. The Environmental Protection Agency (EPA) chairs the NRT; it is vice chaired by the United States Coast Guard (USCG) and composed of representatives of 15 federal agencies. For coastal and offshore incidents, the USCG serves as the chair. The NRT does not ordinarily become involved in response operations, but is involved in preparedness functions, such as publishing information, coordinating planning activities, sponsoring training, and supporting Regional Response Teams (RRTs), which can include activation during a response.

At this time, no RRTs have approved preauthorization plans for subsea dispersant use. Each use must be authorized by a FOSC, utilizing their authority to mitigate hazards to human life (40 CFR §300.910(d)), or with concurrence from the RRT as described below. The NCP describes specific RRT roles with respect to dispersant use, which includes evaluating the desirability of dispersant use as a response method included in preauthorization plans, or in response to incident-specific FOSC requests. For coastal and offshore incidents, the USCG serves as the lead agency for authorizing the use of dispersants with the required concurrence and consultations with other relevant agencies. If an Area Committee (or the RRT) prepares a preauthorization plan for a specific area, the representatives from USCG and EPA, the affected state(s), Department of Commerce (DOC), and Department of Interior (DOI) must approve, disapprove, or approve the plan “with modifications.” A FOSC can authorize the use of dispersants in response to a specific incident that is not covered by a preauthorization plan, with the concurrence of the representatives to the RRT from the EPA, and the affected state(s) in consultation with the representatives from DOC and DOI.

The Federal On-scene Coordinator (FOSC) is responsible for establishing the Unified Command (UC) for an incident and for determining whether to authorize dispersant use. The FOSC can authorize dispersant use without RRT involvement if, in the FOSC’s judgment, it is necessary to protect or substantially reduce a hazard to human life.

3.3 Responsible Party

The Responsible Party (RP) will participate in the UC through a Qualified Individual/Incident Commander (QI/IC), and coordinate with the FOSC to assemble a package of pertinent information to assist the RRT with their dispersant authorization decision making.

4 Summary of Core Information Submitted to Regional Response Teams

To-date, the following information has been used by RRTs to achieve concurrence on subsea dispersant injection (SSDI) during industry-sponsored exercises:

a) signature page for FOSC authorization and other Incident Commanders’ approval;

b) summary of SSDI rationale and readiness to execute;

c) comprehensive incident data sheet;

d) identification of resources at risk;

e) site and incident-specific 3-D modeling information used to predict oil and dispersed oil trajectories;

f) Subsea Dispersant Operations Plan;

g) Subsea Dispersant Monitoring Plan;

h) analysis of potential NEBA/SIMA and risk assessment associated with SSDI.

NOTE See Annex A for more detailed information and operational templates.

5 Evaluating the Use of Subsea Dispersant Injection

The primary goal of dispersant use is to increase the amount of oil that dissipates into the water column and is subject to microbial degradation, thereby reducing the amount of oil remaining on the surface. The use of SSDI offers an available and efficient method of achieving a high encounter rate directly at the source, thereby reducing the potential for floating oil to threaten worker health and safety, and to reach ecologically and economically sensitive shoreline environments. Research and experience has shown that hydrocarbon exposures decline rapidly away from the subsea source and are further mitigated by microbial degradation [24].

This enhanced dispersal of oil is an important factor when using SIMA as a part of the response decision–making process.

Past government and industry experience with responding to open-water oil spills has shown that mechanical recovery alone has often yielded limited rates of recovery [24] because of low encounter rates due to oil spreading into a thin film, and reduced efficiency due to higher wave conditions offshore. As industry operates in deeper waters farther offshore, there are additional limitations posed by greater transit distances for boats supporting the response, and adverse weather conditions that can hamper safe operations and transits to and from port. For these reasons, the use of SSDI can provide an effective means of minimizing significant quantities of oil from the surface quickly, and reduce potential threats to sensitive near-shore, shallow-water environments.

Several factors should be considered in making a decision about subsea dispersant injection in any given scenario, and the decision process should be documented for potential presentation to the RRT. Table A.2 in Annex A may be used to help assess the feasibility of SSDI as a response method in the context of a given spill scenario. Table A.2 provides overall context for addressing the evaluation and use of SSDI as a response tool or during preparation of a concurrence request for the use of SSDI during an exercise or actual incident.

6 Use of Modeling to Support Response Decision-making

The forecast skill of oil spill trajectory models is dependent upon the accuracy and availability of the data requested when the model is developed, accuracy of input information, the judgment of the modeler, and the formulation of the oil spill model itself. Important inputs include wind and current data from meteorological and hydrodynamic models. For spill responses, models are recommended for 24- to 72-hour forecasts due to the decreased accuracy of input information for longer future projections; however, longer (>72 hours) projections provide valuable conceptual and predictive data for planning purposes, especially for potential resources at risk. Subsea 3-D models consider both vertical and horizontal transport, which depend upon many of the same factors as a surface spill but also include model predictions of droplet size, gas content, depth and stratification, and the oil constituents themselves. Current subsea deep ocean hydrodynamic models have not been verified to any degree of accuracy, nor are they configured to resolve local current velocities important to near-term trajectories, which should be considered during a subsea release. For modeling dispersed oil at depth, full water column measurement of current velocities near the spill site should be a priority, along with oil characteristics and droplet size, as well as a baseline conductivity, temperature, and depth (CTD cast) to provide inputs for the modeling. Predictions using this information should have a relatively high forecast accuracy within a 24- to 72-hour trajectory forecast.

Oil spill modeling should be conducted well in advance of an event, using a (credible) worst-case discharge scenario, allowing prediction of oiling extent and character for use in response exercises, training, or planning. It can be modified during an event. As additional data is available or provided, such as results from lab analysis, or updated as conditions, such as flow rates, change, the models may be updated, which would change the initial model results based on either pre-incident data or initial response data. Accommodations (e.g. data, specialists, computing resources) should also be made to conduct operational modeling (e.g. 24–72 hours) during an actual response event. This will allow responders to have access to the most current trajectories and exposure predictions based on the specifics (e.g. location, volumes, oil type, weather/ocean conditions, etc.) of the event.

The outputs from the operational modeling can be used to support decisions relating to worker safety, intervention methods, allocation of boom, guidance for monitoring missions, and other key response decisions.

A summary of the modeling assumptions and model findings is another critical element for submission of the SSDI concurrence package. Models used should be presented and described to the key response decision makers. In addition, illustrations should be provided to assist with helping decision-makers understand the relative impact of dispersants on the movement and character of the released oil. Modeling results should be presented for both treated and untreated releases, for the anticipated period of the release. To determine the maximum potential for shoreline oiling, it may be useful to extend the modeled period well beyond the anticipated period of the release. For example, the model could be set up to run a surface or subsea release for greater than a 72-hour period to simulate an extended, uncontrolled flow. Modeling should address dispersed oil in the water column, as well as surface slicks. Estimation of oil fate should include evaporative losses, dispersion, dissolution (important to oil weathering for deep-water releases), sedimentation, biodegradation, and response activities. Modeling should also specifically address any known environmentally sensitive areas for a given region (e.g. the Flower Gardens Banks National Marine Sanctuary in the Gulf of Mexico).

Annex A.6 provides recommended model input parameters and primary model outputs for the near and far fields that might be used to support response decision-making.

7 Importance of Effective Data Management Techniques

As illustrated in Figure 3, it is worthwhile to understand the importance of the relationships between the Environmental Unit, Situation Unit, Operations (Subsea and SIMOPS), Monitoring Team(s), and Modeling Team in effectively executing high-quality SSDI (including monitoring). Clear communication, shared access to current and accurate information, and agreed data management practices are critical to a safe, effective, and fit-for-purpose SSDI plan.

It is recommended that a dedicated Environmental Data Management Unit (EDMU) be established within the Command System to guide and coordinate essential data management activities. These might include the development and implementation of a Quality Assurance Project Plan (QAPP), a requirement per EPA regulations, leading the development of functional and technical requirements for relevant environmental data, technical coordination with the Situation Unit (those responsible for operating and updating the common operating picture).

8 Use of SIMA to Support Response Decision-Making

The term “net environmental benefit analysis” and its acronym, NEBA, have been used extensively over the years to describe a process used by the oil spill response community for guiding selection of the most appropriate response option(s) to minimize the net impacts of spills on people, the environment, and other shared values.

Given that the selection of the most appropriate response action(s) has, in practice, been guided by more than just environmental considerations, the oil and gas industry is seeking to transition to a term that better reflects the process, its objectives, and the suite of shared values that shape the decision-making framework, including ecological, safety, socioeconomic, and cultural aspects. Industry has consulted directly with non-industry stakeholders who have expressed support for transitioning to a more appropriate term.

Industry is thus introducing the term “spill impact mitigation assessment” (SIMA) as a replacement for NEBA. We recognize that the transition to SIMA (formerly known as NEBA) will take some time, but we believe it is important to begin the process of more accurately describing this longstanding practice and its objectives. For purposes of this document, all references to SIMA should be understood to mean NEBA in its broader context. At appropriate points in time, other publications will be updated to replace the term NEBA with SIMA. Our aim is that other stakeholders will adopt a similar approach to institutionalize this more accurate and descriptive term over time.

SSDI, and all other response methods, are tools that can be used to assist in attainment of the UC’s operational objectives. Typical response objectives that are targeted by using SSDI, in order of priority, are protection of worker safety, protection of human health, and the mitigation of environmental impacts. In selecting the optimum mix of response methods available to combat a spill, the extent to which each method can accomplish the incident objectives, while minimizing any associated negative impacts are compared. Methods traditionally used for evaluating the relative net environmental benefits of various response technologies include NEBA and consensus ecological risk assessment (CERA). Such analyses are typically conducted in support of planning activities, but the principles and some of the methods employed can also be used during response actions, or response simulations and exercises. During exercises, unless a SIMA has been conducted through applicable planning activities that consider the release scenario, an incident-specific SIMA should be conducted and included as part of the RRT concurrence package.

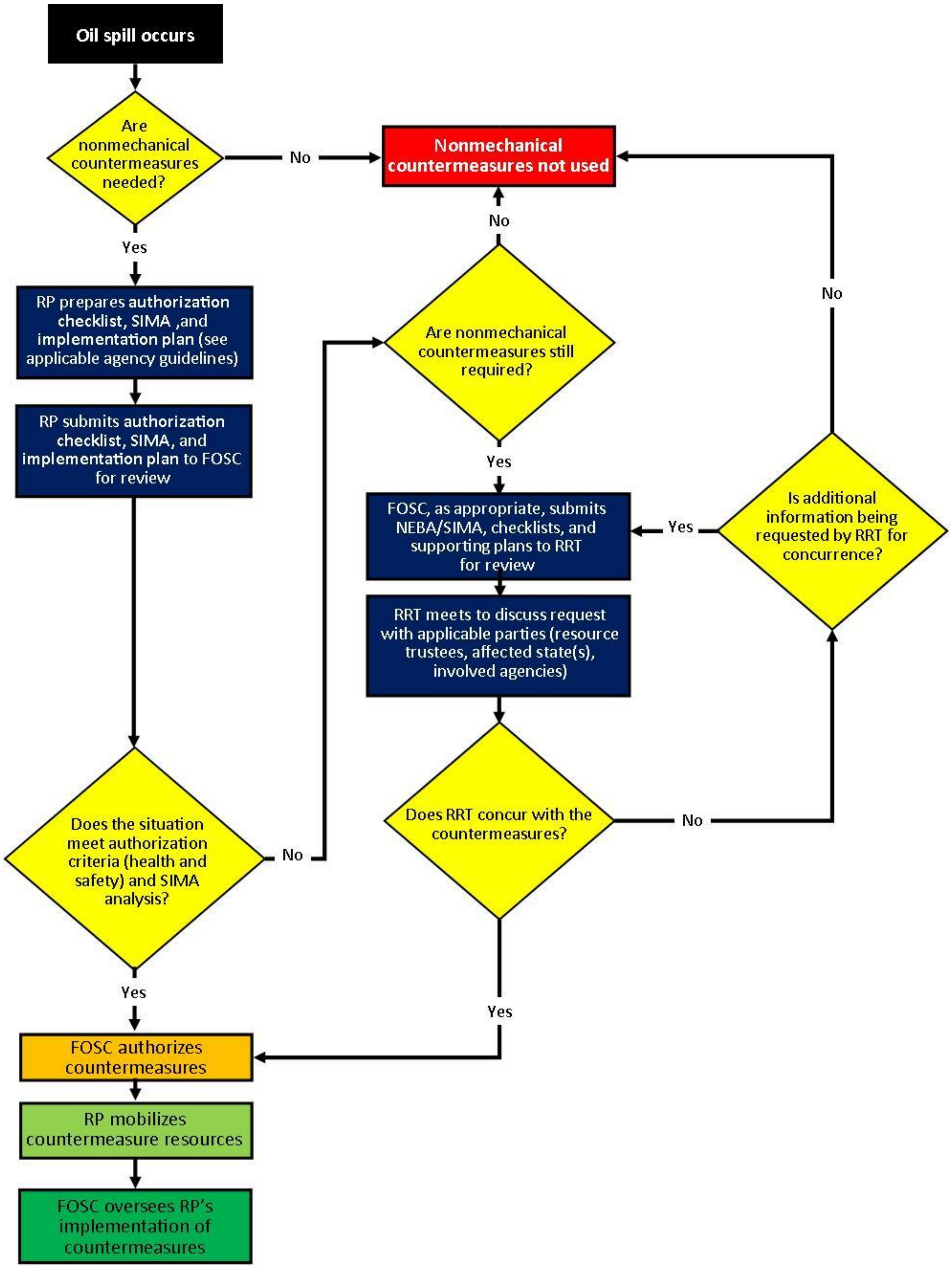
The objective of using SIMA as an SSDI decision support tool is to evaluate the potential net environmental, socioeconomic, worker safety, and human health benefits of using SSDI within the context of the overall response strategy, and help make specific recommendations to help inform decisions. While the period for conducting a SIMA during a response action is compressed, the factors being considered are largely the same as for “pre-event” SIMAs.

9 Regional Response Team Concurrence Request Process

The QI/IC notifies the FOSC, and delivers as much of the information required for completion of the incident data sheet as possible. The FOSC assembles the UC, and determines whether or not dispersant use is appropriate based on incident-specific considerations. If the FOSC authorizes subsea dispersant injection, based in part on a SIMA, he/she must seek concurrence, as provided in 40 CFR Subpart J, from representatives to the RRT from the Coast Guard, EPA, and the relevant state agency (if applicable), in consultation with DOI and DOC natural resource trustees. This is typically accomplished by means of a conference call, which is scheduled by the RRT co-chair from the USCG. Information needed to support the incident-specific RRT call may be provided to RRT members by the USCG RRT Coordinator, and can include the forms described above, which collectively are referred to in Annex A.

During the incident, the members of Unified Command should conduct an RRT conference call in which an overview of the incident-specific information is provided. The QI/IC would typically provide the incident summary, and the FOSC would typically explain the factual basis and need for authorizing subsea dispersant use. Incident-specific RRT member agencies, as appropriate, would determine whether to concur with the FOSC authorization. If concurrence is obtained, the RRT may request actions, including modifications or additions to the plans provided, data reporting procedures, and additional coordination requirements. As the response progresses, the FOSC and RRT can schedule additional coordination calls, enhancing data exchange and update/review of dispersant application and monitoring practices. Changes in application and monitoring strategies or tactics can result based on these reviews/updates.

The operational decision-making process for authorizing the use of subsea dispersant is illustrated in Figure 1. A flow diagram for determining the viability of dispersant use, as well as implementing aerial, vessel, or subsea dispersant operations, is provided in Figure 2.



Key

FOSC—Federal On-Scene Coordinator

RP—Responsible Party (Plan Holder)

RRT—Regional Response Team

SIMA—Spill Impact Mitigation Analysis

Figure 1—Subsea Dispersant Use Decision-making Process

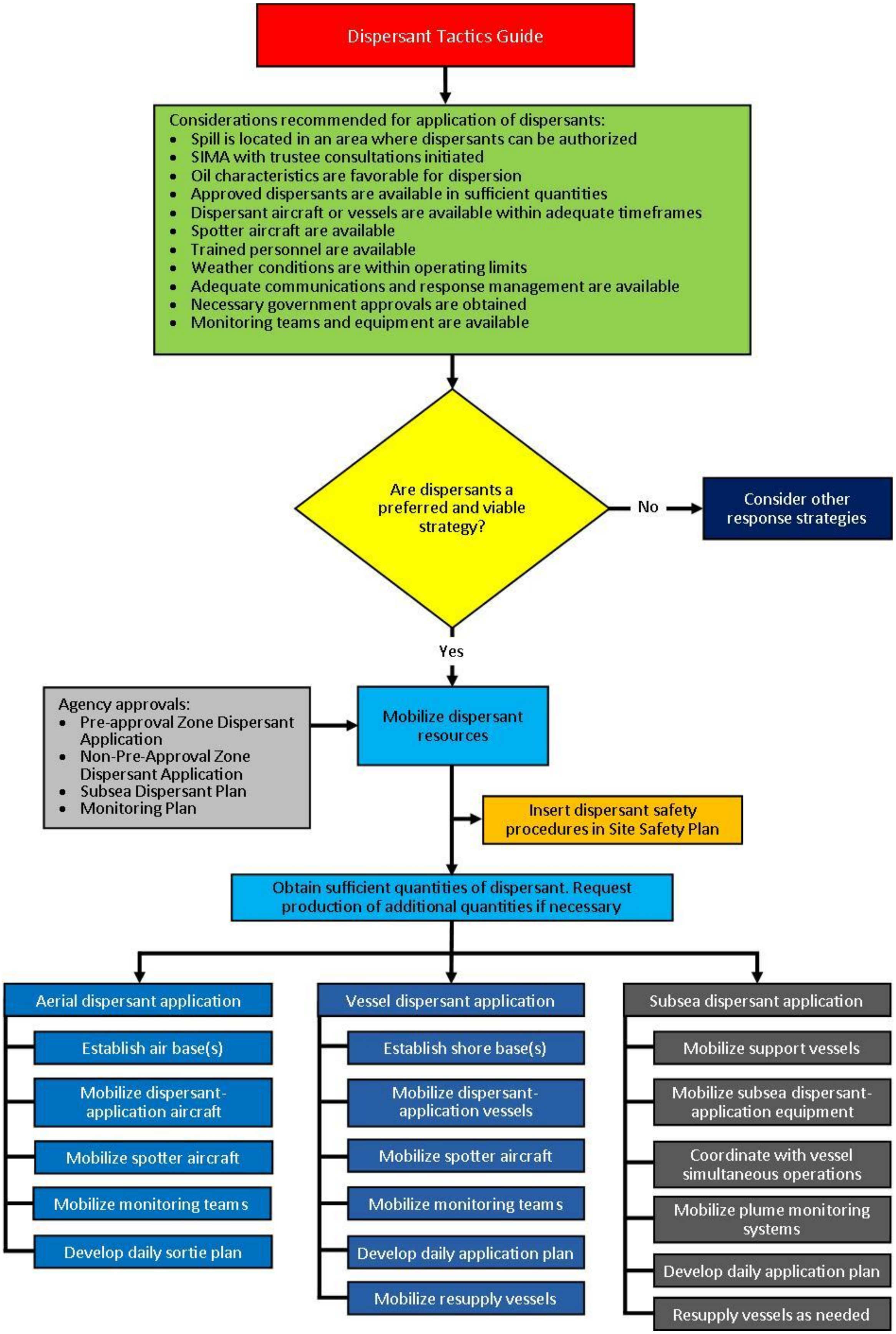


Figure 2—General Surface and Subsea Dispersant Guide

10 Incident Command System Positions with Significant SSDI Roles

10.1 General

While implementation of an SSDI program requires some actions on the part of all positions within the Incident Command System (ICS), some have key operational and tactical roles. Those are the Unified Command (particularly the FOSC and QI/IC), Safety Officer (SO), Planning Section (PS), Environmental Unit (EU), Operations Section (OPS), Source Control Branch or Section (SCB or SCS), and Subsea Dispersant Unit (SDU). SSDI planning activities, which include development of the monitoring plan, data management, and reporting, are typically conducted in the PS/EU. SSDI operations may be managed by operations in close consultation with the EU.

The key ICS positions for SSDI are illustrated in Figures 3 and 4, which offer two possible configurations of the key teams necessary to perform and monitor SSDI. There are advantages and disadvantages to either arrangement, but effective coordination between the SSDI monitoring and operational organizations are important to managing effective overall operations. If these functions are located in different physical locations, consideration should be given to assigning liaison positions within each organization.

Sections 10.2 through 10.8 describe the tasks for each specific position or organization and are amongst the most significant; however, the lists are not intended to be all-inclusive.

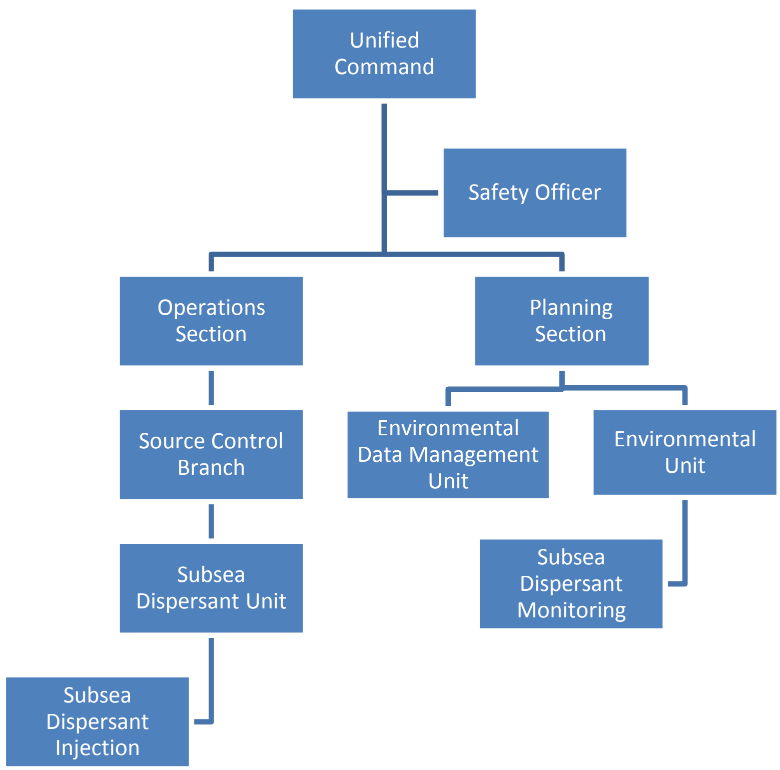


Figure 3—Examples of Organization Elements with Significant SSDI Roles

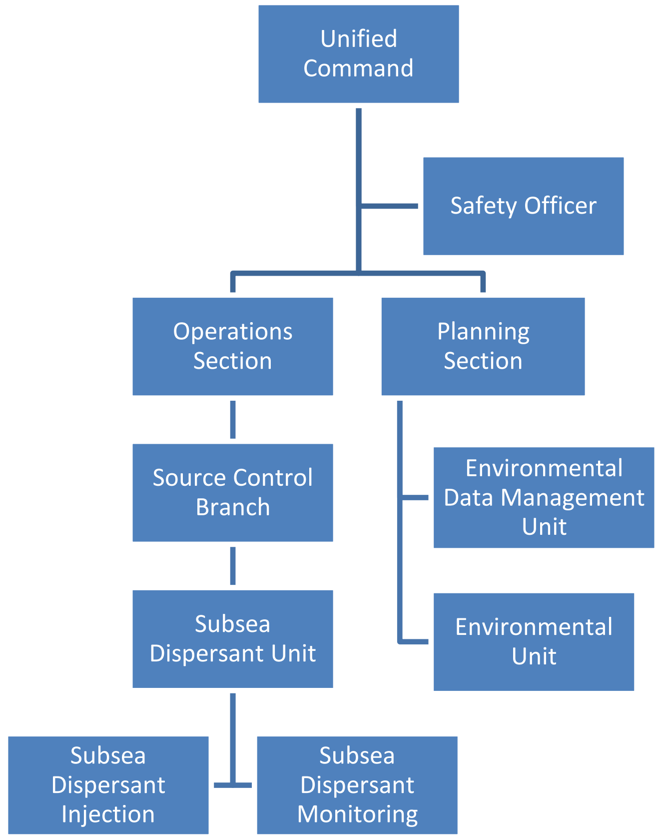


Figure 4—Examples of Organization Elements with Significant SSDI Roles

10.2 Responsible Party Incident Commander Recommended Tasks

The Responsible Party (RP) initiates engagement with the National Response System by notifying the National Response Center (NRC) and other authorities in accordance with NCP and approved response plans for a release, or potential release, of oil. The following lists the tasks of the Responsible Party's IC when providing the FOSC with information necessary to support the decision to authorize subsea dispersant injection as a response method, and to seek concurrence from the RRT.

a) Assure that required internal and external notifications have been made.

b) Initiate required consultations noted in Item 6 in Table A.1 (and other relevant consultations)

c) Ensure coordination of all ICS units involved in subsea dispersant operations and monitoring.

d) Ensure adequate data management, reporting, and documentation procedures.

e) Review and approve the SSDI Operations Plan, Monitoring Plan, and other elements for FOSC approval, as well as other FOSC requested information for the RRT concurrence package.

f) Notify FOSC and request authorization for subsea dispersant use.

g) If FOSC authorizes subsea dispersant use, assist FOSC in briefing RRT and requesting concurrence with subsea dispersant use decisions.

h) Direct the Operations Section to implement SSDI operations and monitoring.

i) Request daily status reports on dispersant operations and monitoring.

j) Request FOSC authorization for any changes in operational parameters, or exceeding authorized incident-specific action levels (i.e. authorized, incident-specific (or codified) threshold that would trigger a change in response strategy; for example, a change in well flow rate might dictate a higher volume of dispersants, or high surface-level VOCs might invoke the use of SSDI).

k) Understand and approve any required changes to SSDI operations and monitoring plans.

10.3 Federal On-Scene Coordinator Recommended Tasks

The FOSC is responsible for authorizing dispersant use in accordance with NCP, and works with all members of the IMT who have direct roles in implementing the subsea dispersant use and monitoring plans throughout the duration of the dispersant application. The FOSC serves as the primary coordination point between the UC, IMT, and RRT. The following are the major FOSC tasks when coordinating subsea dispersant use:

a) Work with QI/IC and SOSC to establish Unified Command.

b) Coordinates final decision on timing, duration, and form of subsea dispersant use.

c) Seek required RRT concurrence/consultations on decision to authorize dispersant use.

d) Verify all federal consultations have been initiated.

e) Review daily dispersant operations and monitor status reports.

f) Coordinate with RRT throughout duration of dispersant use.

g) Approve any proposed changes to SSDI operations and monitoring plans.

h) Provide status briefings to federal partners and external stakeholders.

10.4 Safety Officer Recommended Tasks

The SO is primarily concerned with protecting the safety of workers involved in the response action. Air-monitoring data that is collected from field safety representatives under the leadership of the SO is critical to operations to ensure activities are safely conducted. These data are also important for the Environmental Unit Leader (EUL) in measuring dispersant efficacy to see if VOCs and percent LEL are lowered during SDDI application. The major SO tasks include the following:

a) Develop and endorse a FOSC-approved safety plan for SSDI operations and SSDI monitoring.

b) Oversee air-monitoring operations aboard deployed vessels operating in the source area.

c) Work with EUL to develop coordination procedures, air monitoring strategies, and reporting.

d) Provide air-monitoring data to EUL within any established periods.

e) Develop PPE guidance for field personnel for (including, but not limited to): transportation, storage, and handling of dispersants in accordance with the manufacturer's safety data sheets.

10.5 Planning Section Chief Recommended Tasks

The Planning Section Chief (PSC) serves as the primary coordination point for information exchange between the EUL and operational elements within the Source Control Section or Branch.

a) Establish Environmental Unit (EU) and designate a Dispersant Monitoring Team.

b) Establish an Environmental Data Management Unit (equivalent to the EU within the response hierarchy).

c) Guide SSDI operations plan in coordination with Source Control and others in Operations.

d) Oversee development of SSDI monitoring plan and RRT concurrence package for FOSC.

e) Provide all required dispersant use and monitoring data to FOSC and UC within established timeframes.

10.6 Environmental Unit Recommended Tasks

The EU serves as a primary coordination point for SSDI science and monitoring, and the full range of IMT organizational elements that are involved in data gathering through field activities. The EU performs the following tasks:

a) Coordinate with the PSC and Operations Section Chief (OSC) on dispersant injection operations plan. See A.8 for details.

b) Establish and oversee the Subsea Monitoring team that leads strategy for SSDI monitoring.

c) Develop the incident-specific, adaptive Subsea Monitoring Plan for FOSC approval.

d) Coordinate with the SCB and the PSC to develop the RRT concurrence package.

e) Coordinate collection of pre-dispersant samples and air-monitoring data with OSC and the SO.

f) Organize modeling efforts to produce operational 3-D trajectory analyses.

g) Assist in developing initial DOR and post-subsea dispersant-monitoring DOR recommendations with source control and subsea dispersant group.

h) Identify and prioritize the resources at risk in coordination with resource trustees and incorporate them in ICS Form 232 (RAR Summary).

i) Lead efforts to conduct SIMA assessment and communicate results to UC, PIO, and JIC.

j) Coordinate aerial photography of surface slicks with air operations.

k) Develop daily updates on monitoring data, and their interpretation, to UC through PSC.

l) Provide mission guidance to any offshore sampling teams in coordination with SIMOPS.

m) Assist in preparation of RRT concurrence package by providing flow rate and related data from RP Flow Engineering to PSC and providing timely information updates to the Situation Unit for inclusion in Common Operating Picture and/or other information systems.

10.7 Environmental Data Management Unit Recommended Tasks

The Environmental Data Management Unit is responsible for collecting and storing response-related environmental data collected from air, surface, and subsea surface sediment samples from field operations and resourced in accordance with RP overall Data Management Plan. The following tasks are performed by the Environmental Data Management Unit:

a) Coordinate with Situation Unit to ensure current display of key data sets.

b) Collect and store environmental data from field safety representatives to monitor VOC data above established threshold limits as defined by Safety Officer and approved by FOSC and Unified Command.

c) Collect and store environmental data from water column monitoring field teams.

d) Collect and store all other environmental data from shoreline, shallow water, and/or near-shore areas that provides strategic and tactical guidelines for protecting resources at risk.

e) Share data with NRDA team, legal, and government agencies as requested per approved RP environmental data management guidelines.

10.8 Subsea Monitoring Team Recommended Tasks

The Subsea Monitoring Team is responsible for managing and operating subsea dispersant–monitoring equipment during subsea dispersant injection operations in accordance with a FOSC-approved subsea dispersant monitoring plan. The tasks of the Subsea Monitoring Team are as follows:

a) Coordinate Monitoring Vessel (MV) deployment plans with SIMOPS.

b) Implement the Subsea Dispersants Monitoring Plan.

c) Report monitoring data in accordance with data communications plan to EU for analysis

d) Coordinate shipping of all samples to labs, with results going directly to EU.

e) Submit resource requests for subsea monitoring per equipment list (see Table A.4 for more detail).

f) Maintain field communications with SCB.

g) Coordinate with subsea dispersed oil modeling team.

10.9 Source Control Section or Branch Subsea Dispersant Unit Recommended Tasks

The SCS or SCB supervises the Subsea Dispersant Group/Unit in source control operations, and those involved in environmental SSDI generation or reporting.

10.10 Subsea Dispersant Operations Operations/Unit Leader Recommended Tasks

The Subsea Dispersant Operations Unit is responsible for the management and coordination of subsea dispersant operations at or near the source. The Subsea Dispersant Unit coordinates the development of subsea dispersant application plans and procedures; secures resources; and manages subsea dispersant operations. The goal of subsea dispersant application is to reduce the environmental impact of hydrocarbon release and improve safety for surface SIMOPS (e.g. reduce VOC levels or potential for reaching LEL). Subsea dispersant operations should have equipment set up with sufficient stockpiles available for ongoing operations. Operational objectives for tracking purposes consist of mobilization, deployment, management, and coordination of subsea dispersant injection with the Subsea Monitoring Team. The tasks of the Subsea Dispersant Operations Unit are as follows:

a) Confirm presence/absence of hydrocarbons (VOCs and percent LEL) before and/or during SSDI.

b) Coordinate with SCB to receive video feeds from the remotely operated vehicle (ROV).

c) Coordinate with EUL and Logistics Section Chief (LSC) to procure key resources (e.g. monitoring vessel, analytical equipment, laboratories, 24/7 technicians to operate and maintain equipment).

d) Obtain Site Survey data from Site Survey Unit or Well Containment Group Leader to confirm VOC and percent LEL readings in regard to subsea dispersant use to mitigate effects of VOCs and combustible hydrocarbons in operational zone before and during SSDI.

e) If dispersant use and plan are approved by regulatory authorities and dispersant representative, submit request to dispersant supplier or manufacturer representative for production of and delivery of dispersants.

f) Coordinate with Flow Engineering Group to obtain estimate of flow rate, and Environmental Unit to determine recommended DOR.

g) Submit resource request for subsea dispersant injection per equipment list (see Table A.3 for more detail).

h) Assist EU and SO with developing subsea dispersant FOSC approval and RRT concurrence package for submission through the FOSC to the RRT.

NOTE Both work-class ROVs from the injection vessel will provide visual monitoring for injection operations, with one assisting the monitoring crew with water sampling above.

i) Coordinate selecting vessels to support injection, and supply vessels with company marine/vessel vetting.

j) Coordinate with Logistics to obtain support for fastening equipment to deck for all subsea dispersant injection and support vessels. Necessary support includes welders and welding materials; deck rigging company; third-party class certifications; and marine surveyor.

Annex A
(informative)

Recommended Submittal Elements for SSDI Approval Requests

A.1 General

This annex provides representative forms and information that should be submitted by the Responsible Party to the FOSC and UC when requesting authorization for SSDI use, and to RRT for concurrence and consultations. The information in the recommended forms helps standardize the FOSC authorization and RRT concurrence-request process, and their use will be dependent upon the specific nature of the exercise or event. During an actual event, this information should be provided prior to the meeting or teleconference in which RRT concurrence will be sought. During exercises that include RRT concurrence with SSDI as an objective, this information should be provided at least one week in advance to allow for review and scheduling appropriate staff. For situations where safety is a clear and primary purpose for requesting the use of subsea dispersants due to work health and safety, such as elevated VOCs or percent LEL, some components in this section need not be included in the authorization request, and may include the Safety Officer originating or included in the authorization process. Figure A.1 is an example of an SSDI Approval Signature Page.

To: FOSC
From: Environmental Unit Leader
Date:

[Responsible Party] is requesting formal approval for subsea dispersant injection (SSDI) as part of the response actions for the **[Insert Name of the Event or Exercise]**. We are respectfully submitting the following documents to support the Unified Command's considerations (including seeking RRT concurrence) during this decision process:

a) Signature page (this page) for approvals by UC (see A.1).

b) Summary of SSDI Rationale and Readiness to Execute (see A.2).

c) Comprehensive incident data sheet (see A.3).

d) Identification of resources at risk (see A.4).

e) 3-D modeling information used to predict oil and dispersed oil 24- to 72-hour trajectories (see A.5).

f) Subsea Dispersant Operations Plan (see A.8).

g) Subsea Dispersant Monitoring Plan (see A.6).

h) Analysis of potential SIMA and risk assessment associated with SSDI (see A.9).

Should you have any questions on this information, please contact the Environmental Unit Leader.

Signatures authorizing SSDI are as detailed in the accompanying operational plan.

Role in Unified Command	Signature	Agency	Date
Federal On Scene Coordinator (FOSC)		USCG	
State On Scene Coordinator (SOSC)		[INSERT]	
Responsible Party Incident Commander]		[INSERT]	
[Insert additional SOSCs from other states, as necessary]		[INSERT]	
[Tribal On-Scene Coordinator, as necessary]		[INSERT]	
[Additional signatures, as necessary]		[INSERT]	

Figure A.1—SSDI Approval Signature Page

A.2 Summary of SSDI Rationale and Readiness to Execute

In appropriate situations, SSDI has a number of direct benefits for safety (e.g. reduced VOCs at the surface), environment (e.g. reduced exposures for key RAR), and response effectiveness (e.g. enhanced encounter rate and greater potential for biodegradation). Table A.1 provides a guideline for assessing the relevant benefits in a given scenario and the relative readiness to execute SSDI.

Subsea dispersant injection is one of the few response methods that can be conducted at night, and can be done during relatively high sea states. Subsea dispersant application would be a continuous response activity employed to mitigate a continuous and uncontrolled release from the well. Until the well can be mechanically capped, subsea dispersants are expected to provide the best short-term option to reduce oil reaching the ocean surface and lessen overall environmental impacts.

With chemical dispersant application at the source, subsea dispersed oil concentrations are expected to rapidly dilute both vertically and laterally through a very well–mixed water column, which results in concentrations below 1 ppm within a few kilometers of the wellhead. This dilution capacity was documented during the Deepwater Horizon subsea dispersant monitoring activities in 2010. Subsurface dispersant injection does result in increased hydrocarbon concentrations in the deep oil plume, but the areas should be relatively minor in scale, and thus can pose less of an ecological effect versus broader, non-chemically dispersed oil slicks. In addition, the level of naturally dispersed oil in the upper 10 m to 20 m (30 ft to 60 ft) of the water column is lowered.

The biodegradation of subsea-dispersed oil in deep water is expected to result in reduced oil on the surface, reduced oil in sensitive shoreline habitats, and a substantial decrease in the recovery times of the ecosystem (as a whole).

Direct injection into the plume at the wellhead is expected to deliver higher encounter rates than those at the surface, where the oil expression is broadly spread over a surface slick that continuously increases in size as oil is continuously released from the wellhead. Surface dispersant applications are limited to daylight operations only, would have reduced overall encounter rates due to the size and natural fragmentation of the surface slick, and are expected to be significantly less effective once the oil naturally weathers as a surface slick. As a result, subsea dispersant injection requires a lower overall DOR for the same level of treatment than a surface dispersant application; therefore, significantly less application of dispersant would be required to treat the same volume of oil [11], [14].

Table A.1—SSDI Readiness to Execute

Item No.	Status (Completed, Ongoing, N/A)	SSDI Pre-Operations Assessment Criteria	Response Management Team Lead	Corresponding Document
1		Safety (Personnel): Can SSDI be conducted safely, without undue risk to the application team?	Safety Officer	Response Safety Plan
2		Safety (VOC and LEL): Do high levels of VOCs exist on scene such that use of subsea dispersants will enhance responder safety?	Safety Officer	
3		Safety (PPE): Does sufficient personal protective equipment (PPE) for response personnel on-site conform with appropriate dispersant's MSDS and safe industry practices?	Safety Officer	
4		Environment (SIMA): If RAR exists, has an assessment been conducted that demonstrates a net reduction in RAR impact(s)? See A.4 for RAR information.	Planning Section/ Environmental Unit	
5		Environment (Marine Mammals): Have marine mammals been observed in the response zone? If so, are there accommodations to sustain monitoring of marine mammals, sea turtles, and birds during SSDI operations?[a]	Planning Section/ Environmental Unit/Operations	
6		Required Federal Consultations: Have the other applicable, required consultations (e.g. Endangered Species Act (Section 7); National Historic Preservation Act (Section 106—36 CFR §800) Magnuson-Stevens Act (16 U.S.C. 1801-1884); Essential Fish Habitats (EFH) (50 CFR Subpart J, 1996), etc.) been initiated and documented?	Planning Section/ Environmental Unit	
7		Feasibility and Effectiveness of Dispersant: Is there technical information available based on modeling or direct experience that indicates that the oil being released is dispersible under safe and feasible injection conditions?	Environmental Unit/Operations	
8		NCP Listed Dispersant: The dispersant to be used is listed on the current NCP Product Schedule and is considered appropriate for the existing environmental and physical conditions.	Environmental Unit/Safety Officer	

Table A.1—SSDI Readiness to Execute (continued)

9		Limitations of Other Response Options: Mechanical, in situ burn, and other response strategies alone are deemed not feasible (due to safety issues, lack of resource availability, low efficiency, or lack of timeliness) to protect RARs and/or enhance the recovery of oil.	Operations/ Environmental Unit	
10		Dispersant Availability and Timeliness: Sufficient dispersant and application equipment has been confirmed to be available to make a significant impact on the spilled product.	Logistics	
11		Weather Conditions: Weather and sea conditions are conducive to SSDI. Generally not a factor except where weather conditions could threaten worker safety or compromise initial equipment deployment.	Planning Section/ Situation Unit	
12		Readiness of SSDI Application System: Is the SSDI application system (e.g. injection system, support vessels, metering equipment, deck equipment, etc.), as noted in the SSDI Operations Plan, fit-for-purpose (capable of delivering a DoR sufficient to reduce mean droplet size) and available for deployment in the required timeframe.	Operations Section	
13		Competency of Personnel: The operation should be supervised or coordinated by personnel who have experience, knowledge, specific training, and/or recognized competence with SSDI and the types of application and monitoring systems to be used. In particular, a designated dispersant operations controller should be utilized, and communication procedures should be established with other essential ICS positions, including the OSC, SIMOPS, EU, and the SO(s).	Operations Section	
14		Subsea Dispersant Monitoring Program Deployment: A subsea dispersant monitoring program should be implemented. API 1152 (http://www.oilspillprevention.org) provides recommended guidelines for developing a monitoring plan and incorporates parts of NRT guidelines[a]. Provisions should be made for government representation on the monitoring vessel(s) as requested. Efficacy monitoring systems should be in place before SSDI is initiated, and provisions should be made for assessing and communicating SSDI effectiveness to the Response Command within an agreed time frame. An unmitigated source sample should be extracted for analysis prior to SSDI operations commencing.	Planning Section/ Environmental Unit/Operations	
15		Trained Controller/Observer: The trained controller/observer should fly over the response zone to visually characterize the surface expression prior to SSDI and to assess the effectiveness of the SSDI operations after application commences.	Operations	
16		On-scene commander has sought concurrence with any applicable regional authority (e.g. RRT).	FOSC	

[a] Marine mammals are part of the SIMA process.

[b] The guidance in API 1152 [1] can be used as a planning format, but the actual monitoring plan must be adapted to address incident-specific conditions in accordance with current federal and state regulations.

A.3 Incident Data Sheet

Figure A.2 shows an example of an incident data sheet.

Incident Data Sheet for Subsea Dispersants RRT Concurrence Requests				
Date / Time / Name of Event:				
FOSC Name:				
Sector:	**Phone:**	**E-mail:**		
NRC Report Number:				
Responsible Party Information				
Responsible Party IC:				
Company:	Phone:	E-mail:		
Air Monitoring Data: (Maximum reported in Source Control area of operations)				
VOC (ppm):	Percent LEL:			
Incident Location:				
Block:	Well No.	Lat/Long:		
Water depth (m):				
Depth of release point (m):				
Brief Description of Incident:				
Type of facility / platform / rig (e.g. TLP, SPAR, semi-submersible MODU):				
Event chronology:				
Source of spill: (e.g. severed riser, BOP, or wellhead)				
Oil Characteristics:				
Name:	API Gravity:	GOR:	Temperature (°C):	Viscosity at release (cPa)
Is the oil dispersible into the water column?:	Yes	No	(circle one)	
Spill Description:				
Estimated Flow Rate (bopd):				
Method used for estimate:				
Current On-site Weather Conditions (relative to subsea injection readiness)				
Sea state – wave height (m):	Beaufort Scale:			
Wind direction and velocity (knots):				
Ceiling (m):	Visibility:			
Surface current direction	Velocity (knots):			
Five-day forecast:				
Additional subsea data that could affect operations: (e.g. subsea current speed and direction, oil seeps)				
Subsurface Plume Modeling				
3-D model(s) used:				
Expected plume trajectory and behavior:				

Figure A.2—Initial Incident Data Sheet

A.4 Identification of Resources at Risk

A.4.1 General

Identification of the environmental resources potentially at risk from an oil spill is essential for evaluating the potential net impact mitigation and socioeconomic benefits that can be achieved by the utilization of various response methodologies, as described in Annex B. Sources for identifying resources at risk may include environmental sensitivity maps, Environmental Impact Analyses, Area Contingency Plans, and state, federal, and tribal natural resource trustees. For spill response exercises, the FOSC (or their designated representative) is responsible for assuring the relevant consultations are initiated and the availability of such information to the UC. In actual spill events, the EU, which can include all appropriate resource trustee agencies, will assist in identifying resources at risk. This data feeds into an incident-specific SIMA process that is addressed separately from this document.

A.4.2 Example Resources at Risk for the Gulf of Mexico

A list of the resources at risk (RAR) should be requested from NOAA and any other natural resource trustees that are involved in a response or drill. The RAR table should identify species-specific information, as well as information on the generalized ecological communities and/or habitat types present in the affected area. In rare instances, one critical species or specific community is key to evaluating the level of concern, and should be identified as such in the RAR list. Table A.2 provides an example of the types of RAR that can be provided by NOAA during a spill event in the western Gulf of Mexico (GOM). This table is provided for illustration purposes only. The resources at risk are highly dependent on location, seasonality, the nature of the event, and the portioning of the oil into the environment (e.g. dispersed or floating). See http://response.restoration.noaa.gov/ for most current RAR information.

Table A.2—Example Table of Water Column Resources at Risk for the Western Gulf of Mexico developed by NOAA

<table>
<tr><th>Species</th><th>Spatial Overlap with Early Life Stages</th><th>Potential Impacts</th></tr>
<tr><td>White and brown shrimp</td><td>Spawning inshore of the area of interest; eggs and larvae can be present</td><td rowspan="2">Early life stages in shelf waters can be exposed and experience mortality. It is not likely that a large proportion of the population is exposed to oil, given the timing and location of the spill relative to these species' habitats.</td></tr>
<tr><td>Blue crab</td><td>Spawning inshore of the area of interest; eggs and larvae can be present</td></tr>
<tr><td>Bluefin tuna, yellowfin tuna</td><td>Spawning in the area; eggs and larvae are present</td><td>Early life stages can be exposed and larval mortality can occur. Given that natural mortality rates are high, population level impacts are unlikely.</td></tr>
<tr><td>Swordfish</td><td>Larvae can be present year-round in the area</td><td rowspan="3">Early life stages can be exposed. It is not likely that a large proportion of the population is exposed to oil, given the timing and location of the spill relative to these species' habitats.</td></tr>
<tr><td>Other pelagic species (e.g., dolphin fish, blackfin tuna, blue marlin, dolphin fish, wahoo, whale shark, white marlin, amberjack, mackerel)</td><td>Early life stages can be present in the area; spawning mostly in a different geography.</td></tr>
<tr><td>Red grouper, scamp, and red, lane, gray, and vermilion snapper</td><td>Spawning in the area; eggs and larvae can be present</td></tr>
</table>

A.5 Modeling Inputs and Results

Models are used to predict subsea plume behavior and the fate and transport of oil and dispersed oil both on the surface and in the water column. Since SIMA is used to assess the comparative impacts of varying response techniques that can occur in the future, the use of predictive models is integral to the SIMA process using pre-event data, and updated using incident-specific data.

A summary of the modeling assumptions and model findings should be presented in the RRT concurrence package. Models used should be presented and described based on initial data collected or available, and may be updated later in the response. Modeling results should be presented for both treated and untreated releases, for the anticipated period of the release. To determine the potential for shoreline oiling, it may be useful to extend the modeled period well beyond the anticipated period of the release. Modeling should address dispersed oil in the water column, as well as surface slicks (3-D modeling). When feasible, estimation of oil fate should include evaporative losses, dispersion (natural and chemical), dissolution (important to oil weathering for deep-water releases), sedimentation, and biodegradation. Inputs may include response activities with volume of oil removed to determine the effect of other, all, some, or no response activities that can affect the total oil on the surface and mass balance subsea. Figure A.3 identifies model input parameters that are generally required to conduct 3-D fate and transport modeling.

Modeling should also specifically address any known environmentally sensitive areas for a given region, (e.g. the Flower Gardens Banks National Marine Sanctuary in the GOM). In addition, illustrations should be provided to assist in understanding the potential outcomes.

General information

Latitude ______________________ Longitude ________________________

Date ________________ Time ________________ Time Zone _______

Simulation length _______________________ (hours or days)

Amount of release ______________________ (barrels liters m3 tons gallons)

Release rate and duration ___________________ / (hours or days) for ________ (hours or days)

Type of oil ______________________________ API _______________ Viscosity ____________ cP

Winds: meteorological data from local buoy or add meteorological instruments to measure wind speed and direction, air temperature.

Currents: real-time measurement of currents by such instruments as Acoustic Doppler Current Profiler (ADCPs)

Additional information (as available):

Source oil samples—Obtain laboratory analysis for chemical properties of the oil if available when initial well samples were taken when the well was drilled. Results from the lab taken during the incident may not be available until after the package is submitted.

Vertical profile of water temperature and salinity at release location

Suspended particulate matter concentrations (near release location, over depth, and in time)

Subsurface Parameters

Release depth _________________ m (ft)

Gas/oil ratio __________________ m3/m3 (scf/bbl)

Discharge temp. _________ °C (°F) Location temperature readings ______________________

Opening diameter _____________ m (in.)

Methane hydrate formation (Y/N) in containment __________ or outside containment __________

Surface Parameters

Formation of mousse—observed? ______ (Yes/No)

Minimum distance from release location where observed __________ (feet, yards, meters, miles)

Figure A.3—Recommended Minimum Parameters for Predictive 3-D Modeling

A.6 Subsea Dispersant Monitoring Plan Elements

The complete SSDI Monitoring Plan should be submitted as part of the RRT concurrence package and be based on API 1152 http://www.oilspillprevention.org. Monitoring plans should be adaptive, as they can vary based on the nature of the event and the incident objectives to gain governmental approval for subsea dispersant use. Table A.3 provides an operational checklist to support SSDI Monitoring Plan Development.

Table A.3—Example of a Subsea Dispersant Monitoring Plan Development and Implementation Checklist

Sourced	Equipment	Estimated Time of Arrival
	Fit of purpose marine monitoring vessel(s) (RV)	
	Supply vessels—two “fast boats” for sample relay	
	Rosette sampler outfitted with CTD probe and fluorimeter	
	Winch and data cable of sufficient length	
	LISST-Deep particle size analyzer or equivalent	
	Portable GC/MS for shipboard sample analysis	
	Dual band UV/Vis Spectrometer	
	Shipboard instruments to verify field monitoring data (e.g. dissolved oxygen meter)	
	Allocation of personnel to operate equipment	
Actions		
	Ensure availability of equipment listed above	
	Prepare Subsea Dispersant Monitoring Plan based on spill scenario	
	Communicate equipment air detection needs for source control vessels to Safety Officer	
	Communicate VOC and LEL data needs to Safety Officer	
	Communicate ROV observation needs to Source Control	
	Communicate aerial overflight needs to Operations	
	Request pre-dispersant source oil sample collection by Source Control	
	Advise UC proposed monitoring vessel operations schedules	
	Secure laboratory capability for detailed chemical characterization of water samples	
	Coordinate with UC to develop data communication strategies with action levels	
	Ensure Reporting of data in accordance with data communication plan	
	Modify proposed SSDI Monitoring Plan as required in coordination with UC	

A.7 Environment Data Management

Refer to the NOAA Office of Response and Restoration (http://response.restoration.noaa.gov/) for data management guidance or RP Data Management Plan.

A.8 Proposed Subsea Dispersant Injection Operations Plan Elements

Figure A.4 provides an example and should be modified as needed to account for actual spill exigencies and to ensure utilization of current best management practices. Table A.4 shows an example subsea dispersant injection equipment checklist that can be used to identify the required equipment, and can be included in the Operations Plan to demonstrate adequate availability.

Subsea Dispersant Injection Operational Plan Components

Following is an overview of subsea dispersant injection operations to be used to mitigate the impacts of a well incident from the ________ (*insert name of well*) well in ________ (*block location).* Additional details are included in the ________________ (*Insert Operator*) Gulf of Mexico Regional Oil Spill Response Plan.

a) Mobilize the equipment to the location.

b) Integrate the vessel into the incident's simultaneous operations (SIMOPS) command.

c) Deploy acoustic frequency management system.

d) Collect VOC and LEL readings on-site and provide to Safety Officer and Environmental Unit.

e) Connect surface hose to dispersant supply tanks.

f) Position the vessel as instructed by on-scene commander.

g) Deploy clump weight with coil tubing.

h) Deploy manifold.

i) Remotely operated vehicle (ROV) connects hot stab connection to clump weight on the manifold.

j) ROV connects chemical hose to the manifold.

k) ROV connects chemical hose with applicator to the manifold.

l) If a capping stack or other suitable containment device is deployed that requires the use of subsea dispersant injection, hot stab the chemical injection hose into the fittings provided.

m) ROV #1 takes an overview position to assist ROV #2 in positioning the wand into the plume.

n) Identify initial injection rate. See Annex D for calculations.

o) Commence pumping of dispersant.

p) ROV #2 inserts wand into the plume.

q) Adjust injection rate and wand position to maximize the impact of the dispersant in the plume as per monitoring, and sample on-site data.

r) Consistently record dispersant volumes/rates, timing, pumping pressures, host platform, and other agreed measures and observations at intervals in accordance with Subsea Dispersant Monitoring Plan.

s) Monitor on-scene surface and subsea weather and current conditions.

t) Allocate personnel to operate equipment.

Figure A.4—Example Subsea Dispersant Injection Operational Plan Components

Table A.4—Example Subsea Dispersant Injection Critical Equipment Checklist

Equipment or Material Item	Location	Source	ETA
Subsea dispersant Injection vessel with two work ROVs			
Acoustic frequency management system			
Air monitoring equipment			
Subsea dispersant injection package—distribution panel, hoses, applicators, hot stabs			
Coil tubing system with suitable pump			
Storage tanks for on-deck storage			
Vessel data transmission package			
Approved dispersant supply needed until additional supplies are available on-site			
Dedicated supply vessels—minimum two			

A.9 Analysis of Potential Benefits and Trade-offs Associated with Subsurface Dispersant Injection

The following questions can be used to evaluate the potential benefits and tradeoffs of SSDI.

a) Safety: Do high VOC levels or percent LEL from subsea well hydrocarbons at surface exceed safe work conditions?

a) Aquatic/shoreline RAR: What are the specific aquatic/shoreline resources, organisms, and habitats at risk from the spilled product?

b) Birds/marine mammals/sea turtles: What are the specific species based on ESI maps that can be at risk from the shoreline and offshore impact of the nondispersed spilled product?

c) Time to RAR exposure: What are the estimated times the resources identified in items a) and b) above would be exposed? (The NOAA SSC can be contacted for trajectory and environmental fate analysis.)

d) Spill trajectory: What is the estimated location of untreated oil spill trajectory at the proposed time of initiation of SSDI? (Using model results, latitude/longitude, and proximity to shore, coordinate with the NOAA SSC, the RP, or other information sources to estimate the location of the leading edge of the spill at the proposed time of the first application of dispersants)?

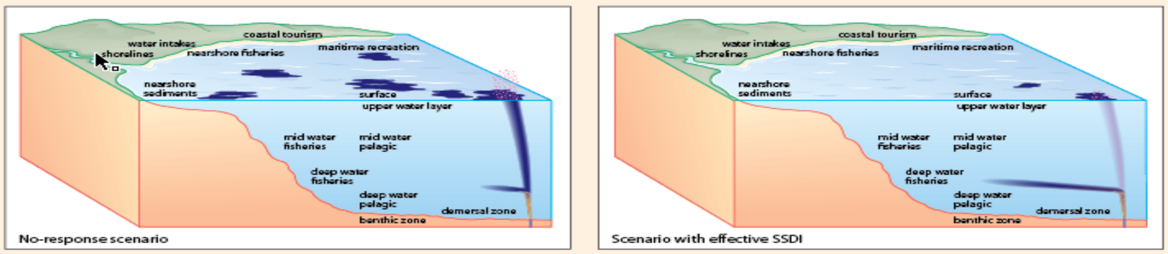
e) Environmental benefit/trade-offs and impacts from dispersed oil: Does it appear that dispersants can be applied at this location in a manner that achieves the desired impact mitigation for the identified RARs? Other than plankton, are there any specifically known resources in the area targeted for dispersant use that might be negatively impacted by application of dispersants? If so, what are the known resources, and is the negative impact to these resources anticipated to be great enough to offset the benefit to other RARs?

f) Are there ways to avoid or minimize adverse effects to known resources (e.g. observers watching for marine wildlife)?

g) Response options: Are all response options available and applicable to the response? See Annex B for details.

The scenario depicted below in Figure A.4 illustrates how SSDI can reduce the overall consequences of a release, and thereby achieve net environmental and socioeconomic benefits.

NOTE This example is provided for illustrative purposes only. A SIMA performed for a specific scenario must take into account the characteristics of the release, the local resources, their ecological, commercial, and cultural value, and their seasonality. The Environmental Unit, with participation from environmental trustees such as DOC, DOI, and applicable state agencies, would utilize the same analytical concepts in identifying potential environmental benefits and risks associated with all available response technologies to full capabilities.



This representative scenario indicates how the successful use of SSDI can reduce the overall consequences of a release and thereby achieve a net environmental benefit.

Note that this example is illustrative, and that individual contingency planning cases need to take into account the specifics of an operation, including the local environmental resources, their ecological, commercial and cultural value and their seasonality.

	Environmental compartment	Representative population/resources	Potential relative consequence* with no response	Potential relative consequence with SSDI
	Seabed benthic zone	Burrowing organisms	Insignificant	Insignificant
Water column	Near seabed demersal zone	Flatfish	Insignificant	Insignificant
Water column	Deep water pelagic (>400 m)	Round body fish	Small	Moderate
Water column	Mid-water pelagic (<400 m)	Round body fish	Small	Small
Water column	Upper water layer (<20 m)	Plankton	Moderate	Insignificant
Water column	Nearshore water (<10 m)	Coral reef	Moderate	Insignificant
	Sea surface	Seabirds/sea mammals	Very large	Small
Shoreline	Nearshore sediments	Seagrass	Moderate	Insignificant
Shoreline	Wetlands	Burrowing organisms	Very large	Insignificant
Shoreline	Rocky shores		Moderate	Insignificant
Shoreline	Sandy shores		Moderate	Insignificant
Socio-economic resources	Coastal tourism		Very large	Small
Socio-economic resources	Inshore fisheries and aquaculture**		Large	Small
Socio-economic resources	Mid-water fisheries**		Small	Moderate
Socio-economic resources	Deep water fisheries**		Insignificant	Large
Socio-economic resources	Seawater intakes		Very large	Small
Socio-economic resources	Maritime recreation		Very large	Small

* Relative consequence categories take into the account a variety of factors, including the sensitivity of habitats, species or populations, the geographic extent of an area that may be affected, the anticipated recovery time and socio-economic value of a resource, if applicable.

** Fisheries authorities are likely to impose a precautionary fishing ban or exclusion to protect perceived risks to human health and market confidence. A ban typically remains until there is evidence that fish are safe for consumption. Such bans can increase the consequence to fisheries through enforced loss of earnings, rather than through impacts on fish populations or stocks.

Figure A.5—SIMA Illustration[3]

Annex B
(informative)

Summary of Primary Response Options

B.1 Overall

By way of example, the six response options appropriate for consideration in an incident-specific SIMA in the Gulf of Mexico are summarized below. For an operational SIMA, performed in support of an exercise or release event, time constraints require that response options be evaluated qualitatively rather than quantitatively based upon specific incident characteristics. While this can be accomplished by an exercise planning team, it should be performed in the Environmental Unit during an actual release, and should involve all emergency consultation with the appropriate trustees. Brief descriptions of the response options, their potential uses, and their limitations should be included as provided in B.2. It is assumed that all response methods may be used, where appropriate, during a response that involves SSDI.

B.2 Response Options

B.2.1 Natural Recovery

B.2.1.1 General

Natural recovery (i.e. no intervention) is defined as there being no human intervention to influence the fate of the spilled oil (monitoring only). It represents the baseline against which all response options are compared. With natural recovery, the spilled oil will drift with the winds and currents, then gradually weather until it evaporates, dissolves, and disperses into the water column, sinks near shore, or strands on the shoreline. Once stranded, weathering will continue and the oil will gradually biodegrade based upon incident site conditions, or become mixed into the sediments. Portions of the relatively fresh oil can be remobilized from the shoreline by wave or tidal action and redistributed many times until they finally degrade, are consumed by organisms, or are deposited permanently.

Natural recovery is considered an appropriate option for spills of nonpersistent oils at sea that do not threaten shoreline or protected habitats. It is also appropriate for some sensitive shoreline habitats where intrusion by people and equipment can cause more environmental damage than allowing the oil to degrade naturally, or where recovery and cleanup are not feasible.

B.2.1.2 Logistics

Monitoring at sea and on affected shoreline is required.

B.2.1.3 Limitations

This response option does not meet public expectation that a meaningful attempt will be made to remove spilled oil from the environment. Since this is a passive response, it does not protect critical shoreline or aquatic habitats. In the case of natural recovery, the floating oil will weather on the sea surface. If onshore winds drive this weathering oil into intertidal and coastal areas, in some cases (e.g. marshes and mangroves), any cleanup effort could potentially do more ecological harm. Natural recovery can also result in persistence of oil slicks at sea surface, which can range from hours for light oil in high seas to months for heavier or emulsified oils in relatively quiescent conditions. Shoreline recovery can take weeks or up to months or years, depending on the type of oil spilled and different environmental variables (i.e. wave energy, amount of solar exposure, rainfall, shoreline erosion processes). Reliance on natural recovery can also affect emergency response capabilities at the well site, as it does not reduce the potential for exposure of surface vessels and personnel to volatile components of the oil that can create a health and safety risk per OSHA regulations and 40 CFR §300.150.

B.2.2 On-water Mechanical Recovery

B.2.2.1 General

On-water mechanical recovery is defined as the removal of oil from water for disposal and possible reuse to prevent or minimize impacts to sensitive near-shore and offshore habitats. Open-water mechanical recovery uses skimmers and booms to concentrate and remove oil from the surface of the water. The success rate of oil removal by means of mechanical recovery is dependent upon factors such as oil thickness, wind, waves, and visibility to spot oil to recover.

B.2.2.2 Logistics

The equipment needed to carry out mechanical recovery involves a large number of skimming vessels, support vessels, storage barges, spotter aircraft, and significant quantities of collection boom. The equipment is transported to the spill site with the appropriate personnel onboard. Recovered oil should be stored and ultimately returned to shore for proper disposal. For the continuing releases of significant volume, this can be a formidable challenge.

B.2.2.3 Limitations

Due to the logistical issues described in B.2.2.2, there is a lag time from the start of the spill to the initiation of mechanical recovery operations, making the window of opportunity to conduct mechanical recovery smaller. Light oil rising to the surface is likely to form very thin sheens, which reduces the efficiency of oil collection at the surface. The longer the oil is present, the more it disperses and is more difficult to recover, with the oil thinning out as it spreads. Thinning of surface slicks reduces the encounter rate for mechanical recovery methods. Even beyond the encounter rate, weather conditions and day length would be critical in the source control area. Open-water boom begins to fail in sea states when waves are over approximately six feet.

B.2.3 On-water In-situ Burning

B.2.3.1 General

On-water in-situ burning (ISB) involves the collection and concentration of oil in fire-resistant booms (as in on-water recovery), but then removes the oil from the water surface by burning, thus minimizing storage and disposal challenges. ISB has the same weather, day length, and encounter-rate limitations as on-water mechanical recovery and realistically needs even lower wave heights, monitoring and tracking of the burn, and favorable wind conditions that allow the burn to be safely ignited and controlled.

B.2.3.2 Logistics

Equipment needs for vessels and booms are similar to on-water mechanical recovery, with the addition of fireproof booms, enhanced monitoring aircraft, ignition capability, and smoke-plume modeling. Unlike traditional mechanical recovery, however, there is no need to store and dispose of collected oil.

B.2.3.3 Limitations

Limitations of weather, wave height, day length, and encounter rate are similar to on-water mechanical recovery. The availability of fire booms, which become unusable over time, would be a factor in spills of long durations. Oil is likely to be easily ignitable when fresh, but becomes less suitable for burning as it weathers and emulsifies. Additionally, this response option is inefficient and impractical on thin slicks.

B.2.4 Aerial Dispersant Application

B.2.4.1 General

Dispersants may be applied to surface slicks from airplanes, helicopters, or vessels. The volume of dispersant applied is a fraction of the volume of oil being treated, with a typical dispersant-to-oil ratio (DOR) of 1:20. Surface dispersant application is pre-authorized by the Region VI RRT responsible for U.S. Gulf of Mexico off Louisiana and Texas coastal and offshore areas where SSDI could be considered for a subsea oil release. It is anticipated that both vessel and aerial applications will be used, in addition to SSDI, as appropriate. When the oil is treated with dispersants, it initially disperses within the upper 10 m (30 ft) of the water column due to natural mixing processes. If these dispersed oil droplets are small enough (generally less than 70 μm) the droplets will remain dispersed in the water column. The dispersed oil will be rapidly diluted due to spreading both horizontally and vertically by tides and currents [15]. Historically, dispersed oil concentrations of 20 ppm to 50 ppm have been reported in the upper 10 m (30 ft) of the water column directly under the slick. These concentrations dilute rapidly as the oil moves through time and space in the water column.

B.2.4.2 Logistics

Application from large, fixed-wing aircraft is the most logical mode of application for surface slicks. It is likely that vessel-based application will occur near the release point to reduce airborne VOCs.

B.2.4.3 Limitations

Aerial dispersant operations require fresh oil, a 300 m (1000 ft) minimum cloud ceiling, three-mile forward visibility, daylight, wind speeds of less than 35 knots, and wave heights of 0.15 m to 3 m (0.5 ft to 9 ft). Effective application rates (DOR) are approximately three to five times higher than for SSDI. Aerial application is limited to daylight hours and, as a result, can only be operational for half of the amount of time compared to SSDI.

B.2.5 Shoreline Protection and Treatment

B.2.5.1 General

Shoreline protection, primarily involving protective booming, is an important tool when oil cannot be effectively treated on water. While protective booming, as well as shoreline berms and inlet dams, can be valuable, it brings about a certain degree of risk of collateral damage due to physical disturbance by work crews installing, maintaining, and dismantling the protective measures. Additionally, there are impacts of disturbance and scarring from anchoring the booms to soils, sediments, or plants, along with increased erosion of shoreline and sediments while the boom jostles in place, or possibly washing onto the shoreline. Shoreline oil treatment/recovery methods, such as mechanical removal of sorbent materials, pose the same, if not greater, risks of physical disturbance.

Examination of the benefits and tradeoffs of shoreline protection and recovery are different than examination of the benefits and trade-offs of on-water response. Given the option, on-water cleanup is usually environmentally preferable to on-shore treatment/recovery.

B.2.5.2 Logistics

Both shoreline protection and treatment tend to be labor-intensive and involve large numbers of responders who have to be trained, transported, housed, and managed in a potentially hostile environment. In addition, worker personal protective equipment, hand tools, washing equipment, protective and containment booms, and any appropriate mechanical equipment should be provided, stored, transported, and maintained.

B.2.5.3 Limitations

The use of protective booms, shoreline berms, and tidal inlet damming, is highly dependent on weather, type of shoreline, topography, and hydrographic conditions. Typically, these protection measures should be strategically placed, and not all shoreline areas can be protected. Workers should also attend to protective booms and berms to confirm that they remain in place and continue to be effective. For shoreline treatment/recovery, heavy machinery on beaches and intrusion by humans on foot can have adverse impacts on some shoreline habitats. Adverse public reaction, restricted commercial and recreational use or access during treatment, high cost, and difficulty in gaining access to impacted shorelines (due to logistic or topographical obstacles) can make shoreline protection and recovery difficult operationally.

B.2.6 Subsea Dispersant Injection

B.2.6.1 General

SSDI has only been conducted during the DWH spill in 2010, where dispersants were applied at the wellhead opening at the sea floor. The same general chemical dispersion principles that are discussed in Aerial Dispersant Application apply, with a few key distinctions.

First, with subsea injection, the encounter rate is extremely high because the dispersant is being applied directly to the oil source as it is released into the water, before the oil begins to rise and spread horizontally and vertically within the water column. Because of the high encounter rate, DORs of 1:50 to 1:100 should be sufficient to effectively disperse the oil. The higher DOR means that less dispersant is required to effectively disperse the oil for subsea dispersant injection versus aerial dispersant application. Because the injection is occurring at the sea floor, the dispersed oil dilutes vertically over a much greater volume of water, and transfer at depth is driven by buoyancy of the dispersed oil droplets (vertically), as well as by deep ocean currents (horizontally). This rapid dilution equates to lower concentrations of dispersed oil than those typically measured after a surface application (where the dispersed oil is typically limited to 10 meters (33 ft) of vertical dilution [15]). During the DWH spill, measured dispersed-oil concentrations at about 1 km (0.6 mi) distance from the wellhead at 1200 m depth (3937 ft) were consistently well below 5 ppm [25].

Oil removal through natural biodegradation processes removes the oil from the environment as petroleum-degrading bacteria found throughout the water column worldwide consume the oil as a food source. The addition of dispersant enhances the rate of biodegradation due to the increased surface area of the very small individual droplets that are formed. Dispersant-treated oil is rapidly diluted to the point that biodegradation can occur at very low concentrations without depleting oxygen or nutrient levels in the water column. Several laboratory studies have shown that dispersant treatment of dispersible oils increases oil compound biodegradation [12],[13],[15],[17],[21],[22].

Subsea dispersant injection also provides a human-health protection and increased safety factor per 40 CFR §300.150. Subsea injection reduces the amount of oil coming to the surface; this, in turn, (a) reduces the potential for exposure of surface vessels and personnel to volatile components of the oil and (b) reduces the need for surface recovery, in-situ burn, and surface dispersant operations, thereby reducing the potential for exposure of response personnel to accidents during these operations. Point source applications can reduce the potential for worker and public exposures by treating the oil where it is being discharged and preventing it from spreading or coming closer to shore.

Use of subsea dispersant injection (SSDI) can reduce the likelihood of exceeding the LELs. Consequently, SSDI is an important tool to safely sustain source-containment operations during a blowout situation.

B.2.6.2 Logistics

Subsea dispersant injection takes more to time deploy due equipment and vessel mobilization time compared to aerial application. Dispersant and ROV operation vessels should be deployed to the well location, a dispersant manifold needs to be positioned on the dispersant supply vessel, and coiled tubing must then be deployed to the seafloor and moved into position using ROVs. A minimum of two ROVs are needed for this operation. One controls the dispersant injection wand into the oil release point, and the second supplies lighting and videography. If a cap-and-containment system is installed on the wellhead, it may be possible to connect the dispersant supply hose directly to an injection port on the capping stack. Given the substantial distance from shore, it is anticipated that the specialized equipment would take several days to be mobilized and set up at the source control location. Once deployed and connected, the system is designed to operate continuously.

B.2.6.3 Limitations

Unlike most other response options, which are limited to daylight hours for aviation and boat safety reasons, subsea dispersant injection can be maintained for longer and continuous operational periods, provided that dispersant stockpile is available and on-site, and weather conditions do not hinder vessel operations. A disruption to the dispersant supply would likely only occur during extreme sea states when dispersant tote transfers could not be conducted.

B.3 Findings Related to SSDI for Safety

Ongoing research on subsea dispersant injection has demonstrated that an effective subsea dispersant operation can reduce oil droplet size. Subsea dispersant injection is expected to decrease the surface expression of oil slicks, thereby decreasing VOC levels and percent LEL in the source control area, which decreases threats to human health and increases the productivity of workers who can operate and communicate unrestrained without the use of respirators.

B.4 Findings Related to SSDI for Environmental Protection

Specific findings related to protection of RAR, and particularly threatened or endangered species, should be presented here. These findings should be based on the modeled exposure estimates and risk analysis for the modeled scenario or spill event. The findings may include impacts to all applicable environmental resources, cultural resources, and commercial resources.

As discussed in A.9, an effective SSDI program should reduce the amount of oil that reaches environmentally sensitive shorelines. In addition, reducing the amount of untreated (nondispersed) oil that surfaces in offshore waters should help protect offshore species, including migratory birds, marine mammals, and sea turtle populations, which depend on access to clean surface waters for their survival.

Annex C
(informative)

Example Timeline for Utilizing Subsea Dispersant Injection

Figure C.1 is an example timeline that identifies key actions that should be initiated by the EU or other ICS organizations tasked with subsea dispersant monitoring in the first 168 operational hours. Events leading to separate milestones are grouped by color.

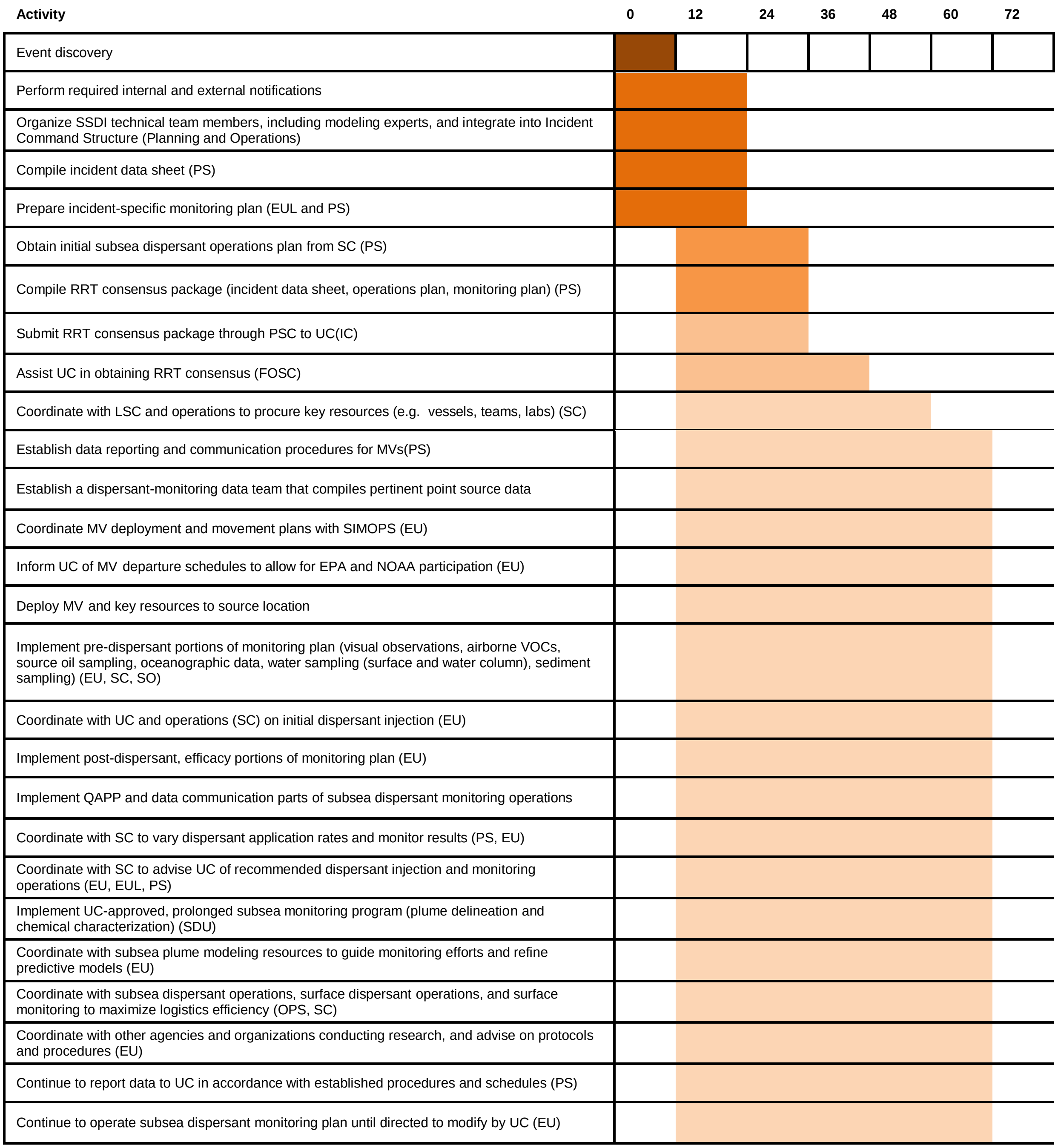


Figure C.1—Subsea Dispersant Operations Process Timeline (hours)

Annex D
(informative)

Subsea Dispersant Initial Injection Rate Calculation Example

To submit the regulatory approval and concurrence package, there must be an initial subsea dispersant injection rate. The injection rate may be adjusted during the operations as monitoring data is collected and analyzed for dispersant efficacy. Based upon API subsea injection testing at SWRI and SINTEF, a 1:100 dispersant-to-oil ratio (DOR) was found to be effective for dispersing oil into the water column[20].

Additionally, the subsea well containment equipment provider may have formulas based upon specific equipment design, and can be used for calculation injection rates.

The initial subsea dispersant injection rate calculation will use a DOR of 1:100.

Once the initial desired injection rate is calculated, the equipment provider for the subsea injection system would need to determine the system capability to deliver the injection rate in gallons per minute (gpm).

We will assume a scenario where the worst-case discharge is 75,000 barrels of oil per day (bopd).

Thus, the initial subsea injection rate is calculated as:

$$75{,}000 \text{ barrels/day} \times 42 \text{ gallons/barrel} \times 1{,}440 \text{ minutes/day} = 2{,}187.5 \text{ gallons/minute}$$

Applying the initial DOR 1:100, the initial injection rate will be 21.875 gallons/minute, or 22 gallons/minute, for the subsea dispersant concurrence package to the RRT noted in A.1.

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