Industry Recommended Subsea Dispersant Monitoring Plan

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Contents

Acronyms and Abbreviations

3-D	Three-Dimensional
CTD	Conductivity, Temperature, Depth
DEMU	Dispersant Environmental Monitoring Unit
DGPS	Differential Global Positioning System
DOC	Department of Commerce
DOI	Department of the Interior
DWH	Deepwater Horizon
EB	Ecotoxicity Benchmark
EU	Environmental Unit
FIR	Fluorescence Intensity Ratio
FOSC	Federal On-Scene Coordinator
ft	feet
GC-MS	Gas Chromatography-Mass Spectroscopy
GPM	Gallons Per Minute
GPS	Global Positioning System
hr	hour
ICS	Incident Command System
LEL	Lower Explosive Limit
LISST	Laser In-Situ Scattering and Transmissometry
NCP	National Contingency Plan
NOAA	National Oceanographic and Atmospheric Association
NRDA	Natural Resource Damage Assessment
NRT	National Response Team
OSHA	Occupational Safety and Health Administration
PAH	Polycyclic Aromatic Hydrocarbon
PEL	Permissible Exposure Level
ppm	parts per million
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
ROV	Remotely Operated Vehicle
RP	Responsible Party
RRT	Regional Response Team
SMART	Special Monitoring of Applied Response Technologies
SSD	Species Sensitivity Distribution
TPH	Total Petroleum Hydrocarbon
VOC	Volatile Organic Compound
UC	Unified Command

Abstract

During the Deepwater Horizon (DWH) oil spill of 2010, subsea dispersant injection was used as a response option, in addition to other methods that have been more commonly applied during other events. At the time of the spill, there were no standardized methods for monitoring the efficacy and environmental effects of subsea dispersant use. During the DWH response effort, a unique organizational unit of the Incident Command System (ICS) structure, known as the Subsea Monitoring Unit (SMU) was created and monitoring methods were developed and modified as the event progressed. Those methods became the basis for policy and guidance development efforts within governmental agencies and industry. The American Petroleum Institute (API) developed a “model plan” for subsea dispersant monitoring that could be used by its member companies as the basis for facility response plans, or Incident Action Plans for a spill event. The National Response Team (NRT) created a guidance document that addresses “atypical” dispersant uses in general. This guidance is intended to be used by Regional Response Teams (RRT), but also contains specific guidelines for use by the responsible party (RP).

This document describes a proposed method for monitoring the efficacy of subsea dispersant injection to inform operational oil spill response decision-making by the Unified Command (UC). It is intended to be used as a model which can be modified to meet the needs of a specific incident. This plan is intended to complement the Subsea Dispersant Operations Plan and does not address surface dispersant operations. However, effective communications with units engaged in surface dispersant application and monitoring are essential.

Industry Recommended Subsea Dispersant Monitoring Plan

1 Introduction

This document describes a proposed method for monitoring the efficacy of subsea dispersant injection (SSDI) to inform operational oil spill response decision-making by the Unified Command (UC). It is intended to be used as a model that can be modified to meet the needs of a specific incident. This plan is intended to complement the Subsea Dispersant Operations Plan, and it is imperative that effective communications be maintained between the organizational units that implement both. This plan does not address surface dispersant operations, but effective communications with units engaged in surface dispersant application and monitoring is also essential. Incident Command System (ICS) elements (i.e., Health & Safety, Simultaneous Operations, Logistics, Communications, Data Management, etc.) that may be involved in implementing various aspects of this plan include the Environmental Unit, Source Control Branch, Subsea Well Containment Group, Safety Officer, and other groups or units within the ICS. If these organizations are not physically co-located, consideration should be given to establishing liaison positions within each to ensure two-way communications between operational and monitoring activities.

The subsea monitoring plan proposed here is intended to be consistent with Subpart J of the National Contingency Plan (NCP) (40 CFR 300.910) and applicable National Response Team (NRT) and Regional Response Team (RRT) guidance, plans, or requirements. This document is intended to supplement, not replace, existing RRT pre-authorizations and the Special Monitoring of Applied Response Technologies (SMART) protocols.

Information generated through these programs will guide the development of, or modifications to, previously established action levels that may inform decisions to continue, modify, or discontinue dispersant applications. Sampling and monitoring programs as described herein are expected to be implemented in a phased approach to enable rapidly deployable monitoring systems to be put into place and begin providing dispersant efficacy information to operational decision-makers. It is envisioned that this initial rapid deployment will be followed by the use of more comprehensive monitoring tools that may assist oil spill responders in determining dispersed oil dilution and its chemical fate. All information generated should be reported to the Environmental Unit (EU).

2 Purpose of Monitoring Subsea Dispersant Operations

Industry is committed to operating in an environmentally and socially responsible manner. Environmental and community and responder safety plans form an essential element of comprehensive and actionable oil spill preparedness and response plans. SSDI is a new concept and, to date, has been associated only with one catastrophic release from a continuous well loss-of-containment incident (e.g., blowout). SSDI involves adding dispersant directly to the production fluid releasing from the well or riser via a remotely controlled underwater vehicle or a fixed injection system associated with a capping stack. The intent is to limit the formation of a surface oil slick, to minimize the aerial release of volatile compounds at the spill response site (a threat to worker health and safety), to prevent or reduce the potential for floating oil to impact sensitive environmental resources, and to optimize the potential for microbial biodegradation. As it is a new approach, it is important that monitoring be conducted in a manner that provides actionable data for decision-makers within the ICS.

The purpose of sampling and monitoring as described in this document is to:

— determine dispersant efficacy;

— characterize the dissolved oxygen and oil droplet sizes for subsea, or near surface, dispersed oil plumes, including background samples;

— assess potential ecological effects as they relate to operational response decision-making; and

— evalute data collected in this plan supporting the Spill Impaction Mitigation Analysis for justifying the use of SSDI.

Monitoring data are used to help decide whether to continue or modify subsea dispersant use by decreasing or increasing dispersant injection rate (gpm). These data help spill responders make more informed and effective decisions about the use of subsea dispersants, in combination with other spill response technologies, to protect responders and minimize environment impacts as best as practical. A detailed monitoring plan also helps identify the supplies, equipment, work scopes, and staff required to use SSDI effectively in the event of a spill. Monitoring teams should consist of personnel specially trained on the technical operation of the equipment detailed in this plan. Addressing these requirements through response planning helps produce more efficient and effective results during the response.

Consistent with other spill response environmental assessment protocols, National Oceanographic and Atmospheric Association (NOAA) Scientific Support Coordinators (SSC) should be the lead federal representatives working with industry environmental scientists to develop and implement the described dispersant monitoring plan. U.S. Coast Guard National Strike Team members should also be involved with operational support consistent with current surface SMART protocols. Subsea dispersant application is still a relatively novel spill response method, so other local, state, and federal agencies, particularly those with concurrence roles established in the NCP, may also assist in the development of this plan and serve in ICS roles that support this plan.

3 Description of Monitoring Approach

Monitoring plans must be adjusted to the magnitude, location, and complexity of the response. Therefore, this monitoring plan utilizes an adaptive, scientifically-based approach and is designed to meet incident-specific response requirements. In some incidents, a basic monitoring program may be adopted to gain initial regulatory approval for subsea dispersant use prior to the execution of a more comprehensive monitoring program. Incidents that involve greater oil volumes and/or continue for longer time periods have the potential to result in greater environmental impact, and the level of monitoring may escalate as the size or duration of an incident increases. Traditional surface dispersant application has utilized the tiered SMART protocol for dispersant effectiveness monitoring. When using SMART protocols, monitoring begins with visual observations to determine dispersant efficacy, and decisions to escalate to higher tiers of the monitoring plan are based on operational needs and the time available to implement additional monitoring systems.

Subsea oil spill scenarios differ somewhat in that several days will be required to initiate subsea dispersant injection due to both equipment deployment time frames and Regional Response Team (RRT) concurrence. Although the protection of worker health and safety, and potentially sensitive surface and shoreline environmental areas, requires initiation of subsea dispersant injection as soon as possible after a well control incident, in most cases, it may be possible to have monitoring assets in position to initiate more sophisticated monitoring procedures concurrently with SSDI.

The existing NRT guidance for *Environmental Monitoring for Atypical Dispersant Operations* and EPA Region VI currently require that monitoring assets be in place prior to dispersant injection. FOSC approval should be sought for any required deviation from those policies.

The monitoring program outlined in this document is designed to obtain data that support real-time or near-real-time operational decision-making. As such, its primary focus is to collect data on dispersant effectiveness, key water quality data (i.e., dissolved oxygen), and dispersed oil concentrations approximately 6 ft close to and far from the release location. While dispersed oil concentrations and comparison to toxicological benchmarks are important assessments, these analyses will not be near-real-time due to the time required to acquire analytical data, and to assess, interpret, and draw ecosystem-level conclusions about the environmental significance of the dispersant application operation. As Phase 3 (see Section 4.3) monitoring data becomes available—specifically dispersed oil concentrations—subject matter experts can compare these data and trends to 3-D oil and fate trajectory modeling results used in the decision to approve the use of SSDI. This analysis should evaluate whether anticipated far-field results are being achieved with the use of SSDI.

Separate vessels and field teams should be utilized, as appropriate, to support efforts to assess any environmental damage (i.e., NRDA) resulting from the oil spill. Finally, it should be noted that this subsea monitoring plan may be integrated into other company-specific operational plans for source control, capping and containment, dispersant operations, data and sample quality control, worker health and safety, etc.

4 Subsea Dispersant Application Monitoring Guidelines

Subsea dispersant injection will generally include the following operations:

— A surface vessel carries and supplies dispersants to the spill site.

— Dispersant is injected from the surface vessel through a line that is connected to a nozzle held at the spill source by a remotely operated vehicle (ROV).

— The ROV positions the nozzle to directly inject dispersant into the flow of oil as close to the release point as possible. If possible, the nozzle should be inserted into the release point to inject dispersant into the oil before it discharges to the environment.

— Dispersant is pumped at a controlled rate from the deck of the surface vessel through the nozzle and into the oil.

— Increasingly, well-capping structures are being equipped with dispersant injection ports built into them, facilitating dispersant application in some instances. This monitoring plan is adaptable and applicable to this type of subsea injection, as well.

The subsea dispersants monitoring plan is designed to complement the dispersant application program and is divided into three sections, which are organized in phases of increasing complexity. Under optimal circumstances, all sections could be implemented simultaneously, but logistical considerations may require implementation in the order presented. The phased approach was developed to allow initiation of subsea dispersant injection with only Phase 1 monitoring to avoid delaying injection while awaiting implementation of more complex aspects of the monitoring plan. After initiating SSDI with Phase 1 monitoring, additional monitoring would be implemented as soon as practical. The three sections that follow address dispersant efficacy, delineation of resultant dispersed oil plumes, and chemical characterization of dispersed oil in the water column.

4.1 Phase 1: Confirmation of Dispersant Effectiveness Near the Discharge Point and Reduction in Surface Volatile Organic Compounds (VOCs)

4.1.1 Description of Operation

The initial question that must be answered by the subsea monitoring program is, “Is subsea dispersant injection (SSDI) effective?” This question can be answered using a combination of direct in-situ monitoring of plume characteristics and monitoring indirect measures, such as the concentration of VOCs in air over the release site and degree of surface water oiling near the release site. This monitoring plan recommends SSDI effectiveness monitoring using the following parameters. The SSDI approval and use through the SIMA process should ensure that dispersants are being applied at a sufficient rate to achieve desired oil droplet sizes that minimize surface VOC and surfacing oil. Effectiveness monitoring of subsea dispersant injection is conducted in three ways:

— visually, by assessment with an ROV (other than the one implementing subsea dispersant injection) equipped with video cameras stationed at the spill source to collect video while dispersant injection is occurring, and without injection to determine if the visible plume of oil is changing color and/or changing shape;

— analytically, by monitoring VOCs on vessels in close proximity to the well site; and

— visually, by analyzing the surface expression of oil using aerial imaging; this technique provided strong evidence that subsea dispersant injection was effective during the Deepwater Horizon (DWH) incident (Figure 1).

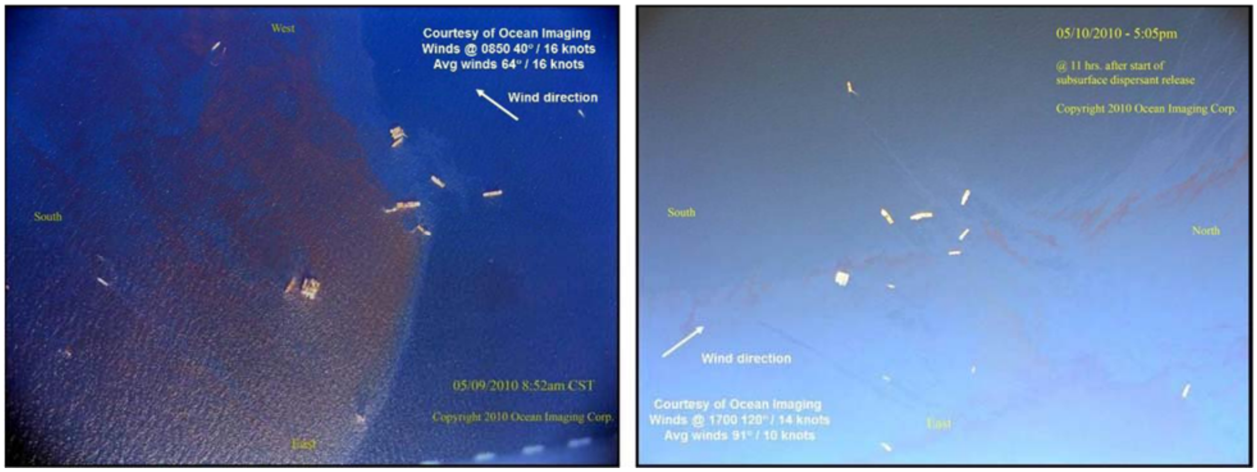

Figure 1—Aerial Surveillance: Use of aerial surveillance to help assess effectiveness of subsea dispersant injection in reducing amounts of surface oiling during the Deepwater Horizon incident. The left image was taken the day before subsea dispersant injection was initiated and the right image was taken 11 hours after initiation.

One of the primary reasons for using SSDI is to reduce VOC concentrations in the ambient breathing zone of responders tasked with containing and capping the release. Surface slicks of fresh oil near the release site are likely to cause elevated concentrations of VOCs. If SSDI is efficiently dispersing oil subsea, surface slicks will be minimized, causing a significant reduction in surface VOCs and thereby minimizing VOC exposure to workers in the source control zone.

4.1.2 Phase 1: Monitoring Methodology

Air quality—VOC measurements:

— Real-time VOC monitoring equipment (e.g., photoionization detector, colorimetric tubes, etc.) and trained users will be stationed on vessels located near the well site. Significant reductions in VOC concentrations will indicate a reduction in fresh oil slicks near the well site. VOC measurement will be affected by surface conditions, such as wind speed/direction and location of the monitoring device relative to the surface slick location. Efforts must take into account subsea currents that transport the rising oil droplets (dispersed or not) some distance from the spill site and local winds that disperse and transport VOCs in the atmosphere away from patches of floating oil. For example, vessels upwind of surface slicks from the flowing subsea well could have low VOCs even with surface slicks nearby. These additional variables could complicate interpretation of the VOC data and may limit the ability to draw definitive conclusions on the effectiveness of subsea dispersants. Weather conditions should be reported along with all VOC data. VOC and other air quality measurements collected via handheld instruments (e.g., O_2, benzene, H_2S, %LEL) should be documented so results can be disseminated rapidly to the Safety Officer for reporting out to Unified Command. It is the responsibility of the Safety Officer to communicate air quality levels that mandate responder actions, including additional monitoring, required donning of personnel protective equipment (PPE), and, in some cases, evacuation from the site based on the incident site safety plan.

— More comprehensive air sampling for specific hydrocarbon constituents, including BTEX, PAHs, and other hydrocarbons, by integrated air sampling with multi-sorbent thermal desorption tubes or worker badges, followed by gas chromatography mass spectrometer (GC-MS) analysis (via NIOSH Method 2549 or equivalent method), may be considered, but will require several days to acquire results since it must be completed using on-shore laboratories.

Plume video:

— Images collected from video cameras on the ROV with and without SSDI are used to determine if the color and dimensions of the visible oil cloud are changing as a qualitative indication that the oil is being dispersed. The ROV will be raised upwards through the water column, keeping a constant distance of approximately 6 ft from the edge of the plume. The video images will be used to detect changes in the plume size and shape as the mixture of oil, gas, and entrained seawater rises through the water column and is dispersed by local currents.

Aerial surveillance:

— Aerial monitoring will be conducted to assess the distribution of oil on the sea surface over space and time prior to (without) and during (with) the application of the subsea dispersant to determine if the use of SSDI is reducing the extent and/or location of floating oil. Aerial surveillance methods should follow accepted protocols[1] and/or response good-practice guidance, and may include plots, video, or images from platforms such as helicopters, fixed-wing systems, unmanned aerial systems (UAS), satellites, and tethered balloons. It is recommended that the spatial scale of the image(s) is large enough to account for differences in wind and current over the observation period.

— Aerial image collection will be conducted with and without SSDI. Aerial surveillance of untreated oil (i.e., no SSDI) should be done numerous times per day to allow for an accurate description of baseline conditions as winds and currents may shift the surfacing oil nonuniformly over time. Imagery used to assess the effect of SSDI must allow time for the water column to become clear of untreated oil and the surface slicks to transfer out of the observation area. This transition time between untreated and treated oil can take several hours. 3-D oil plume and trajectory modeling can be used to estimate the transition time.

Recommended minimum respiratory projection and air monitoring equipment list:

— real-time VOC and air monitoring equipment instruments with trained operators;

— worker detection badges for monitoring permissible exposure limit (PEL) of crews;

— air quality PPE, including half-faced respirators with OV/P100 cartridgse and self-contained breathing apparatuses (SCBA);

— One or two offshore vessels with ROVs equipped with video cameras and trained operators—one for dispersant application and one to monitor dispersant effectiveness;

— aerial surveillance platform(s) capable of capturing a predetermined observation area, Global Positioning System (GPS) record, and ability to transfer the images into UC or the Common Operating Picture (COP) daily.

4.2 Phase 2: Characterization of Oil Droplet Size near Plume and Dispersed Oil Concentrations at Depths in Water Column

4.2.1 Description of Operation

Phase 2 of this monitoring plan seeks to provide key information regarding the effectiveness of the dispersant application by directly measuring the oil droplet sizes near the loss-of-containment (LOC) site with dispersant injection and without dispersant injection, if warranted, and collection and analysis of water samples around the LOC site to characterize dispersed oil sizes and concentrations and key water

[1] An approved field guide is "Open Water Oil Identification Job Aid for Aerial Observation," which was published by NOAA in November 2007 and is available online at http://response.restoration.noaa.gov/

parameters, such as dissolved oxygen measurements. These two tasks are discussed in detail separately below.

SSDI effectiveness relies upon the reduction in oil droplet sizes, which in turn reduces the speed at which these droplets rise to the ocean surface. Compared to larger untreated droplets, this reduction in oil rise time allows for dispersion of the oil in the water column, resulting in rapid dilution at depth and movement away from the release site. Dispersed oil dilution also improves microbial degradation of dispersed oil hydrocarbons and reduces oil exposure of marine organisms at the ocean surface, the volume of floating oil, and VOC concentrations in the atmosphere. For these reasons, it’s important to directly measure the full oil droplet size distribution before and after treatment so the dispersant injection rate can be optimized.

Measurement of oil droplets with and without SSDI can be achieved by positioning a particle size analyzer adjacent or, in some cases, into the releasing oil plume. The positioning of these instruments will be based on the instrument capabilities and the release conditions at the site. A position starting distance should be approximately one hundred times the release diameter and reduced until 80 % to 95 % detector saturation is achieved. Measurements of oil droplet size distributions with and without dispersant injection can be used in conjunction with 3-D fate and trajectory models to determine an optimal dispersant application rate. It is recommended that the particle size analyzer has the capability to also measure gas-to-oil ratio (GOR) since this is a key parameter to oil plume and trajectory models. For example, upward-looking acoustic doppler current profilers (ADCP) may be installed on the sea floor near the release site. A downward-looking ADCP should be deployed from a surface vessel to measure currents in the upper water column if the bottom ADCP cannot profile the entire water column. These data will be used as inputs into the 3-D oil fate and trajectory modeling and interpret monitoring data (e.g., the location of floating oil). This equipment is commonly available under normal operations for doing bottom surveys.

Phase 2 water column monitoring seeks to determine the near-real-time location, extent, and characterization of dispersed oil plumes at depth. An important objective of this phase is to confirm or revise initial assumptions about dispersed oil fate, transport, and concentration over time that were used to assess the ability of SSDI to mitigate potential environmental or safety impacts of the release. The extent of such monitoring increases with the duration and volume of the release. Local oceanographic data, together with oil trajectory models, if available, will determine the likely movement of the subsurface oil and can be used to guide the sampling locations. Since this phase is near-real-time, dispersed oil levels will be evaluated using fluorometry. Ex-situ analyses of water samples will be mostly completed by onshore laboratories and is considered Phase 3 of this monitoring plan, as these data will likely require three to 10 days post-collection to obtain results and will therefore be of limited use in operational decision-making.

It is recommended that a monitoring vessel should conduct sampling casts outfitted with the following in-situ sensors: conductivity temperature depth (CTD) instrument, fluorometer, turbidity meter, and a dissolved oxygen sensor. Water samples will be collected and stored for subsequent chemical analysis from depths determined by the results of the CTD casts for selected stations. Water samples for additional shipboard analysis may include dissolved oxygen measurements, and shipboard volatile hydrocarbons GC-MS. Onshore analyses (per Phase 3) should be collected at depths above, within, and below significantly high fluorescence measurements. In addition, water samples should be collected at locations with low fluorescence measurements at equivalent depths to fully characterize dispersed oil exposure in the water column. To confirm in-situ DO measurements, a few water samples should be periodically analyzed on the vessel to confirm the accuracy of the sensor readings. When practical, pre-SSDI water samples and cast should be conducted and target non-dispersed oil plumes per trajectory modeling in conjunction with CTD and fluorescence readings.

4.2.2 Basic Monitoring Methodology

Oil droplet size measurements:

— direct oil droplet size measurements using optical or laser-based particle analyzer technology capable of measuring oil droplets over applicable size ranges (e.g., 10 to 10,000 microns) with and without SSDI and capable of deployment on a ROV for positioning within the plume near the release site.

Subsea water-column dispersed oil measurements:

- Determine where the sample should be based on information from an incident-specific 3-D trajectory model. If trajectory data are not available, a sampling grid should be developed; it should be centered on the spill location and away from the release following subsea currents. Fluorescence measurements from CTD casts can be used to assist in determining the path of the dispersed oil.

- Maneuver vessel onto location.

- Lower the instruments to approximately 20 to 50 meters above the seabed to avoid subsea infrastructure to the seabed while observing the real-time CTD/fluorometer/oxygen data display to determine if the dispersed oil is detected [2].

- If an area of elevated fluorescence is detected, which could be a dispersed oil plume, water samples may be collected per the sampling and monitoring plan.

- On the up cast, the sample bottles will be triggered and samples collected.

- Following retrieval of the instruments, the samples will be transferred to sample containers and stored appropriately onboard until they are shipped to an accredited laboratory. Some predetermined samples will be selected for on-vessel laboratory analyses for DO and volatile organics.

- Provide sampling results to the Environmental Unit to inform subsea dispersant use decision-making.

- Phase 2 sampling vessels should have the ability to conduct real-time VOC analysis to ensure crews assess and respond accordingly to results within the hot or warm incident zones.

- If rapid (<24 hours after sample collection) water phase total petroleum analysis (TPH) is warranted, oil-in-water (OIW) analysis by fluorescence could serve as a surrogate parameter. Laboratory analysis for TPH via EPA Method 8015 should be correlated to these results to evaluate and improve the interpretation of these field data for response decision-making. Calibrating the OIW fluorescence analyzer with source oil may also improve the accuracy of these measures for TPH.

Basic requirements list:

- offshore vessel(s) with ROVs, fathometer, and dynamic II positioning system;

- CTD system with winch, data cable, and deployment davit or A-frame;

- sensors on CTD, to include:

  - fluorometer;

  - conductivity/temperature/depth sensors;

  - dissolved oxygen sensor;

  - particle size analyzer;

  - turbidity [nephelometric turbidity unit (NTU)];

- water sample capability on CTD (e.g., Niskin bottles on remotely fired rosette sampler);

- data logging computer/printer and software;

- water sample containers/storage capability;

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[2] In 5000-ft depth, it will take approximately two hours for down casting, sampling, and up casting of sampling array.

— *Sample Handling and Chain-of Custody Transfer Plan*;

— depth gauge for intermediate water column depth measurements;

— handheld optical dissolved oxygen meter;

— acoustic doppler current profilers (ADCP).

4.3 Phase 3: Detailed Chemical Characterization of Water Samples

4.3.1 Description of Operation

Phase 3 monitoring seeks to characterize water samples collected during operations addressed in Section 4.2 using accredited contract laboratories capable of processing large volumes of samples and using state-of-the-art laboratory analytical techniques for petroleum analytes and dispersant marker analysis described in the incident-specific sampling and monitoring plan (SAP). Following the retrieval of the sampling rosette, seawater samples will be drawn from sampling bottles into appropriate pre-cleaned sample containers provided by the laboratory and stored according to the intended analysis and maintained under chain of custody (COC). The Quality Assurance Project Plan (QAPP) and standard operating procedures (SOP) will dictate the procedures for sample collection, labeling, naming, handling, storage, and transport, as well as procedures for equipment decontamination and the collection of quality control samples, including field blanks, equipment blanks, and field splits. Water samples will need to be rapidly transferred onshore for analyses at an accredited laboratory and must meet all required COC steps while samples are in transit. Sample transfer via helicopter should be considered when applicable to reduce logistical constraints on the sampling crew and vessel. Vessel transit time, sample transfer time, and laboratory processing can equate to a minimum of three to five days to process a sample, depending on the incident location. In the case of a larger spill event where significant numbers of samples are collected, it could take at least seven to 10 days to receive all analytical results that meet quality assurance and control (QA/QC) standards.

It is recommended that total petroleum hydrocarbon (TPH) analysis for gas and diesel range organics (e.g., EPA Method 8260 and EPA Method 8015) may serve as a parameter to evaluate the extent at which hydrocarbon concentrations are declining at spatial distances away from the release site. TPH data should not be used directly to estimate toxicological impacts; rather, TPH serves as an overall indicator of oil in water. To evaluate toxicological impacts, it is recommended that additional analyses be conducted focusing on the dissolved phase hydrocarbons and specific hydrocarbon classes. For example, water sample analyses may include dissolved (via solid phase microextraction) and total polycyclic aromatic hydrocarbons (PAH), including parent and alkylated homologs. Additionally, water samples may be subject to oil fingerprinting to evaluate if oil constituents are from the release and not from other sources, and analysis for dispersant constituents (e.g., propylene glycol and dioctyl sodium sulfosuccinate).

4.3.2 Basic Monitoring Methodology

— Properly label all water samples collected during monitoring, and store on ice.

— Transfer samples via fast vessel or helicopter to a vehicle that can transfer samples to a shipping carrier or directly to an analytical facility while maintaining appropriate chain-of-custody.

— Provide sample results to the Environmental Unit to inform subsea dispersant use decision-making.

Basic requirements list:

  — Transfer vehicles to shuttle samples from the port to a shipping facility.

  — Shipping facility to transport samples to a laboratory.

  — Contract laboratory that is accredited for hydrocarbon chemical analysis specified in the incident-specific *Sampling and Analysis Plan*.

5 Communication Plan

The communication plan will include a protocol addressing sample tracking, data management, data format, and an accessible digital data storage platform mutually agreed upon by the UC. Data managers should be designated for ensuring the collection and distribution of all data elements described hereafter. These include data generated by the units responsible for implementation of the Subsea Dispersant Operations Plan, the Subsea Dispersant Monitoring Plan, air monitoring data generated through implementation of the Safety Plan, and Source Control activities. All data collected and/or analyzed by the RP or the government (with the exception of data and/or analysis strictly associated with NRDA or legal investigations) will be available to the UC. Unless otherwise instructed by the UC, the communications plan may be based, to the extent applicable, on the NRT guidance for *Environmental Monitoring for Atypical Dispersant Operations*. Data reporting will be on a daily basis, when feasible, unless otherwise approved by the FOSC. The communications plan shall include, but may not be limited to:

— air and water quality data generated by activities described in Section 4;

— the amount of dispersant applied for the previous 24-hour period, in hourly intervals, if possible;

— variations in the planned dispersant application +/-10% of the previous daily average;

— water column dispersed oil loading reports;

— dispersing potential assessment reports and recommendations;

— daily subsea transport estimate of oil, dispersant, and dispersed oil plumes using the most current trajectory modeling available.

6 Quality Assurance Project Plan

The Quality Assurance Project Plan (QAPP) will address sample collection methodology, handling, chain-of-custody, and decontamination procedures to ensure the highest quality data will be collected and maintained. The QAPP will be developed in accordance with EPA Quality Assurance Project Plans 4 and 5, and recommendations from the UC. The QAPP should be based, as appropriate, on the NRT guidance on *Environmental Monitoring for Atypical Dispersant Operations*.

Discrete samples will be tested at a laboratory approved by the OSC, with the concurrence of EPA and, as appropriate, the states, and in consultation with DOC and DOI. The QAPP will include:

— an introduction that identifies project objectives and the project staff;

— a site description and background. The site description will include bathymetry, subsea currents (including temporal variations), and other relevant geological features. The site description will identify any relevant oil seeps or other potential sources of contamination (e.g., recent oil discharges), and relevant oil and/or natural gas infrastructure (e.g., oil platforms, subsea pipelines);

— a description of the sampling and monitoring protocols, data quality objectives, and health and safety implementation strategies included in this monitoring plan;

— quality assurance (QA) to address chain-of-custody procedures, field records (including logs), and qualitative data handling (including photographs).

7 Aquatic Toxicity Assessment for Operational Decision-Making

An aquatic toxicity assessment plan may be developed in consultation with the UC for operational decision-making on dispersant use. The primary method assumed to be relevant for deepwater releases involves comparison of analytical data developed through implementation of this plan to aquatic toxicity benchmarks established through consultation with the NOAA Scientific Support Coordinator (SSC) and UC. Incident-specific benchmarks may be based on species sensitivity distributions (SSDs), accepted scientific study results and/or models, or other relevant toxicity thresholds. When available, 3-D oil fate and effects model results used for supporting the decision to use subsea dispersants will be compared to water sample results collected in this plan to evaluate if similar trade-off data are observed (e.g., illustrate lower toxicity impacts away from the release and on the water surface).

8 Action Levels

The UC should establish action levels that can be used to indicate a need for convening appropriate agencies and technical resources to review current dispersant operations, and whether monitoring data indicates a need to adjust or discontinue the use of SSDI. It is anticipated that the UC will establish action levels that could include dissolved oxygen levels that approach hypoxia (i.e., 2.0 ppm) or measured concentrations of dispersant marker compounds or dispersed oil at concentrations and locations (spatial area) that change the conclusion of the spill impact mitigation assessment (SIMA) to not select SSDI. If a sampling event indicates one or more samples are close to or greater than action levels, additional samples should be collected to characterize the area of concern before changes are made to dispersant injection. Reporting requirements established by the UC for comparisons of monitoring data to action levels will be assumed to be on a 24-hour basis and will be included in the communication plan.

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