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Report to Congressional Requesters

December 2021

OFFSHORE OIL SPILLS

Additional Information Is Needed to Better Understand the Environmental Tradeoffs of Using Chemical Dispersants

A Century of Non-Partisan Fact-Based Work

GAO-22-104153

GAO@100 Highlights

Highlights of GAO-22-104153, a report to congressional requesters

December 2021

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Additional Information Is Needed to Better Understand the Environmental Tradeoffs of Using Chemical Dispersants

Why GAO Did This Study

In April 2010, an explosion onboard the *Deepwater Horizon* drilling rig in the Gulf of Mexico resulted in 11 deaths and the release of approximately 206 million gallons of oil. During the *Deepwater Horizon* oil spill, responders applied dispersants to the oil slick at the ocean surface as well as at the wellhead more than 1,500 meters below the surface. The subsurface use of dispersants was unprecedented and controversial.

GAO was asked to review what is known about the use of chemical dispersants. This report examines, among other things, what is known about the effectiveness of dispersants, what is known about the effects of chemically dispersed oil on the environment, and the extent to which federal agencies have taken action to help ensure decision makers have quality information to support decisions on dispersant use. GAO reviewed scientific studies, laws, regulations, and policies. GAO also interviewed agency officials and stakeholders from academia and industry.

What GAO Recommends

GAO is making four recommendations, including that the Coast Guard and EPA assess the potential environmental effects of the subsurface use of dispersants. The Department of Homeland Security agreed with the three recommendations GAO made to the Coast Guard, and EPA agreed with the one recommendation to the agency.

View GAO-22-104153. For more information, contact Frank Rusco at (202) 512-3841 or RuscoF@gao.gov or Karen L. Howard at 202-512-6888 or HowardK@gao.gov.

What GAO Found

When an oil spill occurs, responders have several options to manage the environmental effects, including using chemical dispersants (see figure). Chemical dispersants used on a surface oil slick can be effective at breaking up floating oil, which can help prevent the oil from reaching shore and harming sensitive ecosystems, according to studies GAO reviewed and stakeholders GAO interviewed. However, the effectiveness of applying dispersants below the ocean surface—such as in response to an uncontrolled release of oil from a subsurface wellhead—is not well understood for various reasons. For example, measurements for assessing effectiveness of dispersants applied at the subsurface wellhead during the *Deepwater Horizon* oil spill had limitations and were inconclusive. In addition, there are limited experimental data on the effectiveness of subsurface dispersants that reflect conditions found in the deep ocean.

Application of Chemical Dispersants at the Surface by Aircraft and Boat

Sources: U.S. Coast Guard (left image); SINTEF (right image). I GAO-22-104153

Chemically dispersed oil is known to be toxic to some ocean organisms, but broader environmental effects are not well understood. Dispersants themselves are considered significantly less toxic than oil, but chemically dispersing oil can increase exposure to the toxic compounds in oil for some ocean organisms, such as early life stages of fish and coral. Other potentially harmful effects of chemically dispersed oil, especially in the deep ocean, are not well understood due to various factors. These factors include laboratory experiments about the toxicity of chemically dispersed oil that use inconsistent test designs and yield conflicting results, experiments that do not reflect ocean conditions, and limited information on organisms and natural processes that exist in the deep ocean.

Since the *Deepwater Horizon* oil spill, the U.S. Coast Guard, the Environmental Protection Agency (EPA), and other agencies have taken some actions to help ensure decision makers have quality information to support decisions on dispersant use. For example, the Coast Guard and EPA have assessed the environmental effects of using dispersants on a surface slick. However, they have not assessed the environmental effects of the subsurface use of dispersants. By assessing the potential environmental effects of the subsurface use of dispersants, the Coast Guard and EPA could help ensure that decision makers are equipped with quality information about the environmental tradeoffs associated with decisions to use dispersants in the deep ocean.

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Abbreviations

BP	BP America Production Company
CROSERF	Chemical Response to Oil Spills: Ecological Effects Research Forum
EPA	Environmental Protection Agency
Interagency Committee	Interagency Coordinating Committee on Oil Pollution Research
NOAA	National Oceanic and Atmospheric Administration
SMART	Special Monitoring of Applied Response Technologies

U.S. GOVERNMENT ACCOUNTABILITY OFFICE
A Century of Non-Partisan Fact-Based Work
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December 15, 2021

The Honorable Frank Pallone, Jr.
Chairman
Committee on Energy and Commerce
House of Representatives

The Honorable Paul D. Tonko
Chairman
Subcommittee on Environment and Climate Change
Committee on Energy and Commerce
House of Representatives

The Honorable Diana DeGette
Chair
Subcommittee on Oversight and Investigations
Committee on Energy and Commerce
House of Representatives

On April 20, 2010, an explosion and fire onboard the *Deepwater Horizon* drilling rig in the Gulf of Mexico resulted in 11 deaths and the release of approximately 206 million gallons of crude oil from a subsurface well over a period of nearly 3 months—the largest oil spill in U.S. history. When an oil spill occurs in the coastal waters of the U.S., responders have several options for mitigating the environmental effects of the spill, including using chemical dispersants.

Chemical dispersants are designed to break up oil into smaller droplets; smaller droplets in a surface oil slick can more easily mix into the water below the surface, and for subsurface oil, smaller droplets may be less likely to rise to the surface. Dispersing oil can reduce the effect of the oil on shoreline ecosystems and natural resources, as well as on birds and marine mammals at the surface. Studies report that the toxicity of chemical dispersants on their own to the environment is relatively low compared to oil. However, because chemical dispersants can help keep oil below the surface, their use can expose the underwater environment and the ocean floor to more of the spilled oil, where it may have harmful effects.

During the *Deepwater Horizon* oil spill, aircraft and boats applied more than 1 million gallons of dispersants to oil that had surfaced from the well. In addition, responders applied another 770,000 gallons of dispersants directly at the wellhead, more than 1,500 meters below the water's surface. The subsurface use of dispersants during the *Deepwater Horizon* oil spill was the first—and only—time this response option has been used.

Concerns and controversy about the potential environmental and human health effects of dispersant use arose during and after the *Deepwater Horizon* oil spill. According to a U.S. Coast Guard report on the *Deepwater Horizon* response, although dispersants were considered an effective response tool, the amount of dispersants used caused public concern and ultimately led to a decision by the federal government to reduce the frequency and amount of dispersants used during the spill.[1] Although subsequent studies reported that there is little likelihood that the public was exposed to dispersants or chemically dispersed oil, there was public concern about whether seafood was safe to ingest after the *Deepwater Horizon* oil spill.[2] A 2018 comparative study by industry of offshore oil spill responses noted that any future use of dispersants would be subject to scrutiny by elected officials and the public.[3] Dispersants have not been used in U.S. waters since the *Deepwater Horizon* oil spill, according to Coast Guard officials.

You asked us to review what is known about chemical dispersants and to examine what federal agencies have done to help officials responding to an oil spill make decisions about using them. This report examines (1) what is known about the effectiveness of dispersants, (2) what is known about the effects of chemically dispersed oil on the environment, (3) what is known about the effects of dispersants on human health, and (4) the extent to which federal agencies have taken action to help ensure decision makers have quality information to support decisions about the use of chemical dispersants.

To conduct this work, we reviewed relevant laws, regulations, guidance, and planning documents pertaining to the use of chemical dispersants. We also interviewed relevant federal stakeholders, including officials from

[1]U.S. Coast Guard, *On-Scene Coordinator Report: Deepwater Horizon Oil Spill* (September 2011).

[2]We reported in 2012 that studies had indicated that dispersants used during the spill did not accumulate in seafood. GAO, *Oil Dispersants: Additional Research Needed, Particularly on Subsurface and Arctic Applications,* GAO-12-585 (Washington, D.C.: May 30, 2012).

[3]A. H. Walker et al., "Comparative Risk Assessment of Spill Response Options for a Deepwater Oil Well Blowout: Part III, Stakeholder Engagement," *Marine Pollution Bulletin*, vol. 133 (2018).

the Coast Guard, within the Department of Homeland Security; the Environmental Protection Agency (EPA); the National Oceanic and Atmospheric Administration (NOAA), within the Department of Commerce; and the Department of the Interior. We corresponded with officials from the Department of Health and Human Services. In addition, we interviewed other stakeholders from industry, academia, and consulting firms. We identified these non-federal stakeholders through interviews and through reviews of dispersant-related reports.

To examine what is known about dispersant effectiveness and effects, we identified key reports through interviews with stakeholders. In addition, we conducted a literature search of studies since 2010 involving chemical dispersants. These studies included those from the Gulf of Mexico Research Initiative, an initiative established in 2010 with support from the BP America Production Company (BP) to study the effects of *Deepwater Horizon* and other spills on the Gulf of Mexico over a 10-year period.[4] We selected for in-depth review those peer-reviewed studies that were synthesis papers or that presented the results of key laboratory and field experiments.

To examine the extent to which agencies have taken action to help ensure decision makers have quality information to support decisions about the use of chemical dispersants, we reviewed agency regulations and proposals, guidance, and regional planning policies for oil spill response and the use of dispersants. In addition, we interviewed the stakeholders we identified above. Appendix I provides a more detailed description of our scope and methodology.

We conducted this performance audit from March 2020 to December 2021 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

[4]BP leased the *Deepwater Horizon* oil rig and was the party responsible for costs associated with cleaning up the spill, among other things. According to the Gulf of Mexico Research Initiative, on May 24, 2010, about 1 month into the *Deepwater Horizon* oil spill response, BP committed $500 million to create a broad, independent research program to be conducted at research institutions primarily in the U.S. Gulf Coast states.

Background

Options for Responding to Oil Spills

An oil spill includes, but is not limited to, any uncontrolled discharge of crude oil, gasoline, or other fuels or oil by-products.[5] According to NOAA, since 1969, at least 44 oil spills of over 420,000 gallons each have affected the waters of the U.S.[6] Options for responding to an offshore oil spill include collecting the oil through mechanical means (e.g., skimming oil from the surface and using subsurface collection devices), burning the oil, and applying dispersants.[7] Collecting the oil through mechanical means is the primary option used, but for large spills and spills far offshore, mechanical recovery may be insufficient, according to Coast Guard officials.

During the *Deepwater Horizon* oil spill, responders used all three options to respond to the spill. According to a November 2010 federal government report on the *Deepwater Horizon* oil spill, an estimated 38 percent of the spilled oil was lost to natural processes such as evaporation and dilution, 17 percent was recovered using subsurface collection devices, 16 percent was chemically dispersed (through both surface and subsurface use of dispersants), 5 percent was burned, 3 percent was skimmed, and the fate of the remaining 22 percent was unknown.[8]

Chemical dispersants function by reducing the interfacial tension between oil and water, which enhances the extent to which oil breaks up into smaller droplets, similar to the way that dish detergents break up cooking

[5]Specifically, under the Clean Water Act, a discharge generally includes, but is not limited to, any non-permitted spilling, leaking, pumping, pouring, emitting, emptying or dumping of oil, which in turn is defined as oil of any kind or in any form. 33 U.S.C. § 1321(a)(1)-(2).

[6]Oil spills can have many causes, including hurricanes such as Hurricane Ida, which damaged pipelines on the ocean floor in the Gulf of Mexico and caused numerous spills. According to Coast Guard officials, none of these spills were treated with dispersants.

[7]According to a 2018 U.S. Coast Guard memorandum, chemical dispersants have been used 26 times in U.S. waters since the 1970s to mitigate the effects of oil spills. Dispersants were used six times between 2000 and 2010, all within the Gulf of Mexico, including in response to the *Deepwater Horizon* spill in 2010.

[8]The Federal Interagency Solutions Group, Oil Budget Calculator Science and Engineering Team, *Oil Budget Calculator: Deepwater Horizon—Technical Documentation* (November 2010). Percentages do not add to 100 due to rounding.

oil on a skillet.[9] In the case of dispersants applied to a surface oil slick, breaking up oil into smaller droplets enhances the extent to which wave and wind energy mixes the oil into the top several meters of the water column—the water between the surface and the ocean floor. Thus, rather than having a surface oil slick, the result is a larger, but more diffuse, mixture of oil droplets and dispersants below the water's surface.[10] Dispersants can be applied to a surface oil slick by aircraft, by boat, or, according to Interior officials, from an offshore platform.

When a subsurface oil spill occurs, such as when oil spills from a wellhead on the ocean floor, smaller droplets generally rise more slowly than larger droplets. If the droplets are sufficiently small, they may remain suspended in the water column. Smaller droplets that rise more slowly may also surface farther away from the source of the oil spill due to currents, thereby reducing the thickness of the slick that forms directly above the source of the spill. Oil droplets that are small enough may remain in the water column until they dissolve, until they combine with organic and inorganic matter and sink to the ocean floor, or until microbes consume them under the appropriate conditions—a process called biodegradation.

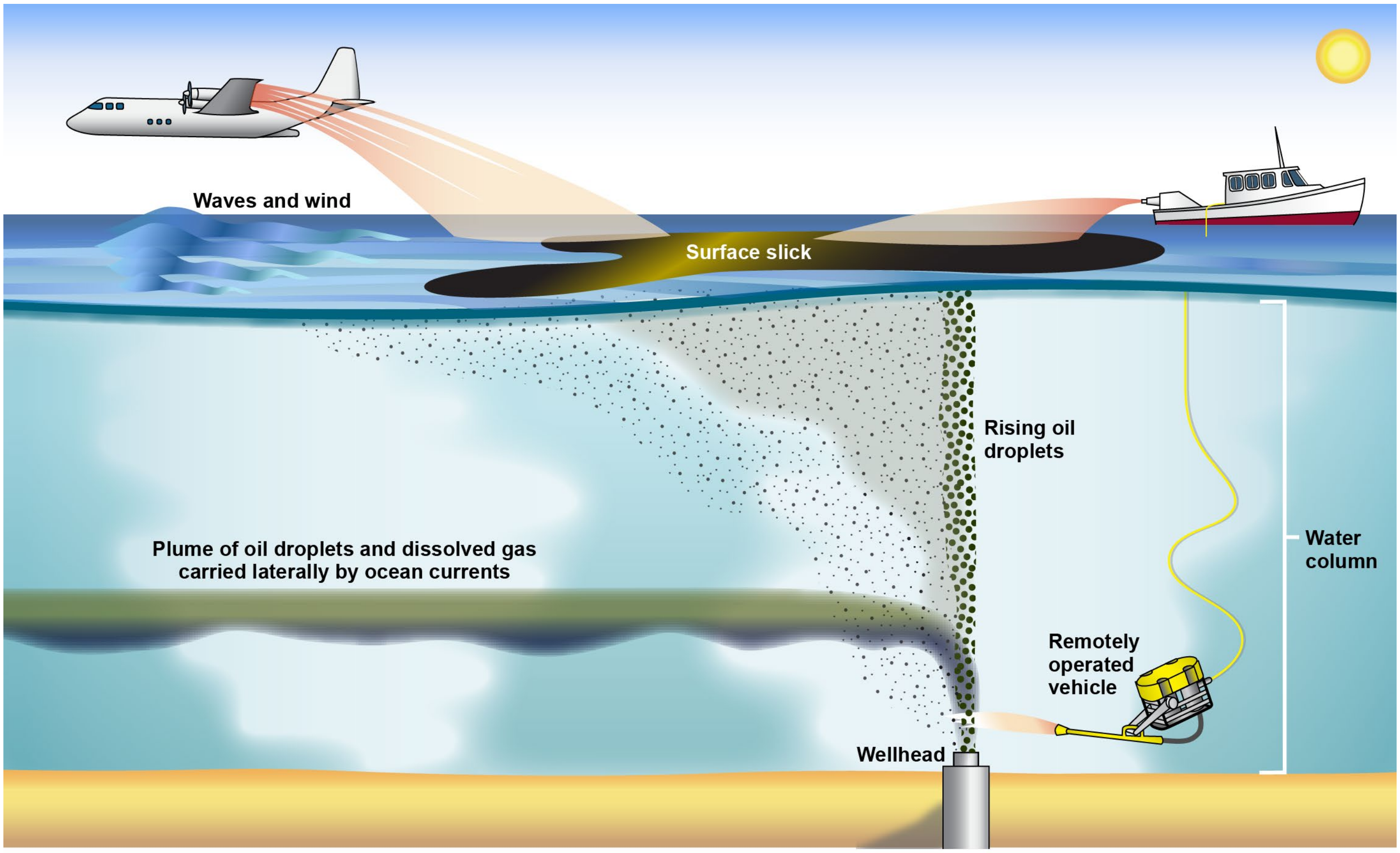
During the *Deepwater Horizon* oil spill, some of the small oil droplets and dissolved gas became trapped in the flow of deep ocean currents, and this resulted in a lateral plume of dispersed oil and gas that was nearly 20 nautical miles long, according to one study.[11] During the spill, responders used remotely operated vehicles to apply dispersants directly to oil released from the wellhead on the ocean floor, and they used aircraft and boats to apply dispersants to oil that had already surfaced. Figure 1 provides an overview of how responders may use chemical dispersants to mitigate the effects of oil released during a subsurface spill.

[9]Interfacial tension refers to adhesive forces that exist between the surfaces of the liquid phase of one substance and either a solid, liquid, or gas phase of another substance.

[10]Throughout this report we use the term "chemically dispersed oil" to refer to the mixture that results when chemical dispersants are applied to oil to facilitate the formation of oil droplets and to distinguish this mixture from oil that may be dispersed naturally.

[11]R. Camilli et al., "Tracking Hydrocarbon Plume Transport and Biodegradation at Deepwater Horizon," *Science*, vol. 330 (2010).

Figure 1: Use of Chemical Dispersants during a Subsurface Oil Spill



Source: GAO review and analysis of scientific literature. | GAO-22-104153

Responders use dispersants (and other response options) primarily to prevent large oil slicks from harming shoreline ecosystems and natural resources. During the *Deepwater Horizon* oil spill, responders also used dispersants to reduce the potentially harmful amounts of gases emanating from the surface oil slick. Responders were concerned that these gases could harm response workers who were working at the surface to stop the flow of oil from the subsurface wellhead. In addition, responders use dispersants in an effort to help microbes consume the oil and remove it from the ocean. Reducing the size of oil droplets and dispersing them into the water column may enhance this process, under the appropriate conditions.

Key Federal Roles and Responsibilities

There are several federal entities with important roles and responsibilities relating to oil spill response, including the following:

- **EPA.** EPA is responsible for maintaining the National Contingency Plan, which sets out the federal government's blueprint for responding to oil spills. More specifically, the National Contingency Plan details federal responsibilities and procedures for preparing for and responding to discharges of oil or releases of hazardous substances, pollutants, or contaminants in inland and coastal zones of the U.S.[12] EPA is authorized to amend the plan in consultation with other federal agencies. As part of its responsibilities, EPA maintains a list—called the Product Schedule—of dispersants and other chemical and bioremediation products that may be authorized for use during a spill.[13]
- **Coast Guard.** The Coast Guard has primary responsibility for directing response efforts to an oil spill within or threatening the coastal zone of the U.S.[14] The Coast Guard provides a designated federal on-scene coordinator for oil spills in or that threaten this zone. The federal on-scene coordinator is to direct response efforts and coordinate all other efforts at the scene of a discharge.[15] This includes authorizing the use of dispersants on the spill, in accordance with the National Contingency Plan. In addition, Coast Guard regulations require owners or operators of certain vessel types to have plans for

[12]*See* 40 C.F.R. pt. 300. EPA's responsibility for managing a response to an oil spill in the inland zone is outside the scope of this report.

[13]While EPA maintains the schedule of products that may be authorized for use, EPA regulations provide that the listing of a product on the schedule does not constitute approval of the product. 40 C.F.R. § 300.920(e).

[14]For the purpose of the National Contingency Plan, the coastal zone is defined as all U.S. waters subject to the tide, U.S. waters of the Great Lakes, specified ports and harbors on inland rivers, waters of the contiguous zone, other waters of the high seas subject to the National Contingency Plan, and the land surface or land substrata, ground waters, and ambient air proximal to those waters. The term coastal zone delineates an area of federal responsibility for response action. Precise boundaries are determined by EPA and Coast Guard agreements and identified in federal regional contingency plans. 40 C.F.R. § 300.5.

[15]40 C.F.R. § 300.120(a).

responding to an oil spill, and those response plans include dispersants as one of the response options.[16]

- **Interior.** Interior is responsible for establishing response requirements for offshore oil facilities. Interior regulations require owners or operators of offshore facilities to have oil spill response plans that identify procedures and assets on which the companies would rely to respond to an offshore spill.[17] Such plans are to include, among other things, a dispersant use plan. Interior is also the primary federal source of funds for oil spill research. The agency operates a wave tank research facility where researchers can conduct tests under some conditions that approximate those found in the ocean.[18]
- **NOAA.** NOAA supports Coast Guard decision makers during spills with scientific support, modeling, and other expertise. NOAA provides scientific support coordinators who advise a federal on-scene coordinator about the environmental effects and tradeoffs associated with different oil spill response options. A scientific support coordinator has access to NOAA scientists, such as oceanographers and biologists, who can provide additional scientific expertise and assistance, such as modeling the expected fate and trajectory of any spilled oil.
- **Interagency Committee.** The Interagency Coordinating Committee on Oil Pollution Research (Interagency Committee) develops priorities for oil spill research across the federal government. The Oil Pollution Act of 1990 established the Interagency Committee to coordinate a comprehensive program of oil pollution research, technology development, and demonstration among federal agencies in cooperation and coordination with external entities, such as industry, universities, research institutions, state governments, and other

[16]*See* 33 C.F.R. pt. 155. Owners or operators must identify in their vessel response plans the oil spill removal organizations that would conduct response activities, such as the use of dispersants. For more information on vessel response plans, see GAO, *Coast Guard: Improved Analysis of Vessel Response Plan Use Could Help Mitigate Marine Pollution Risk,* GAO-20-554 (Washington, D.C.: Sept. 29, 2020).

[17]See 30 C.F.R. pt. 254.

[18]Located in New Jersey, the National Oil Spill Response Research & Renewable Energy Test Facility is the largest outdoor saltwater wave tank facility in North America. The facility has capabilities for full-scale oil spill response equipment testing, research, and training in an ocean environment. Interior's Bureau of Safety and Environmental Enforcement operates the facility, which the federal government, industry, and other groups use to conduct research.

nations, as appropriate.[19] The Interagency Committee, which consists of 16 federal agencies and is chaired by a Coast Guard representative, develops the federal government's oil pollution research priorities on a 6-year cycle. It prepares biennial reports to Congress on research activities and key interagency committee activities. It also holds quarterly meetings during which agency representatives discuss research advances, and invited experts can brief the Interagency Committee on research or technological advances.

In May 2012, we reported on the use of dispersants and recommended that the Coast Guard direct the Interagency Committee to prioritize research into the use of dispersants in subsurface and Arctic conditions.[20] At the time, companies were proposing to drill offshore in Alaskan waters, and there were concerns about oil spill response under Arctic conditions and about limited response capabilities in remote areas. In 2015, the Interagency Committee addressed our recommendation when it identified this research as a priority in its research plan covering fiscal years 2015 to 2021.

Decision Makers for Oil Spill Response

The National Contingency Plan establishes several types of entities, including a National Response Team and Regional Response Teams that are responsible for preparing and planning for oil spills and releases of other hazardous substances. The National Response Team, chaired by an EPA representative and vice-chaired by a Coast Guard representative, is an interagency body that consists of representatives from 15 federal agencies and, among other things, provides guidance to Regional Response Teams.[21] Each Regional Response Team consists of representatives from the 15 federal agencies, as well as state, local, and tribal officials for each region. For the purposes of oil spill response, the U.S. is divided into 13 regions: the contiguous U.S. has 10 regions identified by numbers, and there are also regions for Alaska, Oceania, and the Caribbean. Each Regional Response Team develops a regional contingency plan that establishes procedures for preparing for and

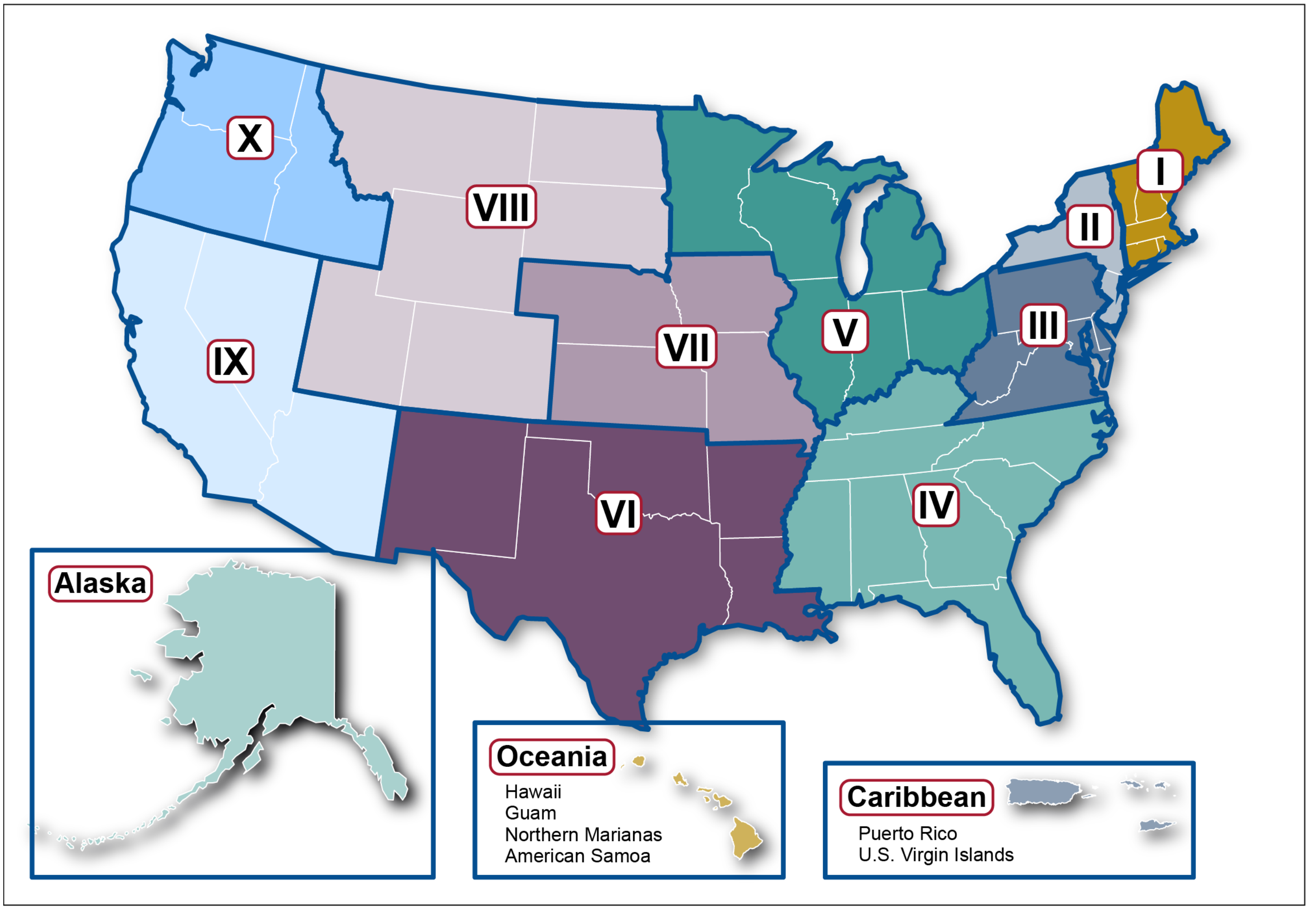
[19] Pub. L. No. 101-380, § 7001, 104 Stat. 484, 559 (codified as amended at 33 U.S.C. § 2761).

[20] GAO-12-585.

[21] According to Coast Guard officials, during a response operation in the coastal zone, such as during the Deepwater Horizon oil Spill, a Coast Guard representative chairs the National Response Team.

responding to oil spills in that region, including describing the process a federal on-scene coordinator follows to authorize dispersant use. Figure 2 shows Regional Response Team locations.[22]

Figure 2: Locations of Regional Response Teams for Oil Spills



Sources: GAO analysis of National Response Team information; Map Resources (map). | GAO-22-104153

[22]Some regions are broken into multiple areas, including coastal areas, which are led by area committees. For example, Regional Response Team VI, which includes coastal states on the western Gulf of Mexico, includes five separate coastal area committees. Each area committee, under the direction of the respective federal on-scene coordinator, develops a detailed area contingency plan that describes response capabilities and natural resources at risk in the area.

Under the National Contingency Plan, a federal on-scene coordinator may authorize the use of dispersants with the concurrence of the EPA representative and, as appropriate, of the Regional Response Team representatives from the relevant states, as well as in consultation with the Department of Commerce and Department of the Interior natural resource trustees, when practicable.[23] For certain situations, each Regional Response Team may prepare a preauthorization plan that authorizes a federal on-scene coordinator in that region to approve the use of dispersants—under circumstances detailed in the preauthorization plan—without obtaining specific concurrence from the Regional Response Team.[24] The details and procedures for a preauthorization plan vary by region; however, regional contingency plans generally preauthorize the use of dispersants for areas at least 3 nautical miles from shore with water depth of at least 10 meters, out to 200 nautical miles. Under the National Contingency Plan, a federal on-scene coordinator may authorize the use of any dispersant, without concurrence from the specified Regional Response Team members, when, in the judgement of the federal on-scene coordinator, the use of the dispersant is necessary to prevent or substantially reduce a hazard to human life.[25]

If dispersants are not preauthorized for a particular scenario, such as spills within 3 nautical miles from shore, as noted previously, the federal on-scene coordinator may authorize the use of dispersants with concurrence from some members of the Regional Response Team and in

[23] 40 C.F.R. § 300.910(b). The President is required to designate in the National Contingency Plan federal officials who are to act on behalf of the public as trustees for natural resources. Various heads of agencies are to be the designated trustees for specified categories of natural resources. For example, the Secretary of Interior is the trustee of natural resources managed or controlled by the Department of Interior, including migratory birds, endangered species, and marine mammals. Additionally, the Secretary of Commerce is the trustee for natural resources managed or controlled by other federal agencies that are found in, under, or using certain specified waters, including water navigable by deep draft vehicles. 40 C.F.R. § 300.600. Among other roles for such natural resource trustees under the National Contingency Plan, the federal on-scene coordinator is to consult with them on the appropriate removal action to be taken during an oil spill, and trustees are to provide timely advice concerning recommended actions with regard to trustee resources potentially affected. 40 C.F.R. § 300.305(e).

[24] 40 C.F.R. § 300.910(a).

[25] 40 C.F.R. § 300.910(d). However, the federal on-scene coordinator must inform the specified members of the Regional Response Team of this use as soon as possible, and once the threat to human life has subsided, the continued use of any chemical agent, such as a dispersant, must be in accordance with preauthorization plans or other provisions under the National Contingency Plan. According to EPA, this exception is to address life-threatening situations where there is insufficient time to obtain the needed concurrences and not to circumvent preauthorization plans or other authorizations.

consultation with certain other members. Although all Regional Response Teams have preauthorized the use of dispersants at the surface, no Regional Response Team has preauthorized the subsurface use of dispersants, according to Coast Guard officials. As a result, a federal on-scene coordinator would need to receive concurrence from the EPA representative and, as appropriate, state representatives from the Regional Response Team, and in consultation with natural resource trustees, when practicable, before authorizing the subsurface use of dispersants.

The Dispersant Decision-Making Process

Dispersant Decision-Making during a 2016 Spill

On May 12, 2016, a subsurface pipeline released an estimated 88,200 gallons of oil about 90 nautical miles off the Louisiana coast, resulting in a 3-nautical-mile-long surface slick, pictured below.

- Within 2 hours of being notified, the U.S. Coast Guard federal on-scene coordinator requested consultation with members of the Regional Response Team about the viability of using dispersants released from aircraft.
- Although the spill was in an area covered by a preauthorization plan, the coordinator sought out consultation with members of the Regional Response Team to determine whether there would likely be a net environmental benefit from using dispersants.
- After weighing factors associated with the incident, the coordinator chose not to use dispersants. Later overflight reports indicated the spill was larger than first reported, but the coordinator deemed that mechanical recovery by skimming vessels was adequate to mitigate the spill given the amount of oil, wave conditions, and around-the-clock skimming operations using ship-board infrared equipment.
- The representative from the National Oceanic and Atmospheric Administration said that if the situation were to change, such as if the surface slick were to become even larger, aerial dispersant use might provide a net environmental benefit.

Sources: GAO analysis of U.S. Coast Guard report; U.S. Coast Guard (photo). | GAO-22-104153

According to Coast Guard officials, before authorizing the use of dispersants, a federal on-scene coordinator would typically consult with stakeholders, including NOAA scientists and other experts, to discuss response options. These consultations would help the federal on-scene coordinator determine the relative benefits and potential adverse environmental effects resulting from a decision to use—or not to use—dispersants. For example, according to the after-action report for a 2016 oil spill in the Gulf of Mexico, consultations with members of the Regional Response Team helped the federal on-scene coordinator decide not to authorize the use of surface dispersants because other response options appeared adequate to mitigate the effects of the spill (see sidebar).

Oil spills inevitably have environmental effects, and response actions may reduce these effects or shift them. Any decision to use dispersants involves tradeoffs between decreasing risks to organisms at the water surface and in shoreline ecosystems, and increasing potential risks to organisms in the water column and on the ocean floor. In determining which response options are best for an individual spill, decision makers weigh the environmental risks and benefits with the goal of minimizing harmful effects as much as possible. When considering the use of chemical dispersants as a response option, the essential question is whether dispersing the oil into the water column offers more benefits (i.e., causes less harm) than leaving the oil on the surface if it cannot be adequately removed by mechanical means—the primary option—or burning. Decision makers collect as much information as possible to assess, for example, whether the potential harm to wetlands or waterfowl that could occur without dispersants is greater than the potential harm to ocean organisms from chemically dispersed oil entering the water column.

Surface Use of Dispersants Can Be Effective, but the Effectiveness of Subsurface Use Is Not Well Understood

Dispersants used at the surface of the ocean can be effective, under the appropriate conditions, at breaking up a surface oil slick into smaller droplets. However, the effectiveness of dispersants used in a subsurface environment is not well understood for several reasons. For example, responders were only able to measure subsurface dispersant effectiveness indirectly during the *Deepwater Horizon* oil spill, and there are limited experimental data on dispersant effectiveness that reflect deep ocean conditions.

Dispersant Use at the Surface Can Be Effective under the Appropriate Conditions

According to studies and reports we reviewed and stakeholders we interviewed, dispersants applied at the surface of the ocean can be effective, under the appropriate conditions, at breaking up a surface oil slick into smaller droplets that can mix into the water column. During some past oil spills, surface dispersant effectiveness has been tested and demonstrated through visual observation and through measurement of dispersed oil in the water column.[26] For example, according to Coast Guard after-action reports, surface application of dispersants by aircraft during the *Deepwater Horizon* oil spill was determined to be effective based on visual observation and water column measurements.

The effectiveness of dispersants on a surface oil slick has also been tested and demonstrated in laboratory, wave tank, and field experiments. For example, researchers have tested and demonstrated dispersant effectiveness under varying conditions at Interior’s large wave tank facility in New Jersey. The facility has a spray bar that simulates surface dispersant application via aircraft and boat (see fig. 3).

[26]For the purposes of this report, we use the terms “surface dispersant” and “subsurface dispersant” to identify the location that dispersants were applied, not to differentiate between types of dispersants.

Figure 3: Department of the Interior's Wave Tank Facility in New Jersey

Facility seen from the air.

Spray bar applying dispersant to oil in tank.

Sources: Department of the Interior (left photo); SL Ross Environmental Research Limited (right photo). | GAO-22-104153

Several factors influence the effectiveness of dispersants applied to a surface oil slick. One important factor is oil viscosity. Viscosity refers to the resistance of a liquid to flowing; for example, molasses has a higher viscosity than water. Dispersants are more effective when applied to light to medium crude oils, which have a lower viscosity, than when applied to heavy oils, which have a higher viscosity. Another important factor is the presence of energy from wind and breaking waves to mix the dispersed oil with the water. For example, in the 1989 *Exxon Valdez* oil spill in Alaska, responders initially attempted to use dispersants to minimize the spread of the surface oil slick; however, responders determined that dispersants were ineffective, and they discontinued using them, in part because there was insufficient wave action to provide mixing energy. By contrast, in the 1996 *Sea Empress* oil spill off the Welsh coast, high winds and waves enhanced the effectiveness of surface dispersant use and prevented at least 17.5 million gallons of oil from reaching the shoreline, according to studies.[27] Other factors that influence surface dispersant effectiveness include water salinity, water temperature, the chemical

[27]D. R. P. Leonard, R. J. Law, and C.A. Kelly, "Responding to the Sea Empress Oil Spill," *Marine Pollution, Proceedings of an international symposium* (1999); R. J. Law and C. Kelly, "The Impact of the *Sea Empress* Oil Spill," *Aquatic Living Resources* (2004).

composition of the dispersant, and the dispersant-to-oil ratio used during the response to the spill.

The timing of surface dispersant application also plays a role in its effectiveness. Oil composition during a spill changes over time as the oil interacts with the environment; this process is called weathering. The longer that oil weathers, the more it evaporates, and the more viscous—and less dispersible—the remaining oil becomes. This means that there is a relatively short window of opportunity for effectively treating the spilled oil.[28] Some researchers have recently found that sunlight, through a process called photo-oxidation, can weather oil more substantially and faster than previously understood, thereby reducing the effectiveness of dispersants. Their study reported that, for dispersants applied by aircraft during the *Deepwater Horizon* oil spill, sunlight may have reduced the effectiveness of the dispersants by about 30 percent.[29]

The Effectiveness of Subsurface Use of Dispersants Is Not Well Understood

The effectiveness of using dispersants on a subsurface spill is not well understood, according to studies we reviewed and stakeholders we interviewed. As previously noted, subsurface dispersants have been used only once, during the *Deepwater Horizon* oil spill. Stakeholders we interviewed disagreed on the effectiveness of subsurface dispersant use during that spill. Some stakeholders stated that the subsurface use of dispersants during the *Deepwater Horizon* oil spill effectively reduced the amount of oil that rose to the surface and lowered risks to response workers. In contrast, other stakeholders said that the conditions of the release enhanced the natural dispersion of the oil, making the subsurface use of dispersants unnecessary and ineffective. Several factors contribute to the lack of consensus about subsurface dispersant effectiveness.

Lack of Precedent for Assessing Subsurface Dispersant Effectiveness

Prior to the *Deepwater Horizon* oil spill, knowledge about the use and effectiveness of dispersants was largely based on surface use, and the concept of subsurface use had only been tested experimentally a few times in shallow water. At the time of the *Deepwater Horizon* oil spill, there were no past incidents that could provide lessons learned about the extent to which subsurface dispersant use might reduce oil droplet size and keep spilled oil from rising to the surface. Further, there was little

[28]According to Interior officials, oil has typically been on the water's surface between 12 and 24 hours prior to dispersant application, and, as a result, dispersants are typically applied to oil that has already lightly weathered.

[29]C. P. Ward et al., "Photochemical Oxidation of Oil Reduced the Effectiveness of Aerial Dispersants Applied in Response to the *Deepwater Horizon* Spill," *Environmental Science & Technology Letters,* vol. 5, no. 5 (2018).

information on how to collect data necessary for assessing subsurface dispersant effectiveness.

Limitations in Field Measurements

During the *Deepwater Horizon* oil spill, responders took various measurements in the water column to assess subsurface dispersant effectiveness, but those measurements did not provide conclusive evidence of effectiveness, according to studies. The measurements included oil droplet sizes, given that a reduction in oil droplet size is a key indicator of subsurface dispersant effectiveness.[30] However, during the *Deepwater Horizon* oil spill, scientists were unable to directly measure the actual sizes of oil droplets at the wellhead, with and without dispersants.

Measuring dispersant effectiveness during actual oil spills can be difficult because, according to a 2020 National Academy of Sciences review, the majority of responders' efforts during a spill focus on ensuring human safety, containing the oil, and minimizing damage to the environment.[31] This was true for the *Deepwater Horizon* oil spill, during which response activities had priority over monitoring. For example, scientists were not permitted within a 1-kilometer radius of the wellhead due to the higher priority of stopping the flow of the oil. As a result, scientists had to collect data more than 1 kilometer away from the wellhead. According to the federal government report on the fate of the *Deepwater Horizon* oil, scientists could not determine whether droplet sizes were reduced due to chemical dispersion or natural dispersion.[32] As a result, data collection was inconclusive regarding whether the subsurface use of dispersants was effective.

In addition to collecting data within the water column, the responders used aerial imagery and aerial photography of the surface slick to help assess the effectiveness of dispersants in reducing the amount of oil that rose to the surface. Responders took aerial images over various wavelengths in an attempt to estimate the relative thickness of the surface oil spill at specific times and determine the volume of the slick

[30]Measurements in the water column also included oil concentrations and oil fluorometry. Fluorometry refers to the detection of the presence of oil in the water column by measuring the light emitted when certain oil compounds are exposed to ultraviolent light, which helps indicate that the dispersant is having its desired effect.

[31]National Academies of Sciences, Engineering, and Medicine, *The Use of Dispersants in Marine Oil Spill Response*. (Washington, D.C.: The National Academies Press, 2020).

[32]The Federal Interagency Solutions Group, *Oil Budget Calculator*.

over time. However, according to the federal government report on the fate of the *Deepwater Horizon* oil, the imagery was inconclusive for evaluating dispersant effectiveness, in part because the technology used at the time could not accurately measure the thickness of the oil slick.[33] According to industry reports, aerial photography demonstrated that subsurface dispersant use reduced the amount of oil that rose to the surface. However, according to NOAA officials, although the photography appeared to demonstrate such a reduction, NOAA could not identify enough scientific data to support the conclusion.

In addition to trying to assess the amount of oil that rose to the surface, scientists measured the amount of potentially harmful gases, known as volatile organic compounds, released from the surface slick. During the spill, responders applied dispersants at the subsurface wellhead in part to reduce the amount of volatile organic compounds that could potentially harm workers operating on the ocean surface. However, according to a 2020 National Academy of Sciences review of dispersants, the data on volatile organic compounds did not support definitive conclusions about subsurface dispersant effectiveness because information was unavailable regarding the location of the vessels from which data were collected in relation to the wellhead, surface oil slick, and prevailing winds.[34] In addition, the tests performed were designed to inform immediate oil spill response, not validate the effectiveness of subsurface use of dispersants in reducing volatile organic compounds.

Although available data do not conclusively demonstrate the connection between dispersants and volatile organic compounds for the *Deepwater Horizon* oil spill, some responders concluded that subsurface use of dispersants protected worker health by lowering the concentration of volatile organic compounds at the surface, according to a national commission that investigated the *Deepwater Horizon* oil spill.[35]

Limited Data from Experiments that Reflect Deep Ocean Conditions

The conditions of a deep ocean spill can be complex, such as for a blowout—an uncontrolled, typically sudden, release of oil or gas from a subsurface wellhead. Reproducing those conditions in laboratory experiments is challenging. To assess the extent to which the subsurface

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[33]The Federal Interagency Solutions Group, *Oil Budget Calculator*.

[34]National Academy of Sciences, *The Use of Dispersants in Marine Oil Spill Response*.

[35]National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling, *Deep Water: The Gulf Oil Disaster and the Future of Offshore Drilling* (Washington, D.C.: January 2011).

use of dispersants reduces oil droplet sizes during a subsurface spill, scientists need to know how big oil droplets are prior to dispersant application. Scientists also need information on conditions around the wellhead because those conditions may influence how the droplets and dispersants behave.

The *Deepwater Horizon* oil spill started as a blowout. During that spill, the conditions that may have influenced the size of the oil droplets escaping through the wellhead—and that are challenging to reproduce in the laboratory—included

- the presence of natural gas, mixed with the oil;
- the high rate at which the oil flowed out of the subsurface wellhead;
- the high pressure and high temperature of the released oil and gas in the deep ocean;
- the high pressure and low temperature of the deep ocean water into which the oil and gas were being released; and
- the size, number, and configuration of the orifices through which oil and gas were being released.

Laboratory facilities in various countries have conducted experiments to assess the effectiveness of subsurface dispersant use in reducing oil droplet size; however, according to the 2020 National Academy of Sciences review, even the largest laboratory facilities are typically at least 100 times smaller than the environment in which an actual oil spill occurs. For example, laboratory facilities typically use pipe sizes that are much smaller than the 18-inch pipe through which oil flowed out of the wellhead during the *Deepwater Horizon* oil spill. One researcher we interviewed explained that if scientists used an 18-inch pipe in their laboratory experiments, the oil would rapidly fill up a testing pool. Instead, scientists use smaller pipe sizes and scale up the experiment results, but this may not reflect ocean conditions. Thus, the information gained from laboratory experiments has limited applicability to real-world deep ocean spills, according to studies.

Conducting experiments in the field is another way to gain information on the effectiveness of dispersants. There has been one field experiment in which oil was intentionally released in the deep ocean—the DeepSpill experiment, which industry and Interior conducted in 2000, off the Norwegian coast. However, the DeepSpill experiment did not involve dispersants. Further, DeepSpill was conducted at a lesser depth than the

Deepwater Horizon spill (844 meters versus more than 1,500 meters), without natural gas mixed in the oil, and under lower pressure than the *Deepwater Horizon* spill. As of the time of our review, no field experiments have been conducted on the effectiveness of dispersant use in the deep ocean, according to studies we reviewed and stakeholders we interviewed.

According to stakeholders we interviewed, a field experiment would be helpful in understanding subsurface dispersant effectiveness. However, conducting such experiments presents challenges. For example, while field experiments may allow testing under more realistic conditions than in a laboratory, field experiments can be difficult to control or replicate. In addition, it is costly to set up a controlled experiment in the deep ocean, and there are environmental concerns associated with releasing oil into the environment.

Under EPA regulations implementing the Clean Water Act, some discharges of oil in U.S. waters, including certain discharges for research purposes, may be permitted.[36] Such discharges may still need to comply with other applicable federal, state, and local requirements.[37] Although EPA can permit such discharges under the Clean Water Act, the agency does not currently have a guidance document addressing the issuance of such permits, according to EPA officials, and has no plans to issue one. EPA officials noted that while such permits have been discussed in the past, EPA has not received any permit requests in at least the past 20 years.

Variation in Modeling Results

Computer models have been developed to assess the effectiveness of the subsurface use of dispersants, both for hypothetical deep ocean spills and specifically for the *Deepwater Horizon* oil spill. These models use both measured and hypothesized conditions to predict how spilled oil, dispersants, and chemically dispersed oil will behave in the environment.

[36]Specifically, EPA regulations provide that the Administrator has not determined certain discharges of oil "as may be harmful" for purposes of section 311(b)(3) of the act, including any discharge of oil explicitly permitted by the Administrator in connection with research, demonstration projects, or studies relating to the prevention, control, or abatement of oil pollution. 40 C.F.R. § 110.5(c). Section 311(b)(3) of the Clean Water Act prohibits the discharge of oil into U.S. waters in such quantities as may be harmful as determined by the President. 33 U.S.C. § 1321(b)(3).

[37]For example, such discharges may still need to comply with other federal and state permitting requirements, including those for any discharge of a pollutant to waters of the U.S. under the National Pollutant Discharge Elimination System Program, according to EPA officials.

The results of modeling depend in part on the quality of data that go into the model. However, as noted above, there are limited laboratory and field data that reflect deep ocean conditions. As a result, modelers have limited data to inform their models, and modelers employ varying assumptions regarding the physical and chemical conditions present during a spill. Therefore, these models have generated widely varying results about how effective subsurface dispersant use is in keeping oil from surfacing.

For example, a 2015 modeling study of a hypothetical subsurface spill predicted that subsurface use of dispersants would generally increase the area over which the oil surfaces—thereby reducing the thickness of the slick—and in some cases, would reduce the amount of oil that surfaces by over 88 percent.[38] In contrast, another modeling study specifically examining the *Deepwater Horizon* oil spill estimated that subsurface use of dispersants reduced the amount of oil that surfaced by 1 to 2 percent during the spill.[39] This model assumed that the oil droplets coming out of the wellhead were already very small because of the highly turbulent conditions of the release, thereby rendering ineffective the subsurface use of dispersants.[40] A different model of the *Deepwater Horizon* oil spill estimated that subsurface use of dispersants reduced surface oil by 9 percent during the spill.[41]

Models developed to assess the effectiveness of subsurface use of dispersants in reducing volatile organic compounds have also generated varying results. For example, one modeling study, which simulated a hypothetical deep ocean oil spill in the Gulf of Mexico, found that subsurface use of dispersants could reduce emissions of volatile organic

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[38]S. A. Socolofsky et al., “Intercomparison of Oil Spill Prediction Models for Accidental Blowout Scenarios with and without Subsea Chemical Dispersant Injection,” *Marine Pollution Bulletin*, vol. 96, no. 1-2 (2015).

[39]C. B. Paris et al., “Evolution of the Macondo Well Blowout: Simulating the Effects of the Circulation and Synthetic Dispersants on the Subsea Oil Transport,” *Environmental Science & Technology*, vol. 46, no. 24 (2012).

[40]C. B. Paris et al., “BP Gulf Science Data Reveals Ineffectual Subsea Dispersant Injection for the Macondo Blowout,” *Frontiers in Marine Science*, vol. 5, no. 389 (2018).

[41]D. P. French-McCay et al., “Oil Fate and Mass Balance for the *Deepwater Horizon* Oil Spill,” *Marine Pollution Bulletin*, vol. 171 (2021).

compounds, from an oil slick to the air, by more than 45 percent.[42] A modeling study of the *Deepwater Horizon* oil spill that used weather observations from a single day found that subsurface use of dispersants resulted in a 28 percent reduction in emissions of volatile organic compounds to the atmosphere.[43]

Chemically Dispersed Oil Can Be Toxic to Some Ocean Organisms, but Broader Environmental Effects Are Not Well Understood

According to studies we reviewed and stakeholders we interviewed, chemically dispersed oil is known to have toxic effects on marine plankton, corals, and ocean organisms in early life stages. However, multiple factors limit a comprehensive understanding of the broader effects of chemically dispersed oil on the environment. These factors include inconsistencies in the design of toxicity and biodegradation experiments, conflicting results of these experiments, and limited information on organisms and natural processes in the deep ocean.

Chemically Dispersed Oil Can Be Toxic to Some Ocean Organisms

Studies report, and stakeholders we interviewed stated, that modern dispersant formulations by themselves have low toxicity and are significantly less toxic to ocean organisms than oil. Studies also report that these dispersant formulations have been developed specifically to minimize toxicity on the environment and do not increase the inherent toxicity of oil. However, dispersants may increase the extent to which organisms are exposed to the toxic compounds in oil.

Oil is a complex chemical mixture with thousands of components, some of which can be highly toxic to ocean organisms. Because dispersants break oil into smaller droplets that spread over a larger volume in the water column, a larger number of organisms within the water column may be at increased risk of exposure to toxic oil components. Chemically dispersing oil can lead to lethal and sublethal toxicity for some species of ocean organisms within the water column, according to studies we reviewed. Lethal toxicity occurs when exposure to a chemical results in

[42]D. Crowley et al., “Modeling Atmospheric Volatile Organic Compound Concentrations Resulting from a Deepwater Oil Well Blowout – Mitigation by Subsea Dispersant Injection,” *Marine Pollution Bulletin*, vol. 136 (2018).

[43]J. Gros et al., “Petroleum Dynamics in the Sea and Influence of Subsea Dispersant Injection during *Deepwater Horizon*,” *Proceedings of the National Academy of Sciences*, vol. 114, no. 38 (2017).

observable death for an exposed organism. Sublethal toxicity occurs when exposure does not result directly in observable death for an organism but reduces its overall health, which may in turn shorten life expectancy.[44]

According to studies, the toxicity of chemically dispersed oil varies based on several factors. These factors include the exposure pathway, such as exposure through inhalation, ingestion, or external contact; the concentration of dispersed oil; the sensitivity of the organism to the oil; the inherent toxicity of the oil, dispersant, and dispersed oil to the organism; and the duration of the exposure. Some studies and stakeholders characterized ocean organisms' exposure to chemically dispersed oil as being short-term in nature given that it is expected to dilute rapidly in the ocean. However, a U.S. government assessment of the environmental damage caused by the *Deepwater Horizon* oil spill reported that, after conducting hundreds of toxicity tests, government officials concluded that even short-term exposure to dispersed oil can have harmful effects to certain ocean species and life stages.[45]

According to studies, some species that can be harmed by chemically dispersed oil include

- **Marine plankton.** Marine plankton are a diverse set of organisms that include bacteria, algae, and animals known as zooplankton. Marine zooplankton, such as copepods, that ingest oil droplets experience more lethal and sublethal effects from chemically dispersed oil than from untreated oil. Copepods are among the most numerous animals in the ocean and are key components of the marine food web.
- **Corals.** Evidence from field studies of deep ocean corals in the vicinity of the *Deepwater Horizon* oil spill suggests that these corals were damaged by chemically dispersed oil and that the damage persisted for several years after the spill occurred. For example, a field study of the area around the *Deepwater Horizon* oil spill found

[44]For example, organisms whose health is reduced by sublethal toxicity may (1) have more difficulty finding prey or avoiding predators, (2) exhibit greater susceptibility to disease, (3) demonstrate a reduced ability to tolerate natural stresses, or (4) have more difficulties reproducing.

[45]Deepwater Horizon Natural Resource Damage Assessment Trustees, *Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement*, Chapter 8 -Trustee Responses to Public Comment (2016).

that almost half of nearby deep ocean coral communities were mostly covered in an aggregate of oil, organic compounds, and inorganic compounds—referred to as marine oil snow[46]—that had settled to the ocean floor.[47] Another study reported that some of the marine oil snow coating the corals contained a component of the main dispersant used during the *Deepwater Horizon* oil spill, and the oil in the marine oil snow was traced to the subsurface well.[48] Corals that were covered with marine oil snow showed evidence of stress and mortality, and negative effects persisted for at least 7 years.[49] One study estimated that although most coral colonies that survived the spill would recover within a decade, it would likely take hundreds of years for their communities to partially recover to their pre-spill biomass.[50] In addition, a long-term field study of shallow-water corals found that chemically dispersing oil led to higher concentrations of oil that were more harmful to the corals than oil slicks that had not been treated with dispersants, although the damage did not persist after 10 years.[51]

- **Early life stages of ocean organisms.** The early life stages of some ocean organisms, such as fish and corals, are generally more sensitive to chemically dispersed oil than are adults of the same species. This sensitivity to chemically dispersed oil can lead to lethal

[46]Marine snow refers to aggregates of particles from plankton, microbes, minerals, and organic waste. When marine snow interacts with oil in the water column, it can combine with the oil to become marine oil snow, which can further aggregate and sink to the ocean floor.

[47]H. K. White et al., "Impact of the *Deepwater Horizon* Oil Spill on a Deep-water Coral Community in the Gulf of Mexico," *Proceedings of the National Academy of Sciences*, vol. 109, no. 50 (2012).

[48]H. K. White et al., "Long-term Persistence of Dispersants Following the *Deepwater Horizon* Oil Spill," *Environmental Science and Technology Letters*, vol. 1, no. 7 (2014).

[49]F. Girard and C. R. Fisher, "Long-term Impact of the *Deepwater Horizon* Oil Spill on Deep-sea Corals Detected after Seven Years of Monitoring," *Biological Conservation*, vol. 225 (2018).

[50]F. Girard et al., "Projecting the Recovery of a Long-lived Deep-sea Coral Species after the *Deepwater Horizon* Oil Spill Using State-structured Models," *Journal of Applied Ecology*, vol. 55, no. 4 (2018).

[51]T. G. Ballou and S. C. Hess, "Effects of Untreated and Chemically Dispersed Oil on Tropical Marine Communities: A Long-term Field Experiment," *International Oil Spill Conference Proceedings*, vol. 1 (1989); and G. A. Ward et al., "Continuing Long-term Studies of the Tropics Panama Oil and Dispersed Oil Spill Sites," *International Oil Spill Conference Proceedings*, vol. 2003, no. 1 (2003).

and sublethal effects, according to studies. For example, one experiment tested the effects of chemically dispersed oil on Atlantic herring embryos using conditions present during actual oil spills. These conditions included short-term exposure and concentrations of oil measured during actual oil spills. This study found exposure of the fish embryos to chemically dispersed oil caused disease and reduced the percentage of normal embryos that hatched from eggs.[52]

Understanding of the Broader Effects of Chemically Dispersed Oil on the Environment Is Limited by Several Factors

Although chemically dispersed oil is known to be toxic to some ocean organisms, several factors limit comprehensive understanding of its other potentially harmful effects on the environment. These factors include laboratory experiments that use inconsistent test designs and yield conflicting results across experiments, laboratory experiments that do not reflect ocean conditions, and limited information on organisms and natural processes in the deep ocean.

Toxicity Experiments Use Inconsistent Test Designs and Yield Conflicting Results

Laboratory experiments on the toxicity of chemically dispersed oil have used a variety of test designs across experiments, according to studies we reviewed and stakeholders we interviewed. Studies have reported that scientists have not adhered to standard methods for conducting oil toxicity experiments, which has resulted in inconsistent test designs. From 1994 to 2000, a multi-stakeholder forum, known as the Chemical Response to Oil Spills: Ecological Effects Research Forum (CROSERF), developed protocols for assessing the toxicity of dispersants, oil, and chemically dispersed oil, which were then published in 2000 and 2001.[53]

The CROSERF protocols recommend standard methods for preparing and characterizing test solutions, exposing ocean organisms to the oil and dispersants, and reporting test conditions. However, scientists have not consistently applied the protocols when conducting toxicity experiments. For example, according to one review of toxicity studies,

[52]C. D. Greer et al., “Toxicity of Crude Oil Chemically Dispersed in a Wave Tank to Embryos of Atlantic Herring (*Clupea Harengus*),” *Environmental Toxicology and Chemistry*, vol. 31, no. 6 (2012).

[53]M. M. Singer et al., “Standardization of the Preparation and Quantitation of Water-accommodated Fractions of Petroleum for Toxicity Testing,” *Marine Pollution Bulletin*, vol. 40, no. 11 (2000); and M.M Singer et al., “Making, Measuring, and Using Water-Accommodated Fractions of Petroleum for Toxicity Testing,” *International Oil Spill Conference Proceedings*, vol. 2001, no. 2 (2001). The CROSERF forum consisted of U.S. universities, industry, consultants, U.S. federal and state agencies, and international organizations.

only seven of 144 toxicity studies reported the full list of oil components on which the protocols recommend reporting.[54] Reasons cited for the inconsistent application of the protocols include the high cost and difficulty of conducting experiments on the large scale called for by the protocols. Since the publication of the CROSERF protocols, several researchers have proposed modifications to them. However, the protocols have not been updated to reflect such proposals.

Inconsistent testing has yielded conflicting results regarding the extent to which chemically dispersed oil is more or less toxic to ocean organisms than naturally dispersed oil. For example, scientists use inconsistent methods of characterizing the oil concentrations they use in their toxicity experiments, which has yielded conflicting findings about toxicity. Scientists characterize the concentrations by either measuring them or estimating them. A review paper examining the results of studies that compared the toxicity of oil that was chemically dispersed to oil that was naturally dispersed noted that the reported toxicity of chemically dispersed oil varied based on the test method used. Specifically, the review reported that 22 percent of the studies that measured the oil concentrations found chemically dispersed oil to be more toxic than naturally dispersed oil. However, of studies that estimated (rather than measured) the oil concentrations, 93 percent found chemically dispersed oil to be more toxic than naturally dispersed oil.[55] The lack of consistency in the toxicity experiments makes it difficult to compare the findings from these experiments and derive overall conclusions.

Biodegradation Experiments Use Inconsistent Test Designs and Yield Conflicting Results

Like tests designs for toxicity experiments, test designs for biodegradation experiments have been inconsistent, according to studies and stakeholders. For example, scientists have used different oil concentrations and dispersant-to-oil ratios when testing the biodegradation of chemically dispersed oil. Whereas standard protocols have been developed for toxicity experiments, there are no such protocols for testing the biodegradation of chemically dispersed oil.

[54] J. Adams et al., “Review of Methods for Measuring the Toxicity to Aquatic Organisms of the Water Accommodated Fraction (WAF) and Chemically-Enhanced Water Accommodated Fraction (CEWAF) of Petroleum,” *Fisheries and Oceans Canada, Canadian Science Advisory Secretariat* (2017). CROSERF protocols recommend that researchers report on three groups of oil components identified in the tested oil.

[55] A. C. Bejarano, “Issues and Challenges with Oil Toxicity Data and Implications for their Use in Decision-Making: A Quantitative Review,” *Environmental Toxicology and Chemistry*, vol. 33, no. 4 (2014). These figures apply to the studies of the toxicity of the primary dispersant used during the *Deepwater Horizon* oil spill.

Studies have recommended development of standard protocols for conducting biodegradation studies.

Dispersants are generally thought to promote biodegradation of oil; however, laboratory experiments that measure the rate of biodegradation of chemically dispersed oil have yielded conflicting results. Some studies have found that dispersants can increase the rate of biodegradation, others have found that dispersants can decrease the rate, and other studies have found dispersants had no effect.

Studies have reported that a wide range of factors can affect the biodegradation of chemically dispersed oil. These factors include the presence of oxygen and nutrients available for microbial growth, the initial population of microbes present, temperature, pressure, and the composition of the spilled oil. Biodegradation experiments have been inconsistent in the extent to which they take into account the variety of factors that can affect biodegradation. The lack of standardization in biodegradation experiments makes it difficult to compare the findings from these experiments and derive overall conclusions regarding the extent to which dispersants facilitate the removal of toxic compounds from the spilled oil.

Some Laboratory Experiments Do Not Reflect the Ocean Environment

Some laboratory experiments do not test toxicity or biodegradation under conditions that reflect the ocean environment, thereby limiting their applicability to real-world scenarios, according to studies. Studies report that the mixing, currents, and tides of the ocean result in organisms being exposed to chemically dispersed oil in concentrations that decrease rapidly over time. However, studies report that some toxicity experiments maintain constant concentrations of chemically dispersed oil, thereby potentially overestimating how toxic the chemically dispersed oil is to ocean organisms.

Similarly, some biodegradation experiments use higher concentrations of chemically dispersed oil—in some cases at least 10 times higher—than what can be expected to occur if dilution was considered. Thus, such biodegradation experiments may not provide reliable results about the rate at which microbes consume the oil during an actual spill. According to EPA, some variability in the amount of oil concentrations is acceptable and necessary to understand a range of environmental conditions. For example, EPA officials reported that the starting oil concentrations for biodegradation experiments need to be higher than would occur in the ocean in order to have detectable amounts of oil for enough observations over time to establish biodegradation rates. Studies have also reported that some biodegradation experiments do not take into account the distribution of nutrients in the ocean. Nutrient concentrations vary significantly with depth and proximity to shore, and experiments that do not take this variation into account may not reflect actual conditions of the ocean environment.

Information on Deep Ocean Organisms and Processes Is Limited

There is limited information available about several aspects of deep ocean ecosystems, including about organisms that live in the deep ocean and about some natural processes that could affect the exposure of those organisms to toxic components in oil. Regarding organisms that live in the deep ocean, studies have reported that the lack of pre-spill, baseline information on what types of organisms inhabit the deep ocean, their number, and their location impeded assessment of the effects of the *Deepwater Horizon* oil spill on deep ocean organisms. In addition, according to studies, there is limited information on the sensitivity of many deep ocean organisms to chemically dispersed oil. The National Academy of Sciences 2020 review noted that it is difficult to assess the sensitivity of deep ocean organisms in a laboratory because they require special conditions—such as high pressure, low temperatures, and darkness—that are difficult to reproduce in a laboratory.[56] Without knowing what organisms live in the deep ocean and their sensitivity to chemically dispersed oil, it is hard to determine the effects of subsurface use of dispersant on deep ocean ecosystems.

Regarding natural processes, one process that is not well understood, according to studies and agency officials, is the extent to which deep ocean organisms exposed to chemically dispersed oil could affect other ocean ecosystems. Studies noted that many deep ocean organisms that consume dispersed oil migrate daily from the deep ocean to shallow waters, where they can be consumed by predators. Such a migration may provide a vertical pathway through which chemically dispersed oil from the deep ocean moves into the rest of the marine food web. However, there is little information available on whether this process does facilitate the movement of chemically dispersed oil.

Another process that is not well understood is the role of dispersants in the formation and settling of marine oil snow, which may expose deep ocean organisms to the toxic components in oil. Studies have reported that marine oil snow can transport a significant amount of oil and its toxic

[56]National Academy of Sciences, *The Use of Dispersants in Marine Oil Spill Response*.

components to the deep ocean, thereby potentially causing harm to deep ocean organisms. According to a review, during the *Deepwater Horizon* oil spill, up to 14 percent of the oil released was associated with marine oil snow that was deposited on the ocean floor.[57] However, it is unclear whether chemically dispersing oil increases or decreases the formation and settling of marine oil snow. One review noted that multiple factors influence how dispersants can affect marine oil snow, resulting in confusing interactions.[58] For example, one study found that while dispersants can decrease the formation of marine oil snow, they can also increase the rate at which marine oil snow sinks to the ocean floor.[59]

There is also limited understanding about the rate at which oil biodegrades in the deep ocean, which makes it challenging to know how long the toxic components in chemically dispersed oil would remain in the ocean. One study of the *Deepwater Horizon* oil spill found that oil biodegraded at a slower rate in the deep ocean than initially estimated.[60] Reviews have further reported that few studies have examined the effect of dispersants on biodegradation under deep ocean conditions, such as high pressure. According to the National Academy of Sciences 2020 review, the potential for high pressure to inhibit biodegradation of oil in the deep ocean has been overlooked.

Dispersant Use Has Been Associated with Some Short-term Adverse Effects on Human Health

The use of dispersants has been associated with some short-term adverse effects on the health of response workers following the *Deepwater Horizon* oil spill. During the spill, some response workers reported personally handling, applying, and coming into contact with dispersants.

In 2012, we reported on a Health Hazard Evaluation conducted by the Centers for Disease Control and Prevention that reviewed potential exposure of *Deepwater Horizon* response workers who had the highest

57 J. Ross et al., "Integrating Marine Oil Snow and MOSSFA into Oil Spill Response and Damage Assessment," *Marine Pollution Bulletin*, vol. 165 (2021).

58 A. B. Burd et al., "The Science Behind Marine-oil Snow and MOSSFA: Past, Present, and Future," *Progress in Oceanography, vol. 187* (2020).

59 U. Passow et al., "How the Dispersant Corexit Impacts the Formation of Sinking Marine Oil Snow," *Marine Pollution Bulletin*, vol. 125, no. 1-2 (2017).

60 S. C. Bagby et al., "Persistence and Biodegradation of Oil at the Ocean Floor Following *Deepwater Horizon*," *Proceedings of the National Academy of Sciences*, vol. 114, no. 1 (2016).

risk of exposure to dispersants.[61] The evaluation found no evidence that workers were exposed to dispersants at potentially harmful levels. However, the evaluation was limited to potential exposure of a small subset of the entire response workforce during a few specific times and at specific sites.

The potential health effects of dispersant use during oil spills were not subject to epidemiological investigation until the 2010 *Deepwater Horizon* oil spill.[62] Two epidemiological studies of the response workers were conducted after the spill. These studies suggested that dispersant use was associated with some acute adverse effects on human health, particularly respiratory issues, such as coughing. The National Institutes of Health conducted one of the studies, which is the largest to date examining the effects of oil spill response on workers exposed to oil and dispersants.[63] The study reported that dispersant use was associated with eye and skin irritation, in addition to respiratory issues. Further, the study reported that, among those who reported symptoms, except for burning eyes, the symptoms did not persist 1 to 3 years after the spill. The other study, examining the effects on Coast Guard oil spill responders, corroborated the findings of the National Institutes of Health study.[64] Both studies were large-scale and systematic evaluations that followed a defined population over time.

However, the National Academy of Sciences' 2020 review reported that various challenges associated with these human health studies complicate interpretation of the findings. For example, the review reported that researchers found it challenging to determine the extent to which a response worker may have been exposed to dispersants and the duration of the exposure. Studies reported that there are no biological markers for identifying whether a human has been exposed to dispersants or

[61]B. S. King and J. D. Gibbons, "Health Hazard Evaluation of Deepwater Horizon Response Workers," HETA 2010-0115 and 2010-0129-3138 (2011). The study was conducted by the National Institute for Occupational Safety and Health, which is part of the Centers for Disease Control and Prevention.

[62]Epidemiology is the study of the causes of health outcomes and diseases in human populations.

[63]C. J. McGowan et al., "Respiratory, Dermal, and Eye Irritation Symptoms Associated with Corexit™ EC9527A/EC9500A following the *Deepwater Horizon* Oil Spill: Findings from the GuLF STUDY," *Environmental Health Perspectives*, vol. 125, no. 9 (2017).

[64]M. Alexander et al., "The Deepwater Horizon Oil Spill Coast Guard Cohort Study: A Cross-sectional Study of Acute Respiratory Health Symptoms, *Environmental Research*, vol. 162 (2018).

chemically dispersed oil. According to studies and Health and Human Services officials, another challenge associated with research in this area is differentiating between the effects from oil, from dispersants, and from chemically dispersed oil. This differentiation is difficult because exposure to oil may also cause respiratory issues, eye irritation, and skin irritation. These challenges make it difficult to identify the cause of the reported effects of dispersant use.

Further, it is difficult to determine the effects of dispersants on human health in a laboratory setting because of ethical concerns associated with deliberately exposing humans to a potential hazard. While epidemiological study of human health effects of dispersant use during the *Deepwater Horizon* oil spill is ongoing, additional epidemiological study into human health effects cannot occur until the next oil spill in which dispersants are used.

Agencies Have Taken Some Actions to Help Support Decisions About Using Dispersants, but Information for Considering Environmental Tradeoffs Is Limited

The Coast Guard, EPA, and other agencies have taken some actions to improve the quality of information available to officials making decisions about how to respond to oil spills, but information that could help with considering the environmental tradeoffs of using dispersants is limited. The National Response Team, led by EPA and the Coast Guard, has developed guidance for monitoring the subsurface use of dispersants, and it plans to update guidance for monitoring the surface use of dispersants as well. EPA has issued new regulations for monitoring dispersant use and has proposed amendments to existing regulations on testing dispersant effectiveness and toxicity. In addition, the Coast Guard and EPA have assessed the environmental effects of the surface use of dispersants; however, they have not examined the effects of subsurface use. Finally, the Coast Guard, EPA, NOAA, and other agencies have taken other actions to support oil spill response decision-making since the *Deepwater Horizon* spill, such as supporting research on dispersants, but there is limited quality information about some aspects of dispersant use.

Agencies Have Taken Actions to Improve Monitoring of the Subsurface Use of Dispersants and Plan to Update Guidance for Monitoring the Surface Use of Dispersants

The Coast Guard and EPA took action following the *Deepwater Horizon* oil spill to help ensure federal on-scene coordinators and others making decisions in response to oil spills have quality information about the effectiveness and effects of the subsurface use of dispersants. Specifically, the Coast Guard and EPA took the following actions to improve monitoring when dispersants are used:

- **Developed new monitoring guidance**. In 2013, the National Response Team, led by the Coast Guard and EPA, issued new guidance for agency responders to monitor dispersants used (1) in a subsurface environment and (2) in any environment for longer than 96 hours.[65] Following the *Deepwater Horizon* oil spill, the Coast Guard's final incident report on the spill identified a need for a rigorous monitoring program if dispersants were to be used again in a subsurface environment.[66] The National Response Team developed the 2013 guidance to provide such a monitoring program and to support Regional Response Team planning and decision-making about the use of dispersants. The guidance recommends that the federal on-scene coordinator and other decision makers consider key indicators, obtained through monitoring, to help determine whether responders should begin using dispersants on a spill and whether they should continue to use dispersants once started. The guidance calls for responders to gather data on the size of oil droplets as a measure of the effectiveness of the subsurface dispersants. The guidance also calls for responders to sample the water to assess the potential toxicity of chemically dispersed oil to ocean organisms and to measure dissolved oxygen as an indicator of potential injury to the ocean ecosystem.

- **Issued new monitoring regulations**. In 2015, EPA issued a proposal for new and amended National Contingency Plan regulations that would detail requirements for dispersant planning and use.[67] As part of this effort, EPA proposed new requirements for the party responsible for a spill to monitor any subsurface use of dispersants, surface use of dispersants in response to an oil discharge of more than 100,000 gallons occurring within a 24-hour period, or surface use of dispersants for more than 96 hours. According to EPA officials we interviewed, the National Response Team's 2013 monitoring guidance and lessons learned from the *Deepwater Horizon* oil spill informed EPA's decision to propose these new regulations. In July 2021, EPA

[65]National Response Team, *Environmental Monitoring for Atypical Dispersant Operations* (May 30, 2013). Industry has also developed its own guidance for subsurface monitoring. American Petroleum Institute, *Industry Recommended Subsea Dispersant Monitoring Plan: API Technical Report 1152*, 2nd ed. (November 2020).

[66]U.S. Coast Guard, *BP Deepwater Horizon Oil Spill: Incident Specific Preparedness Review Final Report* (January 2011).

[67]National Oil and Hazardous Substances Pollution Contingency Plan, Proposed Rule, 80 Fed. Reg. 3380 (Jan. 22, 2015). The proposal included both new monitoring requirements and amendments to existing requirements for the testing of dispersant effectiveness and toxicity.

finalized the monitoring regulations.[68] The newly finalized regulations require some of the actions identified in the monitoring guidance, such as assessing the size of oil droplets and assessing potential toxicity of chemically dispersed oil to ocean organisms.

Although the Coast Guard and EPA have taken actions to improve guidance on subsurface monitoring, the guidance that responders rely on for monitoring the use of dispersants at the surface has not been updated by the National Response Team since 2006. This monitoring guidance, known as the Special Monitoring of Applied Response Technologies (SMART) protocols, details how responders are to use observations of surface slicks and analysis of water and oil samples collected within the upper 10 meters of the water column to assess the effectiveness of dispersants used at the surface.[69] According to the 2018 Coast Guard manual for marine environmental response, federal on-scene coordinators are to follow SMART protocols while using dispersants at the surface.

According to agency documents and stakeholders we interviewed, the SMART protocols should be updated. For example, in 2011, the Coast Guard's final incident report for the *Deepwater Horizon* oil spill recommended that the Coast Guard engage with EPA and NOAA to enhance SMART protocols. In addition, stakeholders we interviewed, including researchers and officials from the Coast Guard and NOAA, said that the protocols should be updated to reflect technological advances and lessons learned from the *Deepwater Horizon* oil spill. Such technological advances could include the use of remote sensors and remotely operated vehicles to provide improved information on dispersant effectiveness at the surface.

Because the SMART protocols have not incorporated new technologies and lessons learned from the *Deepwater Horizon* oil spill, there is less assurance that the federal on-scene coordinator and other decision makers will have quality information about dispersant effectiveness when considering whether to authorize or continue dispersant use. In March

[68]National Oil and Hazardous Substances Pollution Contingency Plan, Monitoring Requirements for Use of Dispersants and Other Chemicals, Final Rule, 86 Fed. Reg. 40,234, 40,263 (July 27, 2021) (to be codified at 40 C.F.R. § 300.913).

[69]U.S. Coast Guard, National Oceanic and Atmospheric Administration and the Environmental Protection Agency, *Special Monitoring of Applied Response Technologies* (Aug. 2006).

2021, the National Response Team established a working group to update the protocols, including to incorporate technological advances. According to a NOAA official, as of June 2021, working group participants from the Coast Guard, NOAA, EPA, Interior, and several states had met three times to discuss updating the protocols.

EPA Has Proposed Amendments to Its Regulations to Improve Testing of Dispersant Effectiveness and Toxicity

In 2015—as part of its regulatory proposal on dispersants described above—EPA proposed amending National Contingency Plan regulations that specifically describe the testing of dispersants and the criteria that dispersants must meet to be authorized for use in U.S. waters. As noted previously, EPA maintains a list of dispersants that may be authorized for use, known as the Product Schedule.[70] Under current regulations, dispersants must be tested to demonstrate they meet certain effectiveness thresholds to be included on the Product Schedule. In addition, current regulations require some toxicity testing of dispersants and chemically dispersed oil, but those regulations do not set toxicity thresholds for a dispersant to be included on the Product Schedule.

The amendments EPA proposed in 2015 would specify new testing protocols for dispersant effectiveness. For example, accredited laboratories that conduct the tests would be required to use a new specialized container that is designed to better assess effectiveness. Under the proposal, laboratories would also be required to test dispersant effectiveness under a wider set of conditions, including with multiple types of oil under different temperatures. In addition, the proposed amendments would require new testing for toxicity and would establish toxicity thresholds that a dispersant must meet to be included on the Product Schedule. EPA officials said that they developed these proposed changes based on research the agency had conducted and on lessons learned from the *Deepwater Horizon* oil spill. The preamble to the proposed rule notes that the proposed revisions are in response to concerns about the toxicity of dispersants and the large quantities of dispersants used during the *Deepwater Horizon* oil spill. It also notes that the proposed amendments are intended to ensure federal on-scene coordinators, Regional Response Teams, and other responders have sufficient information to support decisions to authorize the use of dispersants.

[70]Listing on the Product Schedule does not mean that EPA approves the product; rather, it generally means that certain data have been submitted to EPA, indicating the product has met specified criteria demonstrating that the dispersant has a certain effectiveness. *See* 40 C.F.R. § 300.920.

According to EPA officials, these proposed amendments to testing protocols have not been finalized because EPA has had higher regulatory priorities, the proposed amendments are very complex, and the responsible regulatory office had a relatively small number of staff to review nearly 82,000 comments on the proposal. EPA officials told us they intend to finalize the effectiveness and toxicity testing components of the proposed regulations in 2023.

The Coast Guard and EPA Have Assessed the Potential Environmental Effects of the Surface Use of Dispersants but Have Not Examined the Effects of Subsurface Use

Since the *Deepwater Horizon* oil spill, some Regional Response Teams, led by the Coast Guard and EPA, have conducted assessments, such as biological assessments, that provide information about the potential harmful effects on various aspects of the environment from a decision to use dispersants on a surface spill in their regions. For example, the Coast Guard and EPA have conducted biological assessments related to consultation under the Endangered Species Act to support regional preauthorization plans for the surface use of dispersants.[71] By having approved preauthorization plans in place—and having conducted assessments and natural resource trustee consultations that support those plans—federal on-scene coordinators may not need to obtain the specific concurrences that would otherwise be required to use

[71]Pub. L. No. 93-205, § 7, 87 Stat. 884, 892 (1973) (codified as amended at 16 U.S.C. § 1536). Under section 7 of the Endangered Species Act, federal agencies must ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of its critical habitat. 16 U.S.C. § 1536(a)(2). In 2001, the Coast Guard, EPA, the Fish and Wildlife Service, and the National Marine Fisheries Service established an Inter-agency Memorandum of Agreement regarding oil spill planning and response activities under the National Contingency Plan and the Endangered Species Act. The agreement coordinates the consultation requirements under the Endangered Species Act with response responsibilities under the National Contingency Plan.

dispersants on the surface; they are, therefore, able to respond more expeditiously to an oil spill.[72]

However, agencies have not conducted similar assessments, such as biological assessments, examining the potential effects on endangered species and critical habitats from the subsurface use of dispersants that can be used to inform preauthorization plans or other planning documents. When responding to an oil spill, before authorizing the subsurface use of dispersants, when practicable, a federal on-scene coordinator is to consult with Interior and Department of Commerce natural resource trustees.[73] Separately, a federal on-scene coordinator may also be required to conduct an Endangered Species Act consultation regarding threatened or endangered species.

In addition to conducting biological assessments for the surface use of dispersants, agencies have conducted some other analyses of surface spills and response options. For example, from 1999 to 2012, the Coast Guard conducted a series of ecological risk assessment workshops to examine environmental tradeoffs associated with oil spill response options in coastal regions around the country. These workshops considered the relative risk to natural resources of using different oil spill responses, including using dispersants on the surface, recovering the oil mechanically, and burning the oil, as well as taking no action. However, agencies have not conducted similar analyses that would provide

[72]Depending on the situation and region, a federal on-scene coordinator may authorize the use of dispersants in accordance with an approved preauthorization plan. Specifically, if the use of certain products under specified circumstances as described in a preauthorization plan is approved in advance by the Regional Response Team representatives from EPA, the relevant states, and the natural resource trustees from the Department of Commerce and the Department of the Interior, the federal on-scene coordinator may authorize the use of such products without obtaining the specific concurrence otherwise required under the National Contingency Plan. 40 C.F.R. § 300.910(a). For situations not addressed by preauthorization plans, as noted previously, when authorizing the use of dispersants in response to an oil spill, a federal on-scene coordinator is generally to consult, when practicable, with Interior and Department of Commerce natural resource trustees. *Id.* § 300.910(b). Currently, only the use of dispersants on the surface has been preauthorized, according to Coast Guard officials.

[73]40 C.F.R. § 300.910(b). Specifically, the Secretary of the Interior is the trustee of natural resources managed or controlled by Interior, including migratory birds, endangered species, and marine mammals. The Secretary of Commerce is the trustee for natural resources managed or controlled by the Department of Commerce and for natural resources managed or controlled by other federal agencies that are found in, under, or using certain specified waters, including water navigable by deep draft vehicles. 40 C.F.R. § 300.600(b).

information on the potential effects of using dispersants in a subsurface environment.

Agencies have recognized the importance of understanding more broadly the potential environmental effects of the subsurface use of dispersants. For example, in its 2015 plan identifying federal oil spill research priorities, the Interagency Coordinating Committee on Oil Pollution Research (Interagency Committee), identified the need for additional research to support the consideration of environmental tradeoffs, including answering questions about the potential effects of dispersants and chemically dispersed oil on organisms throughout the water column. However, as we noted previously in this report, there is still limited information on deep ocean organisms, the potential effects of chemically dispersed oil on those organisms, and natural processes in the deep ocean.

According to Standards for Internal Control, quality information—information that is accurate, complete, and relevant—is vital for an entity to achieve its objectives.[74] In the case of a subsurface oil spill, federal on-scene coordinators and other decision makers, tasked with weighing the environmental tradeoffs of subsurface dispersant use, may not have sufficient quality information about the potential effects of the subsurface use of dispersants on ocean ecosystems.[75] By preparing assessments that examine the potential effects of the subsurface use of dispersants on ocean ecosystems, federal agencies could better ensure that decision makers have quality information when considering environmental tradeoffs and making decisions about the subsurface use of dispersants.

Agencies Have Taken a Number of Other Actions, Including Supporting Research, but Quality Information About Some Research Areas Remains Limited

The Coast Guard and NOAA have taken other actions since the *Deepwater Horizon* oil spill to help ensure decision makers have quality information in an oil spill response. For example, in 2018, the Coast Guard revised its marine environmental response manual to provide direction and policies on response to offshore oil spills. The revised manual calls for federal on-scene coordinators to annually review and update the area contingency plans that provide information about sensitive local resources that should be protected from spilled oil—such

[74]GAO, *Standards for Internal Control in the Federal Government,* GAO-14-704G (Washington, D.C.: September 2014).

[75]Coast Guard officials told us that the subsurface use of dispersants is a viable option primarily in the western Gulf of Mexico, where nearly all U.S. offshore oil production and exploration are located.

as sensitive environmental areas or critical infrastructure, including drinking water intakes. In addition, the revised manual calls for a national panel to review a selection of area contingency plans each year, thereby helping to ensure that plans contain up-to-date information.

Since the *Deepwater Horizon* oil spill, the Coast Guard also has held at least 10 exercises with offshore energy companies to practice responding to oil spills. During simulated offshore oil spills, Coast Guard officials and representatives of the energy companies practice consultation and concurrence procedures, and may discuss the environmental tradeoffs of subsurface dispersant use.

The Coast Guard also established new staff positions to assist with oil spill response. For example, according to Coast Guard officials we interviewed, following the *Deepwater Horizon* oil spill, the Coast Guard established a permanent senior civilian position at each Coast Guard District to advise federal on-scene coordinators and others on incident management preparedness. Each advisor also serves as the Coast Guard co-chair on the Regional Response Team. According to Coast Guard officials the advisory position helps ensure that there is someone with experience to advise and provide information to decision makers, such as when considering the use of dispersants during spill response. The Coast Guard also established a new position to support Coast Guard teams that conduct SMART monitoring.

NOAA has also taken action to improve information available to decision makers. For example, according to NOAA officials we interviewed, since the *Deepwater Horizon* oil spill, NOAA has periodically updated models it uses to support decision-making, such as its model that uses wind speed, currents, estimated dispersant efficiency, and other inputs to show the likely path and speed of spilled oil. Knowing the path and speed of the oil can help decision makers understand what sensitive resources could be affected and help the officials determine what measures to take in response. NOAA officials told us that they have updated one of the models to incorporate algorithms on biodegradation and the dissolution of oil. Officials also said they plan to integrate an additional feature to help decision makers understand what types of oil components from a subsurface spill would rise to the surface.

In addition to these actions, since the *Deepwater Horizon* oil spill, Interior, the Coast Guard, EPA, and NOAA have supported research efforts aimed at improving knowledge about dispersants. For example, starting in 2015, NOAA and EPA supported a series of panels on what was known about the use of dispersants in the Arctic, including potential environmental effects and effectiveness under Arctic conditions. Dozens of scientists from academia, government, and industry attended the panels and contributed to reports that detailed the state of the science for dispersant use in the Arctic.[76] Agencies have also supported the National Academy of Sciences in developing multiple reports related to dispersants, including the most recent National Academies report on dispersants in 2020.[77] Agencies have supported individual research projects as well. For example, Interior, the agency with the largest budget for oil spill research, reported to us that it has supported 32 research projects related to dispersants since 2010.[78]

However, while agencies have supported research since the *Deepwater Horizon* oil spill, quality information on some research areas remains limited. In particular, there is limited understanding of (1) the effectiveness of using subsurface dispersants in the deep ocean and (2) the toxicity and biodegradation of chemically dispersed oil. As we noted previously in this report, the effectiveness of using subsurface dispersants in the deep ocean is not well understood due to limitations in field measurements of the subsurface use of dispersants, limited data from experiments that reflect deep ocean conditions, and variation in modeling results. The toxicity and biodegradation of chemically dispersed oil are not well understood because of factors such as inconsistent laboratory testing designs and experiments that may not reflect ocean conditions.

[76]Coastal Response Research Center, *2017 State-of the Science of Dispersants and Dispersed Oil (DDO) in U.S. Arctic Waters: Efficacy and Effectiveness* (New Hampshire: University of New Hampshire, June 2017); *2017 State-of the Science of Dispersants and Dispersed Oil (DDO) in U.S. Arctic Waters: Degradation and Fate,* (New Hampshire: University of New Hampshire, June 2017); *2018 State-of the Science of Dispersants and Dispersed Oil (DDO) in U.S. Arctic Waters: Eco-toxicity and Sublethal Impacts* (New Hampshire: University of New Hampshire, May 2018); *2017 State-of the Science of Dispersants and Dispersed Oil (DDO) in U.S. Arctic Waters: Physical Transport and Chemical Behavior* (New Hampshire: University of New Hampshire, June 2017); and *2019 State-of-the-Science of Dispersants and Dispersed Oil (DDO) in U.S. Arctic Waters: Public Health and Food Safety* (New Hampshire: University of New Hampshire, March 2019).

[77]National Academy of Sciences, *The Use of Dispersants in Marine Oil Spill Response*.

[78]In 2019, we reported that Interior's Bureau of Ocean Energy Management and Bureau of Safety and Environmental Enforcement expended $113.9 million for oil spill research from fiscal year 2011 to 2017. The Coast Guard, EPA, and NOAA expended between $20.7 million and $27.7 million in total on oil spill research over that same period. GAO, *Offshore Oil Spills: Restoration and Federal Research Efforts Continue, but Opportunities to Improve Coordination Remain,* GAO-19-31 (Washington, D.C., Jan. 3, 2019).

According to Standards for Internal Control, quality information is vital for an entity to achieve its objectives. Without quality information about dispersant effectiveness and the potential environmental effects of dispersant use, federal on-scene coordinators and other decision makers may be limited in their ability to consider environmental tradeoffs when responding to an oil spill. As the federal coordinator for oil pollution research, the Interagency Committee is in a position to help improve information from research; it is responsible for coordinating a comprehensive program of oil pollution research and technology development among federal agencies in cooperation and coordination with government, academic, and industry stakeholders, as appropriate. By convening working groups of these stakeholders to improve the quality of information about the effectiveness of the subsurface use of dispersants, and to identify ways to ensure experiments about the toxicity and biodegradation of chemically dispersed oil result in quality information, the Interagency Committee could help ensure that decision makers are equipped to fully consider the environmental tradeoffs associated with a decision about whether to use dispersants.

Conclusions

The use of chemical dispersants to mitigate the effects of the *Deepwater Horizon* oil spill was controversial, raising concerns from the public and government stakeholders about the potential risks to the environment and human health of dispersant use. When the next major oil spill occurs, a federal on-scene coordinator and other decision makers will again face the controversial decision about whether to authorize the use of dispersants, and if so, to what extent. Decision makers must weigh the risks and benefits of using dispersants as part of their response effort.

Since the *Deepwater Horizon* oil spill, the Coast Guard, EPA, and other agencies have taken a number of actions to improve the quality of information available to responders faced with making decisions about using dispersants. The Coast Guard and EPA have developed guidance for monitoring the subsurface use of dispersants and, with other agencies, plan to update guidance for using dispersants on the surface. EPA has finalized regulations that establish monitoring requirements, and it has proposed regulations that would update dispersant testing protocols. Agencies have also conducted various assessments, such as biological assessments and ecological risk assessments, of the effects of the surface use of dispersants, and have supported research efforts aimed at improving information about dispersants. However, much about the effectiveness and environmental effects of dispersant use, particularly in the deep ocean, is not well understood.

Although the Coast Guard and EPA have conducted some biological and ecological risk assessments on surface dispersant use, they have not conducted such assessments on subsurface dispersant use. By preparing assessments examining the potential effects of the subsurface use of dispersants on ocean ecosystems, federal agencies could better ensure that decision makers have quality information when considering environmental tradeoffs and making decisions about the subsurface use of dispersants.

In addition, although agencies have supported research, there is limited quality information about the effectiveness of subsurface dispersants and the toxicity and biodegradation of chemically dispersed oil. This is due to a variety of factors, including a wide variation in modeling results, inconsistent test designs, and experiments that may not reflect ocean conditions. As the federal coordinator for oil pollution research, the Interagency Committee is in a position to help improve the quality of information in these areas. By convening working groups of the appropriate government, academic, and industry stakeholders, the Interagency Committee could help identify ways to improve the quality of information about the effectiveness of subsurface dispersants. It could also identify ways to better ensure that experiments about chemically dispersed oil toxicity and biodegradation result in quality information. With access to better quality information, responders can better weigh environmental tradeoffs associated with dispersant use, and the public will have greater assurance that decisions have been made appropriately.

Recommendations for Executive Action

We are making a total of four recommendations, including three to the Coast Guard and one to EPA:

The Commandant of the Coast Guard should work with EPA and other agencies to conduct assessments—such as biological assessments or ecological risk assessments—examining the potential effects of the subsurface use of dispersants on ocean ecosystems in regions where this is considered a viable response option. (Recommendation 1)

The Administrator of EPA should work with the Coast Guard and other agencies to conduct assessments—such as biological assessments or ecological risk assessments—examining the potential effects of the subsurface use of dispersants on ocean ecosystems in regions where this is considered a viable response option. (Recommendation 2)

The Commandant of the Coast Guard should ensure that the chair of the Interagency Coordinating Committee on Oil Pollution Research, in coordination with member agencies, convene a working group of the appropriate government, academic, and industry stakeholders, to identify ways to improve the quality of information about the effectiveness of the subsurface use of dispersants. (Recommendation 3)

The Commandant of the Coast Guard should ensure that the chair of the Interagency Coordinating Committee on Oil Pollution Research, in coordination with member agencies, convene a working group of the appropriate government, academic, and industry stakeholders, to identify ways to better ensure that experiments about chemically dispersed oil toxicity and biodegradation result in quality information. (Recommendation 4)

Agency Comments

We provided a draft of this report to the Departments of Commerce, Health and Human Services, Homeland Security, and Interior, and to EPA, for review and comment. We received written comments from Homeland Security, reprinted in appendix II, and from EPA, reprinted in appendix III. Commerce, Health and Human Services, and Homeland Security and EPA also provided technical comments, which we incorporated as appropriate. Interior did not provide comments.

Homeland Security agreed with our three recommendations to the Coast Guard and described the actions it plans to address them. With regard to the third recommendation to the Coast Guard (Recommendation 4), the department said that the Interagency Coordinating Committee on Oil Pollution Research would form a working group to develop a framework promoting that chemically dispersed oil toxicity and biodegradation experiments result in quality information. It also said that the working group would present the framework and accompanying findings in a report that would be used to inform interagency assessments examining the potential side effects of the subsurface use of dispersants on ocean ecosystems in regions where this is considered a viable response option. While we agree that such a framework and report could prove valuable in assessing the effects of the subsurface use of dispersants, we emphasize that this recommendation is intended to improve the quality of information from experiments relating to the use of dispersants in all ecosystems, not exclusively to the subsurface use of dispersants.

EPA agreed with our one recommendation to the agency.

We are sending copies of this report to the appropriate congressional committees; the Secretary of Homeland Security; the Commandant of the

Coast Guard; the Administrator of the EPA; the Secretary of the Interior; the Secretary of Commerce, the Secretary of Health and Human Services; and other interested parties. In addition, the report is available at no charge on the GAO website at https://www.gao.gov.

If you or your staff have any questions about this report, please contact us at (202) 512-3841 or ruscof@gao.gov or at (202) 512-6888 or howardk@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix IV.

Frank Rusco
Director, Natural Resources and Environment

Karen L. Howard
Director, Science, Technology Assessment, and Analytics

Appendix I: Scope and Methodology

This report examines (1) what is known about the effectiveness of dispersants, (2) what is known about the effects of chemically dispersed oil on the environment, (3) what is known about the effects of dispersants and chemically dispersed oil on human health, and (4) the extent to which federal agencies have taken action to help ensure decision makers have quality information to support decisions to use chemical dispersants.

To examine what is known about the effectiveness of chemical dispersants as well as their effects on the environment and human health, we reviewed scientific studies and reviews of dispersant science. This includes National Academy of Sciences' reviews[1] of dispersant science and the Coastal Response Research Center's reviews of the state of the science of dispersant use for the Arctic.[2] We also conducted a literature search of studies relating to chemical dispersants that were published from 2010 (the year of the *Deepwater Horizon* oil spill) to July 2020. We conducted searches of various databases, such as Scopus and ProQuest's Science, Technology, and Health Collections, for keywords such as "dispersant" and "oil." We also reviewed studies from the Gulf of Mexico Research Initiative, an initiative established in 2010 with support from the BP America Production Company (BP) to study the effects of the *Deepwater Horizon* oil spill and other spills on the Gulf of Mexico over a 10-year period.[3] We selected for in-depth review those peer-reviewed studies that were synthesis papers or that presented the results of

[1]National Academies of Sciences, Engineering, and Medicine, *The Use of Dispersants in Marine Oil Spill Response*; National Academies of Sciences, Engineering, and Medicine, *Oil Spill Dispersants: Efficacy and Effects* (Washington, D.C.: The National Academies Press, 2005).

[2]Coastal Response Research Center, *2017 State-of the Science of Dispersants and Dispersed Oil (DDO) in U.S. Arctic Waters: Efficacy and Effectiveness*; *2017 State-of the Science of Dispersants and Dispersed Oil (DDO) in U.S. Arctic Waters: Degradation and Fate*; *2018 State-of the Science of Dispersants and Dispersed Oil (DDO) in U.S. Arctic Waters: Eco-toxicity and Sublethal Impacts*; *2017 State-of the Science of Dispersants and Dispersed Oil (DDO) in U.S. Arctic Waters: Physical Transport and Chemical Behavior*; *2019 State-of-the-Science of Dispersants and Dispersed Oil (DDO) in U.S. Arctic Waters: Public Health and Food Safety*.

[3]BP leased the Deepwater Horizon oil rig and was the party responsible for costs, up to a specified limit, associated with cleaning up the spill, among other things. According to the Gulf of Mexico Research Initiative, on May 24, 2010, about 1 month into the Deepwater Horizon oil spill response, BP committed $500 million to create a broad, independent research program to be conducted at research institutions primarily in the U.S. Gulf Coast states.

laboratory experiments and field surveys of dispersant effectiveness and effects.

With regard to laboratory experiments of biodegradation, we conducted an analysis of the methodology and results of experiments published in peer-reviewed journals. We also reviewed U.S. government reports related to the effectiveness and effects of dispersants used during the *Deepwater Horizon* oil spill, such as the Oil Budget Calculator[4] and the National Resource Damage Assessment.[5]

We interviewed a variety of stakeholders from academia, industry, non-governmental organizations, and government agencies on the topics of dispersant effectiveness and effects. We identified stakeholders through reviewing the literature and through referrals made during interviews. Stakeholders included researchers at U.S. universities; industry representatives from ExxonMobil and the American Petroleum Institute; consultants from U.S. research and planning firms; and representatives from the National Academy of Sciences, the Coastal Response Research Center, and the Gulf of Mexico Research Initiative. Although not necessarily representative of the views of all stakeholders, they represent a variety of important perspectives. We interviewed U.S. agency officials from the Coast Guard, the Environmental Protection Agency (EPA), the Department of the Interior, the Department of Commerce's National Oceanic and Atmospheric Administration (NOAA), as well as a Canadian government official from its Department of Fisheries and Oceans. We corresponded via email with officials from the Department of Health and Human Services to obtain information related to the effects of dispersants and chemically dispersed oil on human health.

To examine the extent to which federal agencies have taken action to help ensure decision makers have quality information to support decisions to use chemical dispersants, we examined relevant laws, existing and proposed regulations, plans, guidance, and other documents pertaining to the use of chemical dispersants. We reviewed relevant laws, including the Oil Pollution Act of 1990, the Clean Water Act, and the Endangered Species Act.

[4]The Federal Interagency Solutions Group, *Oil Budget Calculator*.

[5]Deepwater Horizon Natural Resource Damage Assessment Trustees, *Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement* (2016).

We reviewed the National Contingency Plan, which provides the organizational structure and procedures for preparing for and responding to discharges of oil and certain other releases. We also reviewed regional and area contingency plans, which are required under the National Contingency Plan and which describe considerations for officials making decisions about dispersant use. We reviewed assessments conducted in some regions that examined the effects of a decision to use surface dispersants on the environment. We also reviewed Coast Guard and Interior requirements related to dispersant use planning for certain vessels and for offshore oil facilities.

In addition, we reviewed national and agency-specific lessons-learned and after-action reports for the *Deepwater Horizon* oil spill, such as the National Commission on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling report, the Coast Guard's 2011 On-Scene Coordinator Report, and Coast Guard's Incident Specific Preparedness Review Final Report. We also examined U.S. guidance for monitoring the use of chemical dispersants, including the National Response Team's 2013 Environmental Monitoring for Atypical Dispersant Operations and the 2006 Special Monitoring of Applied Response Technologies protocols. Lastly, we reviewed the reports, meeting minutes, and research and technology plan of the Interagency Coordinating Committee on Oil Pollution Research (Interagency Committee); interviewed Interagency Committee officials; and observed a quarterly meeting of the Interagency Committee.

To further our understanding of how decisions are made about the use of chemical dispersants and the extent agencies have taken action to support those decisions, we interviewed officials from four federal agencies. We interviewed officials from two offices within the EPA to identify actions they have taken, including EPA's proposal to revise provisions of the National Contingency Plan related to the use of chemical dispersants. We interviewed Coast Guard headquarters officials, as well as Coast Guard personnel involved with the monitoring of dispersant use. We also interviewed officials from four Coast Guard Districts who support oil spill response decision-making for Regional Response Teams. In addition, we interviewed NOAA scientific support coordinators who support decision-making, as well as NOAA scientists that support spill response efforts through modeling and other efforts. We also interviewed Interior headquarters officials who discussed relevant Interior requirements and agency actions.

We conducted this performance audit from March 2020 to December 2021 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Appendix II: Comments from the Department of Homeland Security

U.S. Department of Homeland Security
Washington, DC 20528

Homeland Security

December 1, 2021

Frank Rusco
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Washington, DC 20548

Karen L. Howard
Director, Science, Technology Assessment, and Analytics
U.S. Government Accountability Office
441 G Street, NW
Washington, DC 20548

Re: Management Response to Draft Report GAO-22-104153, "OFFSHORE OIL SPILLS: Additional Information Is Needed to Better Understand the Environmental Tradeoffs of Using Chemical Dispersants"

Dear Mr. Rusco and Ms. Howard:

Thank you for the opportunity to comment on this draft report. The U.S. Department of Homeland Security (DHS or the Department) appreciates the U.S. Government Accountability Office's (GAO) work in planning and conducting its review and issuing this report.

The Department is pleased to note GAO's recognition that the Coast Guard, Environmental Protection Agency (EPA), and National Oceanic and Atmospheric Association (NOAA) have taken actions to help ensure decision makers have quality information to support decision making on dispersant use. Notably, the report highlights several actions taken by the Coast Guard and other agencies to improve the quality of information available to officials making decisions related to oil spill response, including the:

- development of monitoring guidance for subsurface dispersant use;
- assessment of environmental impacts from surface dispersant use; and
- provision of broad support for research efforts aimed at improving knowledge about dispersants.

DHS remains committed to better understanding the overall effectiveness, potential adverse impacts, and conceivable benefits associated with the use of subsurface oil dispersants.

The draft report contained four recommendations, including three for the Coast Guard with which the Department concurs. Attached find our detailed response to each recommendation. DHS previously submitted technical comments addressing several accuracy, contextual, and other issues under a separate cover for GAO's consideration.

Again, thank you for the opportunity to review and comment on this draft report. Please feel free to contact me if you have any questions. We look forward to working with you again in the future.

Sincerely,

JIM H CRUMPACKER Digitally signed by JIM H CRUMPACKER Date: 2021.12.01 11:35:15 -05'00'

JIM H. CRUMPACKER, CIA, CFE
Director
Departmental GAO-OIG Liaison Office

Attachment

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Attachment: Management Response to Recommendations Contained in GAO-22-104153

GAO recommended that the Commandant of the Coast Guard:

Recommendation 1: Work with EPA and other agencies to conduct assessments—such as biological assessments or ecological risk assessments—examining the potential effects of the subsurface use of dispersants on ocean ecosystems in regions where this is considered a viable response option.

Response: Concur. The Coast Guard Office of Marine Environmental Response will form a working group with EPA and other agencies which, following the final results of the Interagency Coordinating Committee on Oil Pollution Research (ICCOPR) will coordinate assessments that examine the potential effects of subsurface dispersant use during worst-case oil discharges, as well as the potential effects of not using subsurface dispersants during worst-case oil discharges.

Currently, the Coast Guard does not have the organic scientific expertise to conduct robust assessments and will leverage the full extent of the interagency working group accordingly. The Coast Guard expects these assessments to take, at a minimum, four years to complete with an estimated completion date in Spring 2026. Once the working group convenes, currently projected for Summer 2022, the Coast Guard will develop interim milestones and refine the estimated completion date (ECD) for implementing this recommendation, as appropriate.

ECD: April 30, 2026.

Recommendation 3: Ensure that the chair of the Interagency Coordinating Committee on Oil Pollution Research, in coordination with member agencies, convene a working group of the appropriate government, academic, and industry stakeholders, to identify ways to improve the quality of information about the effectiveness of the subsurface use of dispersants.

Response: Concur. The chair of the ICCOPR, in coordination with key members of the committee, will form a working group to develop a framework for improving the quality of information on subsurface dispersant use and effectiveness. Once complete, the ICCOPR will present the finalized framework, and any accompanying findings in a report, which will be used to inform interagency assessments examining the potential side effects of the subsurface use of dispersants on ocean ecosystems in regions where this is considered a viable response option. ICCOPR will convene this working group in Summer 2022 and anticipates completion by Fall 2023. ECD: November 30, 2023.

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Recommendation 4: Ensure that the chair of the Interagency Coordinating Committee on Oil Pollution Research, in coordination with member agencies, convene a working group of the appropriate government, academic, and industry stakeholders, to identify ways to better ensure that experiments about chemically dispersed oil toxicity and biodegradation result in quality information.

Response: Concur. The chair of the ICCOPR, in coordination with key members of the committee, will form a working group to develop a framework promoting that chemically dispersed oil toxicity and biodegradation experiments result in quality information. When the framework is complete, the working group will present the finalized framework and any accompanying findings in a report, which will be used to inform interagency assessments examining the potential side effects of the subsurface use of dispersants on ocean ecosystems in regions where this is considered a viable response option. ICCOPR will convene this working group in Summer 2022 and anticipates completion by Fall 2023. ECD: November 30, 2023.

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Appendix III: Comments from the Environmental Protection Agency

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

November 29, 2021

Mr. Alfredo Gomez
Director
Natural Resources and Environment
U.S. Government Accountability Office
Washington, DC 20548

Dear Mr. Gomez:

Thank you for the opportunity to review and comment on GAO's draft report, *Offshore Oil Spills: Additional Information Is Needed to Better Understand the Environmental Tradeoffs of Using Chemical Dispersants* (Project No. GAO-22-104153). The Environmental Protection Agency (EPA) appreciates that the report is a balanced representation of the complexities facing federal agencies in addressing the use of chemical dispersants in offshore oil spills. The Agency is providing the response below to the draft report findings, conclusions, and recommendations, as well as technical comments for GAO's consideration. EPA agrees better environmental information would benefit decisionmakers with response roles and responsibilities for subsurface dispersant use.

Recommendation 2: The Administrator of EPA should work with the Coast Guard and other agencies to conduct assessments—such as biological assessments or ecological risk assessments—examining the potential effects of the subsurface use of dispersants on ocean ecosystems in regions where this is considered a viable response option.

EPA Response: EPA agrees with this recommendation and understands it to provide flexibility on conducting these assessments as part of contingency planning in the coastal zone where subsurface dispersant use may be considered a viable response option. EPA will provide support to U.S. Coast Guard (USCG), and coordinate with the National Oceanic and Atmospheric Administration and other Federal agencies as appropriate, to identify assessment methodologies and examine potential effects of subsurface use of dispersants on ocean systems for select regions. This coordination will take into account resource constraints and limitations in data collection and information gathering given the complexities of subsurface dispersant use in the deep-sea environments. In Fall 2022, we will meet with USCG and other Agencies to initiate this discussion.

Thank you again for the opportunity to review and respond to the GAO's draft report, *Offshore Oil Spills: Additional Information Is Needed to Better Understand the Environmental Tradeoffs of Using Chemical Dispersants.* If additional information is needed, please contact Susan Perkins at 202-564-8618.

Sincerely,

Wayne E. Cascio, M.D.
Principal Deputy Assistant Administrator and EPA Science Advisor, Office of Research and Development

Barry N. Breen
Acting Assistant Administrator, Office of Land and Emergency Management

Enclosure

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Appendix IV: GAO Contacts and Staff Acknowledgments

GAO Contacts

Frank Rusco, (202) 512-3841 or Ruscof@gao.gov

Karen L. Howard, (202) 512-6888 or Howardk@gao.gov

Staff Acknowledgments

In addition to the contacts named above, Karla Springer (Assistant Director), Dave Messman (Analyst-in-Charge), Ellen Fried, Emily Gupta, and Edward (Jim) Rice made key contributions to this report. Colleen Candrl, Gina Hoover, Patricia Moye, and Dan Royer also contributed to the report.

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