REPORT OF THE 2019 DISPERSANT SCIENCE TASK FORCE OF THE RRT 10/NORTHWEST AREA COMMITTEE

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EXECUTIVE SUMMARY

The Dispersant Science Task Force of the NWAC/RRT10 was one of five task forces chartered by the RRT Executive Committee on February 8, 2019. The Dispersant Task Force was assigned six activities:

1. Review Arctic Spill of National Significance (SONS) state of dispersant science findings;
2. Review the regional Biological Opinion prepared by the National Marine Fisheries Service and the U.S. Fish and Wildlife Service ("the Services");
3. Review National Academies of Science, Engineering, and Medicine (NASEM) dispersant study;
4. Review NMFS West Coast Response Plan;
5. Develop a white paper reviewing the most recent publications on dispersants and determine if changes are recommended for the NWACP;
6. Develop a fact sheet for public consumption.

A total of 17 people originally signed up for the dispersant science group, and a total of ten calls were convened between March and August 2019 to accomplish the work. In addition, one special session was held in May with Dr. Nancy Kinner of the University of New Hampshire to discuss the Arctic SONS state of dispersant science project. The Task Force facilitator briefed the group's progress to the NWAC and the Steering Committee on 29 May and 8 August, respectively.

The Task Force adhered to its overall charge of reviewing the recent science to determine if those findings warranted subsequent review of regional policy. The volume of scientific study was overwhelming, given the amount of work that has taken place in the wake of the *Deepwater Horizon* spill. However, the Arctic SONS project and the NASEM review, both of which concluded this year, provided convenient access to and syntheses of the research and the task force benefited from these rigorous scientific reviews and their conclusions.

Our reading of the recent science suggested that the broad structure of scientific understanding with respect to how dispersants work (or don't), inherent toxicity of modern dispersant mixtures, and differences across impacts from oil itself, chemically dispersed oil, and dispersants remained relatively consistent with pre-*Deepwater Horizon* knowledge. The two areas where recent research raises yellow cautionary flags, from the perspective of interpretation and extrapolation into policy considerations, fall under the categories of 1) dispersed oil and dispersant effects to exposed marine organisms like larval fish, and to air-breathing animals at the air-sea interface like marine mammals or seabirds; and 2) possible human health effects to response personnel and the broader public. In both cases, separating effects from oil alone (i.e., not using dispersants), and dispersed oil or dispersants, was challenging and frequently not possible.

Our review of the current state of knowledge on dispersants, as well as consideration of the uncertainties associated with them, led the Task Force to develop three recommendations to be forwarded to the Northwest Area Committee and the Region 10 Regional Response Team:

1. The Dispersant Science Task Force recommends the consideration of a Net Environmental Benefits Analysis/Consensus Ecological Risk Assessment/Spill Impact Mitigation Analysis-type workshop approach for anticipating potential resource impacts of dispersant use and other response alternatives in our region. Regional subject matter experts, such as fisheries and wildlife scientists, should be recruited to help develop more sophisticated decision support

tools and resources that would elucidate tradeoffs related to impacts of dispersant use on marine species during oil spill response, in advance of the next major oil spill.

2. The Task Force recommends working with response agencies, oil spill response organizations, and health professionals to improve the environmental and occupational "chain-of-custody" accounting for dispersants and other spill response chemicals in order to prevent or minimize potential exposure. This might include:
   - Review of record-keeping procedures and requirements related to handling and application of spill response chemicals like dispersants to document potential exposure hazard;
   - Review of personal protection equipment requirements and policies, to ensure that responders are adequately protected under all conditions;
   - Review of standard (chemistry-based) and novel approaches to determining presence or absence of dispersant residues in the environment to provide rapid assessment capabilities to provide information to concerned and affected communities during response.

3. The Task Force supports the chartering of a subsequent task force to examine the existing NWACP dispersant use policy to ensure consistency with current regional needs, values, uses, scientific knowledge, and treaty rights.

It has been at least 14 years since the NWACP dispersant policy was reviewed and revised. While recent scientific findings may not in themselves prompt or preclude a policy review, they would augment and strengthen such a process by providing new insights into environmental fate, behavior and effects. In addition, it is possible that pending requirements on the action agencies (i.e., USEPA and U.S. Coast Guard) resulting from the ongoing Endangered Species Act consultation process by the Services may result in mandatory changes to the policy. We believe that it is an appropriate and opportune time to review regional dispersant policy to ensure consistency with current science, regulatory requirements, contemporary community standards and values, and treaty rights and obligations.

INTRODUCTION

Dispersants are chemical mixtures of surfactants, solvents, and other compounds that reduce surface tension between oil and water in order to enhance naturally-occurring dispersion by generating larger numbers of small oil droplets that are entrained into the water column by wave energy (National Research Council, 2005), where they can be further diluted, biodegraded, and acted upon by other weathering processes.

Chemical dispersants are a rarely-used response option in the United States, having been either tested or used operationally during actual spill events a total of 27 times over more than 40 years (Helton, 2018). Globally, prior to 2007, dispersants were operationally used 213 times (Steen and Findlay, 2008). However, in 2010 chemical dispersants were employed on an unprecedented scale during the *Deepwater Horizon* oil spill in the Gulf of Mexico. The use of dispersants during that spill raised concerns regarding the behavior and fate of the oil and dispersants, and their potential impacts on human health and the environment.

In light of the concerns that arose during the *Deepwater Horizon* response, and the large amount of scientific research that ensued in the wake of that spill, Regional Response Team 10 and the Northwest Area Committee (RRT 10/NWAC) chartered a task force in 2019 to review the recent science related to dispersants to determine if it warranted a review of the existing dispersant use policies specified by the Northwest Area Contingency Plan (NWACP). Chapter 4000 of the NWACP states:

> **Our understanding of dispersant…efficacy and toxicity is evolving, and the appropriateness of (its) application is subject to change based on field and laboratory testing. As new information becomes available, these policies will be revisited, modified, and enhanced as appropriate.**

The geographic focus of this discussion is the area covered by the NWACP. For dispersant use considerations, this effectively is the U.S. portion of the Salish Sea (defined here as the inland sea encompassing Puget Sound, the San Juan Islands and the waters off Vancouver, B.C.; the area spans from Olympia, Washington to the Campbell River, British Columbia, and west to Neah Bay) and the coastal Pacific waters of Washington and Oregon.

RRT 10/NWAC DISPERSANT TASK FORCE OBJECTIVES

The following activities and products were initially identified for the RRT 10 Dispersant Task Force when chartered by the Executive Committee of the RRT:

1. Review Arctic SONS findings;
2. Review Biological Opinion;
3. Review National Academy study;
4. Review West Coast Response Plan;
5. Develop a white paper reviewing the most recent publications on dispersants and determine if changes are recommended for the NWACP;
6. Develop a fact sheet for public consumption.

Two major scientific reviews (Arctic SONS and National Academies) had concluded in the first part of 2019, and the Gulf of Mexico Research Initiative (GoMRI), the 10-year, $500 million independent research program funded by BP, was concluding its broad support of research on many aspects of oil spill science, including oil, dispersed oil, and dispersants. In addition, the Coast Guard and USEPA have undertaken review of response planning in many parts of the country to ensure compliance with requirements under the Endangered Species Act (ESA), resulting in biological assessments (prepared when listed species may be affected by actions such as response, analyze the potential effects of projects on ESA-listed species and critical habitat, and justify particular effect determinations; used as the technical basis for formal consultation and conference processes) and biological opinions (trustee agency opinions on how federal agencies' actions affect listed species and critical habitat). Although broader in scope these assessments and opinions may include specific concerns about the potential use of chemical dispersants.

The West Coast Response Plan listed as #4 above, is a planning document under development by the Office of Protected Resources within NOAA/NMFS, and is intended to provide response guidance to NOAA personnel along the west coast; however, it is an internal agency project and the plan is not currently available to the public, although it may be released in the future. As such, it was not reviewed by the task force.

RRT 10/NWAC DISPERSANT TASK FORCE MEMBERS & AFFILIATIONS

Members of the RRT 10 Dispersant Task Force were: Erica Bates (WA Ecology); Matthew Bissell (NOAA/ERD); Victoria Broje (Shell); Brett Ettinger (USCG/Sector Puget Sound); Fred Felleman (Friends of the Earth); Samantha Fisher (ENE); George Galasso (NOAA/ONMS); Tiffany Gallo (NRCC); Haley Kennard (Makah Tribe); Sonja Larson (WA Ecology); Brian MacDonald (WA Fish & Wildlife); Josh McElhaney (USCG/Sector Puget Sound); Don Noviello (WA Fish & Wildlife); Heather Parker (US Navy/NOSC PM); Elizabeth Petras (USCG/Thirteenth Coast Guard District); Linda Pilkey-Jarvis (WA Ecology); Jim Rosenberg (NOAA/ERD); Gary Shigenaka (NOAA/ERD). One member withdrew from the Task Force in August.

BACKGROUND

From an operational perspective, application of dispersants can result in a relatively large "encounter rate" with the oil. That is, a single piece of equipment (especially an aircraft) can potentially treat a large surface area of oil on the water rapidly, compared to methods like skimming and other mechanical means of oil recovery. Dispersants can also reduce shoreline impacts, where spill response is both difficult and costly. However, like all response methods, dispersants carry their own ecological and human health risks and trade-offs.

Some sources have found that on-water skimming operations (a.k.a. mechanical recovery) typically end up only collecting ~10-15% of spilled oil, or less in open water (ITOPF, 2014). However, per the Northwest Area Contingency Plan, mechanical recovery is always the primary response method of choice as it is the only method that physically removes spilled oil from the marine environment.

Dispersants are viewed as a critical response tool for many types of spills, including larger spills far from shore, spills more distant from stockpiles of recovery and containment equipment, when weather and ocean conditions preclude the use of other options, or when weather conditions are predicted to become more severe. Their suitability for vessel or aircraft deployment increases their utility as a rapid response option. In addition, they can be effective when wind and wave conditions prevent vessel-based mechanical recovery or in-situ burning operations, and they may represent the only effective option when slicks have spread very thin (i.e., < 0.1 mm).

Chemically dispersing oil does not remove oil; rather, it reduces the droplet size of the oil and moves it into the water column. There, it mixes with larger volumes of water that dilute oil concentrations and allow weathering processes like dissolution and biodegradation to occur. Biodegradation is the process by which oil is broken down in the environment by oil-eating bacteria. Chemically dispersing oil transfers the impacts of spilled oil from the surface of the water (where impacts to marine mammals and seabirds are highest), and the shoreline, to the water column (where other species may temporarily experience higher exposures) (Figures 1 and 2). Because dispersants may reduce shoreline oiling, their use can result in the generation of less oiled solid waste (sediment, sorbents, pads, etc.) which would ultimately end up in a landfill. While the potential impacts of shoreline response on the environment are considered in environmental trade-offs decision-making during a response, challenges with waste disposal are not, as proper disposal of waste is considered part of the obligation of the spiller.

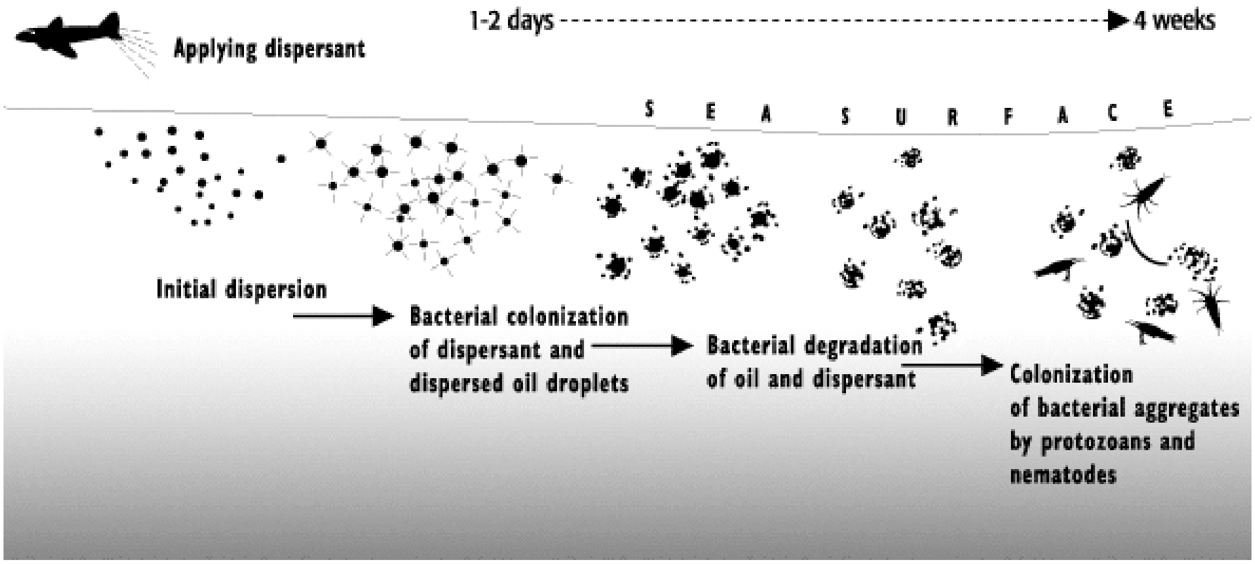

Figure 1. Theory of how oil is processed in the marine ecosystem following dispersant application. Droplets of oil and dispersant are colonized by degrading bacteria on which protozoans and nematodes (small worms) feed. Source: NOAA/response.restoration.noaa.gov.

Dispersing oil does not mean that it is "gone"; unfortunately, at least one government official has used those words during a spill response, and they are misleading and incorrect. In the simplest analysis of environmental tradeoffs, dispersant use moves oil into the water column in the short term, to reduce subsequent shoreline impacts or potential exposure to organisms frequenting the surface of the water (e.g., whales, seals, and seabirds). Once in the water column, the oil can be naturally broken down as droplets more quickly than if allowed to stay as a slick and strand on shorelines. The reality is more complex; the effectiveness of dispersants and their potential tradeoffs vary for different scenarios for a number of reasons including, but not limited to, the following: some oils are more readily dispersible than others; no dispersant application is completely effective (i.e., some oil will remain on the surface to continue to expose organisms there); water column organisms are variably sensitive to acute exposure to dispersant and dispersant-oil droplets; and recent studies have shown that dispersant use can increase exposure to some organisms through certain routes like aerosolization and flocculation).

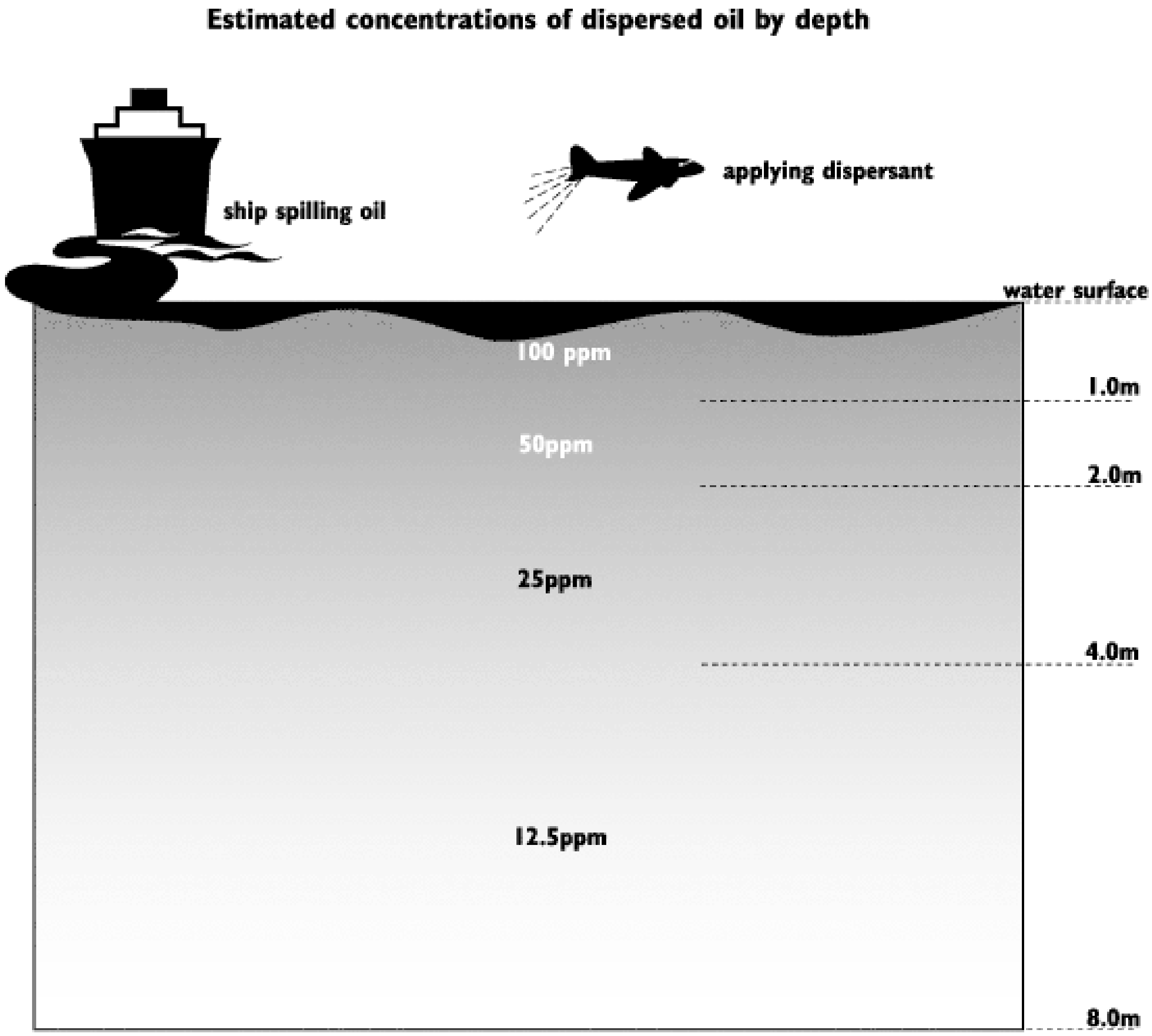

Figure 2. Cross-section of the water column showing expected short-term water concentrations of dispersed oil (estimated from field studies) following a surface application. To avoid contaminating the sea floor, most dispersant policies restrict use to waters deeper than 10 meters (about 30 feet). Concentrations decline as currents and waves dilute and disperse the oil further. Source: NOAA/response.restoration.noaa.gov.

The recent National Academies dispersant review (NASEM, 2019) states that modern dispersant products (e.g., Dasic Slickgone NS, Finasol® OSR 52, Corexit® EC9500A) are mixtures of solvents and surface active agents (surfactants) with different physicochemical properties and therefore different potential fates in the environment. The report further notes that the modern products have been formulated with less-toxic chemical constituents, employing ingredients found in common consumer products such as cleaners and cosmetics. It is helpful to have a basic understanding of dispersant components, because they are a mix of chemicals with different potential environmental behaviors and fates. While details of ingredients are generally proprietary, IPIECA and IOGP (2015a) indicates that most are mixtures of two to three nonionic surfactants, along with solvents. Surfactants are surface-active compounds (hence, "surfactants") whose molecules have a water-loving portion (hydrophilic) and an oil-loving portion (oleophilic). Figure 3 illustrates a visualization of a surfactant molecule and how surfactants behave in the presence of oil and water. Surfactants can be categorized as anionic (with a negatively charged hydrophilic part), nonionic (neutral hydrophilic part), cationic (positively charged hydrophilic group), or amphoteric (cationic and anionic in the same molecule). There are thousands of commercial surfactants that are common ingredients in soaps, cleaners, cosmetics, and many other industrial and consumer-grade products. The surfactants that are used in dispersants are commercial chemicals that are also used in other non-response-related products.

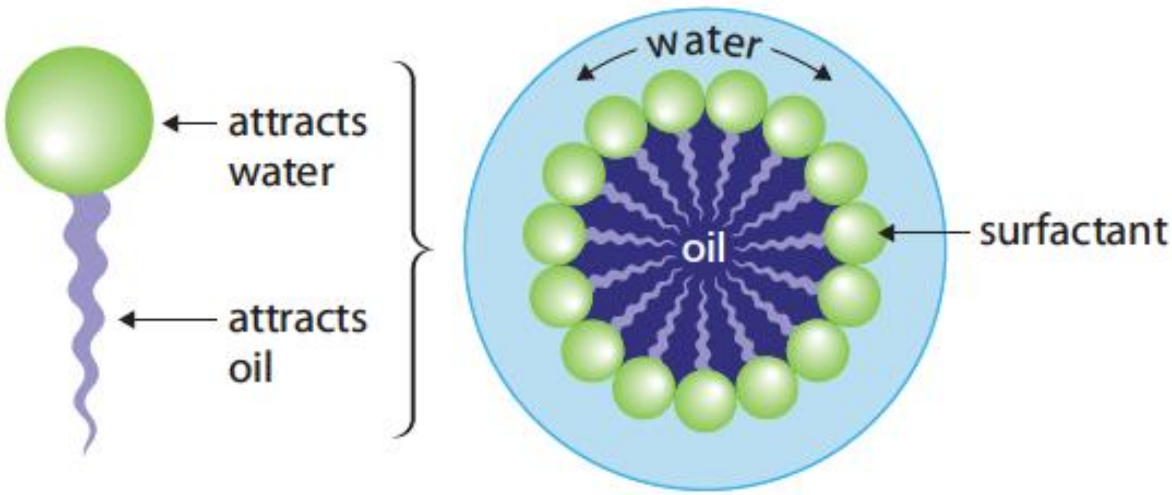

Figure 3. Conceptual diagram of a surfactant molecule and how these are intended to align between water and oil in a dispersant mixture. Source: IPIECA and IOGP (2015a).

The surfactants used in dispersants are intended to reduce the interfacial tension between oil and water by forming a "bridge" between the two fluids, resulting in a much reduced interfacial tension that facilitates the formation of smaller oil droplets in water.

Solvents are added to dispersants for two reasons: first, to produce a liquid product more amenable to being sprayed; and second, to facilitate the penetration of surfactants into the oil. Modern dispersant formulations use glycol ethers, hydrocarbons, and water as solvents.

The list of ingredients in Corexit 9500A that was released by the USEPA during the *Deepwater Horizon* spill is listed below with their Chemical Abstracts Service (CAS) Registry Numbers, with notations by a U.S. Food and Drug Administration scientist on other commercial and industrial applications (Dickey, 2011):

- Propylene glycol (CAS 57-55-6)
  - a generally recognized as safe (GRAS) food additive, among other common uses
- Petroleum distillates hydrotreated light fraction (CAS 64742-47-8)
  - a mixture of n-alkanes ranging from nonane to hexadecane
- Ethoxylated sorbitan mono- and trioleates and sorbitan monooleate (CAS 1338-43-8, 9005-65-6, 9005-70-3)
  - Surfactants used in cosmetics, toothpaste and other consumer products
- Sodium dioctylsulfosuccinate (CAS 577-11-7)
  - a wetting agent in food, industrial, and cosmetic applications and an OTC medicinal laxative

IPIECA and IOGP (2015a) provided a more detailed accounting, with a similar list of other non-dispersant-related applications (Table 1 below). In this table, and in other discussions of dispersant formulations, there are references to "Span" and "Tween" as generic surfactant names. Span refers to nonionic surfactants with a hydrophilic part based on sorbitan and an oleophilic part based on a fatty acid; Tween is another nonionic surfactant made from ethoxylated sorbitan esters. The better-known "DOSS," sodium diisooctylsulphosuccinate, is an anionic surfactant; during the *Deepwater Horizon* spill, DOSS was used as the chemical surrogate for the presence of dispersant in water and fish tissues.

Table 1. Ingredients of Corexit® 9500 and 9527, as provided by manufacturer Nalco. Source: IPIECA and IOGP (2015a).

Chemical abstracts service number	Name	Generic name	Examples of common, day-to-day use
1338-43-8	Sorbitan, mono-(9Z)-9-octadecenoate	Span	Skin cream, body shampoo, emulsifier in juice
9005-65-6	Sorbitan, mono-(9Z)-9-octadecenoate, poly(oxy-1, 2-ethanediyl) derivatives	Tween	Baby bath, mouth wash, face lotion, emulsifier in food
9005-70-3	Sorbitan, tri-(9Z)-9-octadecenoate, poly(oxy-1, 2-ethanediyl) derivatives	Tween	Body/face lotion, tanning lotions
577-11-7	Butanedioic acid, 2-sulfo-, 1,4-bis(2-ethylhexyl) ester, sodium salt (1:1) [contains 2-Propanediol]	DOSS	Wetting agent in cosmetic products, gelatin, beverages
29911-28-2	Propanol, 1-(2-butoxy-1-methylethoxy)	Glycol ether solvent	Household cleaning products
64742-47-8	Distillates (petroleum), hydrotreated light	Hydrocarbon solvent	Air freshener, cleaner
111-76-2	Ethanol, 2-butoxy [NOT included in the composition of COREXIT® 9500]	Glycol ether solvent	Cleaners

The unavailability of detailed compositional information caused public concern and outcry during the *Deepwater Horizon* response, ultimately leading to the release of the Corexit® ingredients listing above. However, detailed lists of constituents for other dispersant products remain unavailable at the current time. Similarly, Place et al. (2010) expressed the need for better, more detailed compositional information from the perspective of environmental analytical chemistry and improved understanding of fate and effects of dispersant mixtures as they reside and weather in the environment. Because many, if not most ingredients in dispersant formulations are also incorporated in a wide range of other products that might find their way into the environment, the presence of chemical dispersant components in environmental samples should be interpreted cautiously. For example, Hayworth and Clement (2012) found that DOSS detected in the waters near Orange Beach, AL in 2010 and 2011 was not dispersant-related, but instead was associated with point and nonpoint sources of runoff during storm events.

Given the complexities associated with comparing potential exposures and impacts to the range of resources and habitats of concern in our region, a structured process of tradeoff analysis, whether it is discussions among resource trustees in the Environmental Unit, or a formal consultation with an RRT, may be of benefit to define what we know and don't know about oil, dispersed oil, and dispersant toxicity—and how they compare. Appendix B provides details of the common frameworks for comparing environmental and other (economic, societal, cultural) risks and impacts that might result from a spill incident and associated response. In the following paragraphs and in subsequent sections of this paper, we will discuss the utility of such response alternative discussions, especially from a Pacific Northwest regional perspective.

Although there are many examples of these kinds of activities that compare response alternatives, beginning with the first Net Environmental Benefits Analysis (NEBA) convened during the *Exxon Valdez* oil spill to examine shoreline treatment options (NOAA, 1990), a more recent report from a 2016 workshop conducted for the Flower Gardens Banks National Marine Sanctuary(FGBNMS) (CRRC, 2016) is a helpful reference in reviewing its discussion of response tradeoffs and implications for the well-being of the sensitive and unique marine resources in that marine sanctuary. As a result of these discussions, RRT 6 amended its area contingency plan to provide guidance for oil spill responses that might impact the FGBNMS. That guidance (RRT 6, 2019) states:

> This guidance and the May 2016 workshop consensus do not specifically preclude the use of aerially applied dispersants, subsea dispersants, or in-situ burns in situations that would result in preventing or reducing impacts to the FGBNMS. The guidance does state that such actions must be implemented with consideration of all environmental factors to include the distance from the coral reefs and potential transport mechanisms. The principle focus is to protect the FGBNMS through the use of the best information available and with consultation with the FGBNMS senior management as well as other technical and scientific experts. Operational decisions should avoid or minimize the potential for environmental impacts to these highly sensitive communities. Taking an inclusive approach will better assure that operational decisions would minimize the potential for concentrations of dissolved or dispersed oil components in the water column that pass through these sensitive coral reefs and associated habitats would have adverse impacts to the community and the animals that occupy the FGBNMS.

CURRENT FRAMEWORK FOR DISPERSANT APPROVAL AND USE IN THE U.S. (National Research Council, 2005)

Under the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR 300, the national response system is the federal government's mechanism for emergency response to discharges of oil into navigable waters of the United States. The system provides a framework for coordination among federal, state, and local responders and responsible parties. Structurally, the national response system is comprised of three organizational levels: National Response Team (NRT, co-chaired by the U.S. Coast Guard and the Environmental Protection Agency), Regional Response Teams (RRTs), and Area Committees. In addition to regional planning and response to federal incidents, this regulation outlines how select RRT members are vested with the authority over the use of chemical dispersants.

The U.S. Coast Guard is designated as the Federal On-Scene Coordinator (FOSC) responsible for ensuring a safe and effective response to all discharges of oil into the marine environment, Great Lakes, and most major navigable rivers. The U.S. EPA is the FOSC for navigable waters of the Columbia River upstream of Bonneville Dam as well as the Snake River. The U.S. Coast Guard is also designated, along with the U.S. Environmental Protection Agency (EPA), as co-chairs for the RRT. At the time of an oil spill incident, a FOSC may authorize the use of dispersants on oil discharges upon concurrence of the EPA representative to the RRT and the state with jurisdiction over the waters. The use of dispersants may require consultation with the National Marine Fisheries Services and/or US Fish and Wildlife Service under the Endangered Species Act (ESA). The RRT representatives for U.S. Department of Commerce and U.S. Department of the Interior may aid in facilitating the consultations. In an effort to compensate for the need to make a rapid decision regarding dispersant use early in the timeline of a spill, the NRT revised the National Contingency Plan to require both Area Committees and RRTs to address, as part of their planning activities, the desirability of using appropriate dispersants and the development of preauthorization plans (40 CFR 300.910). Section 7 of the Endangered Species Act requires consultation with the appropriate Service prior to taking an action that may impact any federally listed species. Approval for use of dispersants, during both planning and emergency phases, falls into this category. Therefore, for purposes of dispersant use planning, any pre-approval agreement is subject to consultation with the Services prior to its implementation.

CURRENT RRT 10/NWACP DISPERSANT USE POLICY

Waters within Regional Response Team Region 10 (RRT 10) and the Northwest Area Committee (NWAC) area of responsibility fall into three different zones with respect to dispersant use: A Pre-Authorization Zone, Case-by-Case Authorization Zones, or No Dispersant Use Zones. In a ***Pre-Authorized*** area, the Federal On-Scene Coordinator (FOSC) may authorize the use of dispersants without further concurrence or consultation with the RRT. For ***Case-by-Case***, according to Section 300.910(b) of the National Contingency Plan (NCP), FOSC authorization to use dispersants requires the concurrence of the Environmental Protection Agency (EPA) and RRT state representatives with jurisdiction over the waters threatened by the release or discharge, and consultation with the Department of Interior and Department of Commerce representatives to the RRT. It is the policy of RRT 10 to also consult with appropriate tribal governments with off-reservation treaty rights in the threatened waters. In the ***No-Use*** Zone, as the name implies, RRT 10 and NWAC have determined it is not appropriate to use dispersants. In these areas, dispersants may be used only if, in the judgment of the FOSC, they are required to prevent or substantially reduce a hazard to human life.

Current zone designations may be accessed online at: https://waecy.maps.arcgis.com/apps/webappviewer/index.html?id=ff1d0cd00e6641209e25b9ee56df46fc but are shown in a static graphic below in Figure 4.

The Dispersant Pre-Authorization Zone is defined in Chapter 4000 of the NWAP as United States marine waters 3 to 200 nautical miles from the coastline outside of Puget Sound[1] and Strait of Juan de Fuca or an island shoreline except for waters designated as a part of a National Marine Sanctuary and the Makah Tribe Usual & Accustomed (U&A)[2] marine area or waters within three miles of the border of the Country of Canada or the Makah Tribe U&A marine area.

The Dispersant Case-by-Case Authorization Zones are defined as:

- All U.S. marine waters in Puget Sound and the Strait of Juan de Fuca that are both within 3 nautical miles of the coastline or an island shoreline, and greater than 10 fathoms (60 feet) in depth, except any area located within a designated No Dispersant Use Zone (described below);
- Waters designated as a part of a National Marine Sanctuary and waters that are part of the Makah Tribe U&A marine area that are also greater than 10 fathoms (60 feet) in depth;
- Waters of the Strait of Juan de Fuca and North Puget Sound from Point Wilson to Admiralty Head and north, and greater than 10 fathoms (60 feet) in depth;
- Marine waters within 3 miles of the borders of the Makah Tribe U&A marine area and the country of Canada. In consideration of the use of dispersants within 3 miles of the Makah Tribe U&A marine area, the RRT 10 will consult with the Makah Tribal government. In

[1] This portion of the NWAP was last revised prior to the term "Salish Sea" coming into accepted use. Where originally used, the term "Puget Sound" was retained in definitions and verbiage taken directly from the NWAP.

[2] This term was used by controversial Territorial Washington Governor I.I. Stevens in 12 treaties in the Northwestern United States. It describes lands adjacent to streams, rivers, or shorelines to which a tribe(s) usually traveled or was accustomed to travel for the purpose of taking fish. As this term applies to National Forest Systems lands, these areas are outside reservation boundaries. Western Federal courts have either referred to or defined the term when deciding lawsuits about the extent of a tribe's off-reservation treaty right to take fish. It has not been found by the courts to include hunting, gathering, grazing, or trapping. It is possible for "usual and accustomed areas" to extend beyond treaty area boundaries and to overlap large areas of a neighboring tribe, based on the specific treaty language. Source: www.fs.fed.us/people/tribal/tribexb.pdf.

considering the use of dispersants within 3 miles of the international border with Canada, RRT 10 will consult with the Joint Response Team, composed of representatives of the United States and Canadian governments.

The Dispersant No Use Zones are defined as:

- Marine waters that are both less than 3 nautical miles from the coastline and less than or equal to 10 fathoms (60 feet) in depth;
- Marine waters south of a line drawn between Point Wilson (48° 08' 41" N, 122° 45' 19" W) and Admiralty Head (48° 09' 20" N, 122° 40' 42" W); and
- Freshwater environments.

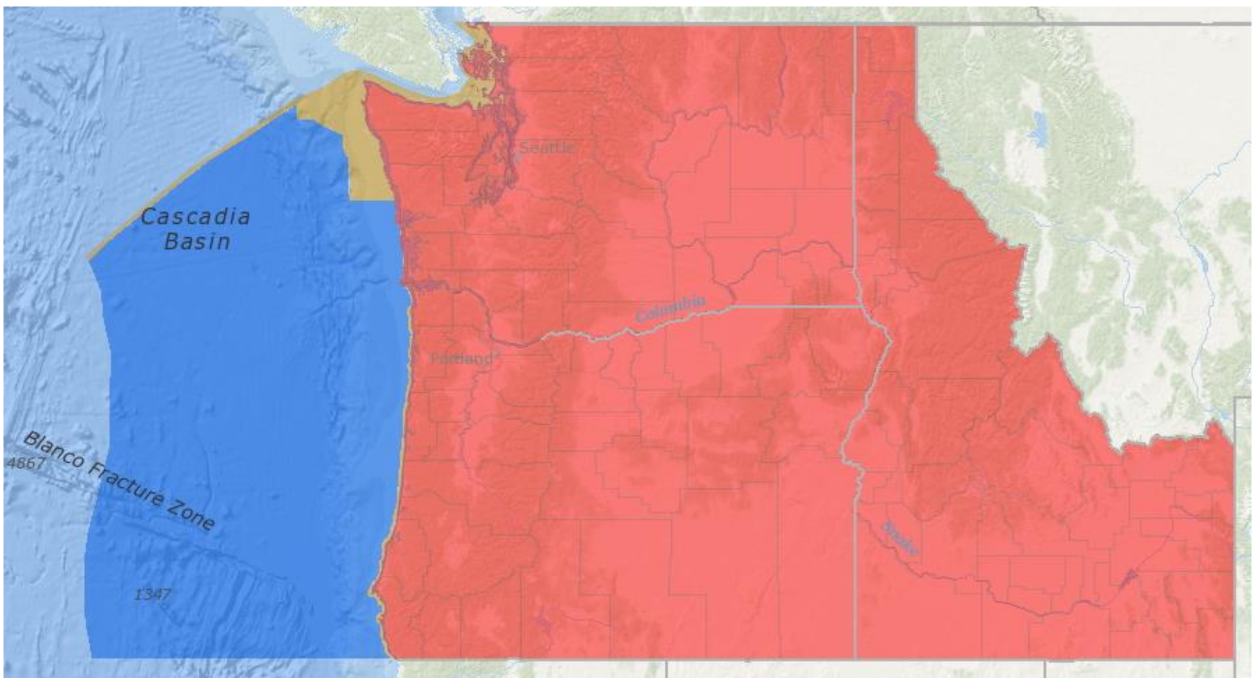

Figure 4. Northwest Area Plan dispersant use zone designations. Key to colors: darker blue = Pre-Authorized; beige = Case-by-Case; magenta = No Use. Source: Washington Department of Ecology.

SUMMARY OF REGIONAL DISPERSANT USE POLICIES IN THE U.S.

Several of the Regional Response Teams around the U.S. have adopted dispersant use policies specific to their respective waters. While these are similar, they may incorporate designations or exceptions to accommodate unique features, resources, or habitats. The summaries below are abridged; for full details, please refer to specific area and regional contingency plans. Figure 5 shows the locations of RRTs in the U.S..

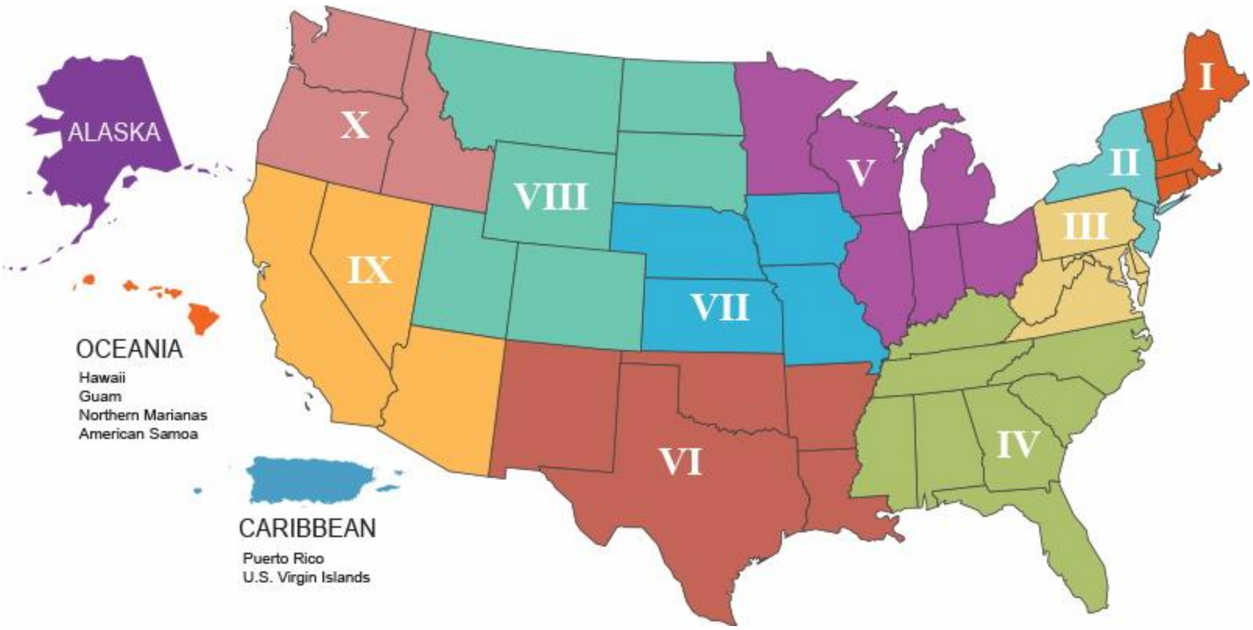

Figure 5. Map of U.S. showing locations of Regional Response Teams. Source: National Response Team.

RRT 1
Maine and New Hampshire have **full pre-authorization** seaward of the 12 nautical mile line out to the extent of the Exclusive Economic Zone (200 mile limit) where water is deeper than 33 feet. **Partial pre-authorization** is in place between 3 and 12 nautical miles where water is deeper than 33 feet. **No pre-authorization** exists within 3 nautical miles of land or in water of depth equal to or less than 33 feet, but dispersant use is not explicitly prohibited in these waters.

Massachusetts and Rhode Island have **pre-authorization** zones seaward of two nautical miles from land where mean water depth is greater than 40 feet. **No pre-authorization** exists within 2 nautical miles of land *or* where mean water depth is less than 40 feet, but dispersant use is not explicitly prohibited in these waters.

Exceptions to the rules: special consideration areas/situations may be spatial, seasonal or species-specific in nature and range from outright prohibition to a requirement for consultation prior to deployment of dispersant. These areas are designated and described in writing by the Natural Resource Trustees.

RRT 2
New Jersey and New York have **pre-authorization** in waters greater than 3 nautical miles from land. Trial application (not to exceed 110 gallons of dispersant) is pre-authorized between 0.5

and 3 nautical miles from land. **No-use zone:** dispersants are not recommended within 0.5 nautical miles of land but are not entirely off the table. A request for use in this zone must be accepted by RCP concurrence network and follow all guidelines prescribed in the ACP and RCP.

RRT 3
Virginia, Maryland, and Delaware have **pre-authorization** 3 nautical miles from land seaward to EEZ (200 nautical miles). Trial application is permitted 0.5 nautical miles from land out to 3 nautical miles, excluding all bays and coves. **Exceptions to the rules:** They have identified several areas near shore (e.g. Big Stone Beach Anchorage) where currents and circulation are conducive to chemical applications, thus are approved.

RRT 4
In general, Florida, Georgia, South Carolina, North Carolina, Mississippi, and Alabama have **pre-authorizations** in waters greater than 3 nautical miles provided waters are deeper than 33 feet. **Case-by-case** approval is required in (1) state waters within 3 nm from shore, (2) special federal management areas such as reserves, sanctuaries, refuges, etc., (3) waters less than 33 feet, (4) waters with mangrove or wetland ecosystems. **No-use** concept exists in the ACP, but no areas are currently designated as such.

Caribbean RRT
Three zone designations: **Green (Pre-Authorization); Yellow (Case-by-Case Approval);** and **Red (Exclusion Zone).**

<u>Criteria for **Green**/ALL conditions must apply</u>
Puerto Rico: Not classified Yellow or Red; at least 0.5 nm seaward of any shoreline; and water depth at least 60 feet.
Virgin Islands: Not classified Yellow or Red; at least 1.0 nm seaward of any shoreline; and water depth at least 60 feet.

<u>Criteria for **Yellow**/ANY condition applies, area not designated as Red Zone</u>
Puerto Rico: Waters designated as marine reserves, National Marine Sanctuaries, National or State Wildlife Refuges, or proposed or designated Critical Habitats; waters within 0.5 miles of a shoreline; waters less than 60 feet in depth; or waters in mangrove or coastal wetland ecosystems, or directly over coral communities which are in less than 60 feet of water.
Virgin Islands: Waters designated as marine reserves, National Marine Sanctuaries, National or State Wildlife Refuges, or proposed or designated Critical Habitats; waters within 1.0 mile of a shoreline; waters less than 60 feet in depth; or waters in mangrove or coastal wetland ecosystems, or directly over coral communities which are in less than 60 feet of water.

<u>Criteria for **Red**/Use prohibited unless: dispersant application is necessary to prevent or substantially reduce hazard to human life; and/or an emergency modification is made on an incident-specific basis</u>
Puerto Rico: No current Red Zone designations.
Virgin Islands: Waters of the Virgin Islands National Park including waters one mile seaward from the park boundary; Waters of the Buck Island Reef National Monument including waters one mile seaward from the park boundary.

RRT 6
Louisiana and Texas have **Pre-Approval** offshore of the ten-meter isobath or three nautical mile line, whichever is farthest from the shore, out to the EEZ (200 nautical miles offshore). **Case-by-Case:** an expedited approval process exists for waters shoreward of the pre-approval area (excluding inland bays and estuaries), *and* in which dispersants can be applied in a specified manner so as to achieve an acceptably low level of environmental risk.

Appendix 43 provides guidance for response operations in the vicinity of the Flower Gardens Banks National Marine Sanctuary.

RRT 9
California's pre-approval zones are only in waters no closer than 3 nautical miles from the nearest shoreline, not within 3 mile of the CA/Mexico border, not within a National Marine Sanctuary, and for uses that do not involved subsea application or application at the surface for more than 5 days.

Case-by-case: There is a separate "Expedited approval process" for areas not in pre-approved area.

No-use: Habitat sensitivities are listed for separate areas covered by the contingency plan. A prohibition in dispersing in these areas in not explicitly stated, but strongly implied.

Exceptions to the rules: None listed.

RRT 10
Oregon and Washington have **Pre-Authorized** use in waters 3 to 200 nautical miles from the coastline outside of Puget Sound and the Strait of Juan de Fuca or an island shoreline except for waters designated as a part of a National Marine Sanctuary and the Makah Tribe U&A marine area or waters within three miles of the border of the Country of Canada or the Makah Tribe U&A marine area.

Case-by-Case areas are seaward of the no-use zone and shoreward of the pre-authorization zone. In this area FOSC authorization to use dispersants requires the concurrence of the EPA and state representatives to the RRT with jurisdiction over the waters threatened by the release or discharge, and consultation with the DOI and DOC representatives to the RRT.

No-Use: marine waters that are both less than 3 nautical miles from the coastline and less than or equal to 10 fathoms (60 feet) in depth.

Exceptions to the rules: marine waters south of a line drawn between Point Wilson and Admiralty Head; and all freshwater environments are included in the no-use zone.

Alaska RRT
With the exception of certain designated avoidance areas, the preauthorization area begins 24 miles offshore and extends southward to the Exclusive Economic Zone, located 200 miles offshore, and 100 miles north of the Aleutian Chain. Two anchor points, located at Cape Suckling and Cape Sarichef, ensure all vessels entering Southcentral Alaska from the south, and traffic using the Great Circle route through Unimak Pass are subject to these dispersant preauthorization requirements.

In all cases, one or more dispersant application field tests to determine the effectiveness of oil dispersion under existing site-specific environmental conditions will be conducted. The ARRT Conditions/Stipulations requires dispersant applications to maintain minimum horizontal separation from swarming fish, rafting flocks of birds, marine mammals in the water, and/or marine mammal haul-outs. Also, an adequate buffer is required to be established to reduce the chances of applying dispersants to sensitive shorelines/nearshore areas and to ensure that drifting dispersant and/or dispersed oil mixtures do not adversely affect intertidal and benthic biota.

Case-by-case: Undesignated Areas span between the shoreline and the 24nm U.S. Contiguous Zone or the 1,000m isobath, whichever is further seaward.

No-use: Avoidance areas were determined through stakeholders and a public comment period.: Essential Fish Habitat; Habitat Areas of Particular Concern (HAPC); seasonality of primary and secondary productivity; fishery stock assessments and commercial fishery harvest data; short-tailed albatross (endangered species) concentration areas and distribution; Audubon's Important Bird Areas; Endangered Species Act-listed threatened and endangered species and their critical habitat; cetacean Biologically Important Areas in Alaska1; physical oceanography parameters (e.g., bathymetry, sediment loading, salinity gradients, kinetic energy and mixing rates, settling rates, benches, troughs, navigational entrances, etc.); hydrographic flow patterns (e.g., lateral, vertical, stratification, upwelling, and seasonal variations); areas of public concern; and other scientific information. Avoidance areas are described in each of the subarea plans.

Exceptions to the rules: Decisions to use dispersants within avoidance areas and in Undesignated Areas outside of the Preauthorization Area require additional concurrence from the following agency representatives before a decision to use dispersants is made: EPA's FOSC, USCG's FOSC, and the Alaska Department of Environmental Conservation's (ADEC) State OSC when state waters are threatened. Consultation with Alaska Regional Response Team (ARRT) members from the DOI and DOC is also required before decisions to authorize dispersant use have been made (unless dispersant use becomes necessary to protect human life, as outlined in the National Contingency Plan).

OCEANIA RRT

Each of three coastal area committees (Hawaii; Guam and Commonwealth of the Northern Mariani Islands; and American Samoa) have designated dispersant use zones: "Dispersants are Preapproved"; "Dispersants are Preapproved with Consultation"; and "ORRT Approval is Required".

The only dispersant plan in Oceania with any preauthorization designation is for Hawaii - in the Hawaii Area Contingency Plan (R. Yender, pers. comm., 1 August 2019).

OVERVIEW OF RECENT AND ONGOING CONSULTATIONS AS THEY RELATE TO DISPERSANT USE POLICIES

The consultation process under the Endangered Species Act (ESA) is complicated and can be confusing. For an overview and summary of ESA consultations, please refer to Appendix C. The following section summarizes the state of regional consultations at the time of this writing (August 2019). In this section, cited references may be found in the regional source documents specified and are not included in the reference section for this white paper.

RRT 10 – Consultation on the NWACP. USCG and EPA initiated consultation on the response actions in the NWACP, including the use of dispersants, in August 2018. The full Biological Evaluation (BE) and attachments are available at the RRT 10/NWACP website. The USCG and EPA are continuing to work with the NMFS and USFWS on the consultations.

Determinations within the BE are made by species, not activity, thus it isn't correct to state that dispersant use is likely or not likely to adversely affect ESA listed species. Rather the analysis is done on the effects of all actions within the NWACP and whether they would result in adverse effects on listed species. The BE developed for the NWACP concluded most marine species would not be adversely affected by response actions described in the NWACP nor designated critical habitats adversely modified or destroyed. Concurrence on this determination by the Services is pending.

It is expected that NMFS and USFWS will issue both their Biological Opinion (BO) and letters of concurrence on the NWACP after additional input from CG and EPA. NMFS and USFWS will issue their opinions on all species and critical habitats likely to be adversely affected through the formal consultation process that concludes with their biological opinions and non-discretionary actions that USCG and EPA must take to minimize adverse effects. For species and critical habitats where effects have been determined to be not likely to be adverse, and the Services have concurred, NMFS and USFWS are likely to provide conservation recommendations. If the Services determines that the current NWACP dispersant policy warrants changes to avoid or minimize impacts on ESA listed species or critical habitats, those recommendations will be shared with USCG and EPA prior to finalizing the consultation process. The ESA Section 7 consultation process is required to ensure that Federal actions do not jeopardize the continued existence of listed species or adversely modify or destroy critical habitat. But it is also an opportunity for the Services to provide recommendations on ways to reduce the impact of Federal actions on ESA listed species and critical habitats.

RRT 9 –Consultation on the California Dispersant Plan (CDP). USCG and EPA worked closely with NMFS and USFWS to develop a BE to evaluate the effects of actions authorized under the California Dispersant Use Plan. The conclusion of the BE is that the actions may affect, but were not likely to adversely affect, ESA-listed species or designated critical habitats. During the consultation, both NMFS and USFWS made conservation recommendations to reduce the risk of impacts on listed species. These recommendations were included in the updated CDP. USFWS provided a letter of concurrence March 7, 2017. NMFS provided a letter of concurrence on May 11, 2018. The entire record of the consultation, including the references cited below, can be found at: https://response.epa.gov/site/site_profile.aspx?site_id=8592

The use of dispersants is limited to marine waters, thus there are concerns about the effects of dispersants on ESA-listed marine mammals, sea turtles, and fish. The following text was developed by NMFS for the CDP concurrence letter and referenced in the NWACP Biological Assessment. All references in NMFS CDP concurrence letter are available at the EPA website listed above.

"The dispersants proposed in the CDP are water soluble. Therefore, in the unlikely event that a whale is sprayed, the dispersants are not likely to remain on a listed cetacean except for a very short time. They are likely to make any oil encountered less sticky to the cetaceans (Lessard and DeMarco 2000, Claireaux *et al.* 2013) and may help to minimize observed impacts such as oil sticking to dolphins during the DWH spill (Dias 2017, DWH NRDA Trustees 2016). The potential genotoxic and cytotoxic effects following the 24 hour exposure scenario of skin fibroblast cells to the Corexit® dispersants and dispersed oil presented in a newer study by Wise (2014) are unlikely to occur in a field scenario, and cytotoxic impacts are noted by Judson *et al.* (2010) as a typical response of cells to xenobiotics. The most likely scenario is that of a cetacean surfacing in an oil slick that has been sprayed with dispersant and that the dispersant/dispersed oil mixture would be washed off the whale as it swam through the area or dived again.

Dispersed oil may be less sticky than undispersed oil (Lessard and DeMarco 2000, Claireaux *et al.* 2013) because of the micelle structure of dispersed oil droplets and, for the baleen whales, any oil taken into the whale's mouths during feeding may be less likely to foul their baleen. Just as uncontaminated water is ejected during feeding, water with dispersed oil would be rapidly ejected compared to the observed time for clearing oil fouled baleen with running water (70% within 30 minutes and 95% within 24 hours – Geraci 1990 in USCG and EPA 2015). This should reduce the ingestion of oil and lower the time whales are exposed to oil. Geraci (1990 in USCG and EPA 2015) calculated that 150 gallons of oil would need to be ingested by an adult whale to cause deleterious effects. As presented in the second CDP BA (USCG and EPA 2015), Goldbogen et al. (2007) calculated the potential oil intake by a fin whale feeding in a spill zone still contaminated with 1 ppm hydrocarbons (Bejarano *et al.*, 2013) to be approximately 18 gallons per day. Therefore, reducing oil concentrations to this level or lower and preventing prolonged exposure times would help prevent potential ingestion impacts to baleen whales.

While it is speculated that the direct application of dispersants onto a cetacean would cause inflammation of sensitive membranes such as on the eyes or mouth, it is known that volatile hydrocarbons cause this impact to marine mammals (Geraci and St. Aubin 1988, Geraci 1990 in USCG and EPA 2015). By mitigating exposure to volatile hydrocarbons, dispersant use could minimize this impact. No-spray buffers reduce the likelihood of direct effects from dispersants to a discountable level. (NMFS 2018)."

The following describes likely effects of dispersants on sea turtles:

There is limited data available regarding the impact of dispersants or dispersed oil to sea turtles. Similar to the analysis for cetaceans and other organisms frequenting the surface of the water, the application of dispersants to an oil slick is expected to benefit sea turtles by reducing the amount of oil on the surface that could stick to them or irritate sensitive membranes such as their eyes, reducing the amount of oil that could be ingested by them, and reducing oil fumes that may be inhaled by them. Average turtle dives last 5-30 minutes and longer dives may last for more than an hour for leatherback sea turtles (Hochscheid 2014) allowing for oil compounds in their lungs time to be absorbed into their blood streams. Recent information generated for the NRDA process for the DWH oil spill clearly shows oiled turtles absorbed PAHs from oil via ingestion and inhalation based on gastrointestinal and lung data (Ylitalo *et al.*, 2017) including a Kemp's ridley sea turtle with an esophagus full of oil. Sea turtles are known to ingest petroleum, perhaps due to mistaking oiled detritus as prey or indiscriminate feeding (Camacho *et al*. 2013), and even very lightly oiled sea turtles recovered during DWH had ~50% occurrence of ingestion (DWH NRDA Trustees 2016). Ylitalo *et al.* (2017) examined 492 sea turtles but found limited data on exposure to dispersants. DOSS (dioctyl sodium sulfosuccinate – a dispersant component) levels were below quantification except in the oil in the esophagus of the aforementioned heavily oiled sea turtle. This indicates that dispersants were either not used in the vicinity of these oiled turtles before they died, or that the dispersant and or dispersed oil was not bioavailable or bioaccumulated by the turtles. This latter hypothesis is in agreement with the research of Wolfe *et al.* (2001, 1999, 1998) which found negligible trophic transfer of petroleum hydrocarbons from invertebrates to vertebrates and that depuration of petroleum hydrocarbons form both vertebrates and invertebrates increased when dispersant was used. This is likely due to the micelle structure of the dispersed oil molecule being absorbed to/by the dispersants and not bioavailable. When this information is considered in conjunction with the rarity of the four sea turtle species in the preapproved application area, the likelihood of direct adverse impacts from dispersants is insignificant.

Impacts to the forage resources of the four sea turtle species is discountable. Green sea turtles are primarily herbivorous but also consume sessile and mobile invertebrates (Lemons et al., 2011). They primarily use resources in shallow, nearshore waters outside of the preapproval zone where any dispersed oil is expected to be diluted to the point it is not detectable or problematic. Olive Ridley sea turtles are pelagic and omnivorous. They are known to dive up to 150m deep to forage on benthic invertebrates. Loggerhead sea turtles found in the action area are typically pelagic juveniles and they are rare off the coast of California except during certain warm water oceanographic conditions. Loggerheads mostly prey on benthic invertebrates, although they also consume some fish and plants. Pelagic red crabs are a favorite prey species. They forage between 0-100m in depth.

Leatherback sea turtles are the species most likely to be found in the cooler waters north of Southern California. They prey upon scyphomedusan jellyfish species, and their critical habitat designation is based upon eddies and oceanic front areas that produce aggregations of brown sea nettles such as along the central California coast. Little is known about the potential impact of dispersants or dispersed oil to jellyfish species, or to brown sea nettles in particular. One study was conducted following the DWH oil spill examining the impact of Louisiana sweet crude oil on two related scyphozoan species, but this study was unfortunately conducted with exposure durations that are unrealistic to a surface application dispersed oil scenario (16-hour and 6-day exposures) and only the nominal concentration of the whole oil was calculated. Nonetheless, it is interesting to note that the two scyphozoan species showed different tolerances to oil pollution. This means that it cannot be assumed that jellyfish in the same species class will react similarly to dispersed oil or dispersant. In general, jellyfish species seem to be very tolerant of marine conditions with compromised water quality conditions and are found in many urbanized nearshore areas, in increasing numbers, where some petroleum contamination is very likely (Purcell 2012).

In order to add an additional level of protection to leatherback sea turtles and their designated critical habitat, the action agencies agreed to add a minimal horizontal no-spray buffer of 100m to observed aggregations of brown sea nettles even without direct observation of a leatherback sea turtle. As discussed earlier, spill specific variables are likely to increase the size of the buffer. The application of this no spray buffer makes the likelihood of adversely affecting the leatherback sea turtle's prey availability or its designated critical habitat discountable.

The following describes likely effects on salmonids:

Once in the ocean, salmonids may be widely distributed in the action area and throughout the water column depending on temperature, prey availability and the presence of predators. Salmonids smolt in estuaries, entering the ocean as juveniles, and largely stay in coastal waters feeding on zooplankton and larval fish. As they grow into subadults and adults, their range and depth utilization greatly expand (Groot and Margolis 1991, Welch *et al*. 2003) as does the variety of their prey resources (e.g. anchovies, herring, etc.).

An ambient sea water study on Chinook smolts (Lin *et al*. 2009) found that the application of Corexit® 9500 to Prudhoe Bay crude oil significantly reduced the oil's lethal potency by 20 times. A subsequent freshwater study on Chinook pre-smolts found similar results (Van Scoy *et al*. 2010). These studies indicate that ESA listed salmonids in the action area may benefit from dispersant applications because the spilled oil becomes less bioavailable to these lifestages. Similar to the other ESA listed fish species for which data has already been presented, the preapproved use of dispersants in federal waters is unlikely to result in significant impacts due to the short duration of exposure to dispersants and dispersed oil, the high mobility of salmonids in the action area, the range of depths used by salmonids, and the wide distribution and abundance of their prey species (NMFS 2015). Juvenile salmonids occupying near shore waters during the first months or years at sea are unlikely to be exposed to problematic concentrations of dispersant or dispersed oil 2-3 nmi from the application site due to dilution in the water column and advection in ocean currents. This contrasts with impacts to early life stages of pink salmon in nearshore areas from undispersed crude oil spilled there by the *Exxon Valdez* in Alaska which are well documented (Bue *et al*. 1998, Heintz *et al*. 1999, Rice *et al*. 2001).

There have been several studies conducted specific to salmonids due to their commercial and ecological importance. Exposing adult chinook salmon to whole and dispersed crude oil in a freshwater experiment did not reduce their homing success or affect the number of days needed for migration (Brannon *et al*. 1986). Similar work conducted on Coho salmon in marine waters had the same result (Nakatani and Nevissi, 1991). Earlier work exposed immigrating adult salmon (99% were Coho salmon) to a mixture of petroleum hydrocarbons and found that the salmon did not avoid hydrocarbon concentration less than 3.2 ppm (Weber *et al*. 1981). When considered together, these three studies indicate that salmonids migrating from the ocean are unlikely to be deterred by dispersants or dispersed oil, or perhaps even undispersed oil unless it is at higher concentrations than typically found post dispersion in the ocean.

In their conclusion, NMFS concurred that the USCG and EPA that the CDP, as updated through the consultation process, was not likely to adversely affect ESA-listed species or adversely modify or destroy critical habitat.

USCG District 4 - Consultation on dispersant use and *in-situ* burning. The District is leading the effort to consult on dispersant use and in-situ burning in the waters of the eastern Gulf of Mexico and SE US waters (North Carolina and south). The consultation with NMFS is nearly complete, but additional information is needed in the BE to cover the recently Brydes whale and other species listed since the consultation was initiated in 2017. Below is a table (Table 2) developed by the consultants to evaluate likely effects of the use of dispersants on various whales in the action area. Note, sperm whales, fin whales and humpback whales are also found in the Pacific Northwest. The BE concluded with USCG and EPA determination that in-situ use and dispersant use is not likely to

adversely affect ESA listed species or designated critical habitats. The full BA is available at the RRT IV website:
https://www.nrt.org/sites/52/files/RRT4S&T_BA_Assembled_20160808_FINAL.pdf

Table 2. Anticipated effects of chemical dispersants and chemically dispersed oil on listed species found in Coast Guard District 4 (eastern Gulf of Mexico and SE US waters). Source: RRT 4.

Listed Species Common Name, Scientific name	Direct Effects[a]		Indirect Effects[b]	
	Dispersant	Chemically dispersed oil	Dispersant	Chemically dispersed oil
Sperm whale, *Physeter macrocephalus*	Unlikely as whales would be in contact with the spray only when on the surface for short periods of time, and dispersant spraying would be performed with caution if whales were observed in the area.	Unlikely because of the low risk of ingestion: sperm whales feed at depths over large areas during foraging episodes.	Unlikely as dispersant concentrations are expected to be below effects levels for prey.	Unlikely as chemically dispersed oil concentrations are expected to be below effects levels. Only prey entrained within the top few meters of the water column may be impacted, likely representing only a small fraction of the available food source.
North Atlantic right whale, *Eubalaena glacialis* **Humpback whale, *Megaptera novaeangliae*** **Fin whale, *Balaenoptera physalus*** **Sei whale, *Balaenoptera borealis*** **Brydes whale, *Balaenoptera adeni***	Unlikely as whales would be in contact with the spray only when on the surface for short periods of time, and dispersant spraying would be performed with caution if whales were observed in the area.	Unlikely because the amount of oil potentially ingested during feeding is below the levels thought to be deleterious.	Unlikely as dispersant concentrations are expected to be below effects levels for prey.	Unlikely as chemically dispersed oil chemically dispersed oil concentrations are expected to be below effects levels. Only prey entrained within the top few meters of the water column may be impacted, likely representing only a small fraction of the available food source.
Critical Habitat for the North Atlantic right whale, *E. glacialis*	Unlikely to have impacts on PCEs.	Unlikely to have impacts on PCEs.	None	None

Alaska RRT – Consultation on the Alaska Unified Plan. In Alaska, the RRT was the first to consult on their entire plan. At that time there was a Unified Plan that included all area contingency plans and the Regional Contingency Plan (RCP). Since that time, the plan has been separated into Captain of the Port zone ACPS, an inland ACP and an RCP. The plans framework is more consistent with the National Contingency Plan, where each COTP is responsible for developing their own ACP and is also consistent with USCG Commandant Instructions. Because the action on which the USCG and EPA consulted was the actions carried out by the plans, there was no need to re-initiate consultation. All documents related to the consultations can be found at alaskarrt.org website.

The NMFS issued their Biological Opinion and concurrence letter on May 15, 2015. The AK Unified Plan was not likely to adversely affect most species but would adversely affect beluga whales. USCG and EPA also conducted a consultation with USFWS on species under their jurisdiction and the issued their Biological Opinion on February 27, 2015.

The BO included measures that had to be followed by the USCG and EPA these include annual reporting on spill response, and efforts to ensure that FOSCs contacted the Services and/or DOI and NOAA representatives for support on responses.

KEY POINTS FROM THE ARCTIC SONS STATE OF DISPERSANT SCIENCE PROJECT

- Dispersants do not chemically change oil. Rather, dispersants increase the oil droplet surface-area-to-volume ratio by reducing oil droplet size, which facilitates hydrocarbon dissolution and biodegradation.

- The application of dispersants to floating oil moves some of the oil from the surface and reduces the potential exposure of surface-dwelling species; but temporarily increases upper water column concentrations by orders of magnitude and can increase exposure to organisms in the water column.

- Dispersants do not change the inherent toxicity of the oil but alter (increase) the concentrations of dispersed whole oil and dissolved components of oil in the water column; thus, increasing biotic exposure to oil.

- Floating oil and dispersed oil may move independently and not necessarily in tandem. Oil that is dispersed into the water column is less affected by winds and is primarily moved by currents.

- Dispersant fate: most studies focus on surfactants (e.g., dioctyl sodium sulfosuccinate, DOSS) alone, not the full dispersant formulation.

- Dispersants generally have lower toxicity when compared to oil.

- Laboratory studies on dispersant toxicity can be difficult to interpret and compare due to differences in exposure protocols, test organisms and endpoints, and the differences between calculated (or nominal) exposure concentrations vs. empirically measured concentrations (these resultant concentrations from the two approaches can be substantially different).

- Early life stages of fish are very sensitive to oil exposure.

- Light can increase the toxicity of oil in and on the water significantly (photo-enhanced toxicity).

- Many uncertainties related to ecotoxicity and potential human effects can be attributed to a basic paucity of research, especially with respect to potential human impacts.

- Since dispersants are rarely used, and accidental human exposures are exceedingly rare, and data on background or baseline levels of human exposure to dispersant-related chemicals in the environment are scarce, it is difficult to fully elucidate and reliably disentangle health effects of oil alone, dispersant alone, dispersed oil, stress, or any combination of these.

KEY POINTS FROM THE NATIONAL ACADEMIES OF SCIENCE, ENGINEERING, AND MEDICINE (NASEM) DISPERSANT REVIEW

General Observations

The focus of the NASEM report is on marine oil spill scenarios for which dispersants would be considered a potential response option. In the United States, that is limited to areas beyond 3 nautical miles from shore and in depths greater than 10 m.

Field and modeling studies show that dispersants can be a useful tool for oil spill response. Dispersants can reduce the amount of surface oil, thereby reducing response personnel's potential exposure to hazardous compounds in oil and lessening the extent of surface oil encountered by marine species. Dispersants may also reduce the fouling of shoreline habitats by reducing the amount of surface oil that is blown ashore.

In evaluating trade-offs and making choices about dispersants and other response options, decision-makers should use Net Environmental Benefit Analysis (NEBA) tools to assess the comparative environmental benefits and drawbacks of various options. NEBA (which traditionally has been restricted to environmental concerns only) should be expanded to address the health of response personnel, community health, and socio-economic impacts of various response options as well.

Transparency is important in cases where dispersants are used. Real-time information on dispersant use and up-to-date health risk information or guidance should be publicly available.

Effects on Marine Life

Dispersants have been used in part to reduce the hazards of surface oil. However, the action of dispersants increases the amount of oil in the water column, where fish and other species below the water's surface may be exposed through ingestion or absorption.

The results of laboratory toxicity studies have been equivocal, at least in part due to a lack of consistency in the preparation of media, exposure procedures, and chemical analyses. The NASEM report recommends an approach for using results from many studies to develop a standard method for assessing the toxicity of individual oil and dispersant components.

Is dispersed oil more toxic to marine life than oil alone? To determine the relative toxicity of dispersed oil, many laboratory studies have compared solutions of oil equilibrated with seawater to oil and dispersant mixtures equilibrated with seawater. Toxicity testing protocols consist of three main elements: media preparation, exposure, and chemical characterization. Preparing a dose of oil (media preparation) is not as simple as preparing a dose of a single miscible compound, because oil components vary in solubility and partition into both the oil and aqueous phases. The NASEM report highlights the variable loading approach for preparing a range of concentrations for toxicity testing as preferred. In this approach, a water-accommodated fraction (WAF, aqueous phase separated from the oil after mixing) is prepared for each concentration of oil to be tested, for example 100 mg oil/L. When a dispersant is included, a chemically-enhanced water-accommodated fraction (CEWAF) is produced at the same oil concentration. Both WAFs and CEWAFs contain microdroplets, but CEWAFs contain a higher concentration of microdroplets for the same initial loading of oil. WAF and CEWAF have the same dissolved oil concentration because at equilibrium the dissolved concentration depends on the oil: water ratio, not the amount of oil present in microdroplets.

An analysis using available variable loading toxicity tests comparing CEWAFs to WAFs shows that the higher concentration of microdroplets in the CEWAF does not increase toxicity until the oil loading is above approximately 100 mg oil/L. Hence, variable loading experiments indicate that at or below approximately 100 mg/L, dispersed oil is no more toxic than untreated oil. Above approximately 100 mg oil/L the increase in toxicity with dispersants is due to increased generation of oil microdroplets—although field measured concentrations during oil spills are typically well below this concentration.

As mentioned in the Arctic SONS summary, phototoxicity may increase the impact of oil in that sunlight increases the toxicity of certain polyaromatic hydrocarbons in oil by 10-100-fold as well as produce new derivative compounds. By reducing surface oil, use of dispersants could reduce potential toxicity of oil.

The NASEM report states that dispersants increase the aerosolization of oil at the air-sea interface. This increases potential inhalation exposure risk for organisms that breathe at that margin, such as marine mammals and seabirds.

In making choices about dispersant use, it is important to recognize the hazards due to the toxicity of the oil itself. That is, unmitigated floating oil slicks pose a significant hazard to wildlife, especially animals found at the ocean surface where they come to rest, feed, or breathe. Decisions on dispersant use should consider the risks posed by oil, relative to the risk of dispersed oil.

Human Health Effects

Two studies examined the health effects of dispersants on responders after the *Deepwater Horizon* spill and reported respiratory and skin irritation. However, drawing conclusive results from those studies is hindered by delays in collecting health information, combined with a reliance on self-reporting. The limitations make it difficult to accurately estimate workers' exposure to dispersants and therefore to untangle the effects of dispersants from the effects of oil and of dispersed oil.

In advance of the next significant oil spill, requirements for gathering information related to worker health and safety should be improved, with a clear focus on whether and how workers were exposed to dispersant.

Concentrations of a common dispersant component -- dioctyl sodium sulfosuccinate (DOSS) -- were measured in fish and shellfish tissue during and following the *Deepwater Horizon* spill, and were found to be low or non-detectable, suggesting negligible human health risk associated with dispersant exposure from eating seafood.

NASEM determined that large-scale oil spills result in mental and behavioral effects in community members. During the spill response following the DWH oil spill, the use of an unprecedented volume of chemical dispersant contributed to these effects. Further, the publicity related to the lack of publicly available information on the chemical constituents of the dispersant formulations contributed to concerns. They made the following recommendations: Wherever possible, full disclosure of a confidential business information agent should accompany initial use. If the authorities are not willing to strongly reassure the concerned public in the midst of a disaster such as the DWH oil spill that a secret ingredient in a dispersant is harmless, it would be best not to use that dispersant. Further, disclosure of real-time dispersant use information and up-to-date health risk information or guidance should be publicly available. Actively engaging public health authorities at the national and state levels early on to provide risk communications will improve transparency, and may increase trust and understanding of health risks, assisting in mitigating the overall psychosocial impact of dispersant use during an oil spill.

Health impacts of oil spills in both workers and community members likely are at least partly dependent on the duration of the recovery period from the oil spill. If dispersants shorten the duration, presumably overall impacts on worker and community health would lessen. This should be included as part of trade-off considerations as decisions are made about dispersant use.

OBSERVATIONS OF THE RRT 10 DISPERSANT TASK FORCE

- The recent dispersant science studies do not fundamentally alter what is known about the physics and chemistry of how dispersants work, especially with respect to the science of surface dispersant applications: these mixtures of surfactants, solvents and other chemicals reduce the interfacial tension between oil and water and facilitate the creation of smaller oil droplets in water that can enter and remain in the water column, where they can be diluted, move with currents, and be subjected to more rapid weathering (including biodegradation, which is considered to be a major fate process).

- The ambient environmental conditions found in the region are not expected to significantly alter the efficacy of currently used dispersants.

- A substantial amount of the recent dispersant science has focused on the efficacy, fate, and effects of direct injection of dispersants into a leaking wellhead. As this was one of the more controversial actions from the *Deepwater Horizon* oil spill, and because oil production in places like the Gulf of Mexico continue to push into increasingly deeper waters, this is not surprising. However, the science related to subsea injection of dispersants is also not relevant to our region, as there are no active or planned offshore oil exploration or production plans.

- The Arctic SONS ecotoxicity workgroup concluded that the pre-2016 literature supported the notion that dispersants increased the oil exposure of water column organisms but did not chemically change the oil to make it more toxic:

  > *Dispersants make smaller oil droplets…This increases the rate at which oil constituents are partitioned to the water column but does not change the toxicity of those constituents.*

  Because a widely publicized journal article (Rico-Martinez et al., 2013) concluded that addition of dispersants increased the toxicity of Macondo crude oil by a factor of 52, this is an important distinction to note. That is, dispersants may increase *exposure* to, but are not known to alter the *inherent toxicity* of oil. The Rico-Martinez et al. paper elicited a published response from other dispersant researchers (Coelho et al., 2013) that suggested the original authors did not adopt key methodological elements of oil and dispersed oil toxicity protocols; and further, they drew real-world conclusions from static exposure tests without reporting actual exposure concentrations.

- The Arctic SONS Efficacy and Effectiveness workgroup noted three poorly studied topics with some relevance to conditions and products that may be encountered in our region:

  - Effects of low salinity waters on how and how well dispersants work;
  - Behaviors of oil with viscosities > 2000 cP;
  - Dispersants other than Corexit.

  The University of Washington LiveOcean Pacific Northwest Ocean and Estuary Forecast model of salinity (https://faculty.washington.edu/pmacc/LO/forecast_sound_oil.html) shows most waters in our area of concern to be above thresholds of known dispersant ineffectiveness—although the influences of rivers like the Columbia and Fraser on salinity conditions off the Washington-Oregon coast and in the Salish Sea are impressive.

A Task Force member pointed out that most waters of the Salish Sea would not be considered to be low salinity; even in those areas with larger freshwater inputs (e.g. inside of Whidbey Island), a salinity of at least 22-25 ppt is maintained. Many of the lower salinity areas are found within designated non-use zones; additionally, in the Pacific Northwest, all freshwater bodies, e.g., the Columbia River, are classified as no-dispersant-use.

In a review of dispersant performance with salinity, Fingas and Ka'aihue (2005) suggested that dispersant efficacy was optimal between 20-40 ppt, with Corexit 9500 less sensitive to variations in water salinity.

Another Task Force member noted that while most dispersants were designed for marine environments, there are others designed to work in low salinity environments. Several studies are available for information on their efficiency, including George-Ares et al. (2001) and Kulekeyev et al. (2014).

The question of oil viscosity, however, has more relevance in our region. Canadian tar sands oil, which forms the basis for dilbit products that are shipped across the Northwest, has a native viscosity of >50,000 cP; dilbit products will be blended to a much lower viscosity to improve flow and transfer characteristics. Existing modeling capabilities, such are those available in WebGNOME, NOAA's trajectory model, include the ability to map weathering of spilled oil to an identified threshold viscosity like 2000 cP. This capability might be useful to model oil fate over time to estimate dispersibility of a spilled oil under a given set of environmental conditions.

The lack of knowledge and information related to dispersant mixtures other than those in the Corexit product line will be a common issue anywhere in the U.S., where Corexit EC9500A is by far the largest stockpile available for spill response. There are, however, other modern formulations that are produced and approved for use in other countries: e.g., Dasic Slickgone NS and Finasol OSR 52.

- Understanding the methods used in oil and dispersant toxicity studies is key to judging how comparable they are to other similar studies, and how relevant they are for real-world spill conditions. The RRT 10 Dispersant Task Force learned from a presentation from Dr. Nancy Kinner of the University of New Hampshire/Coastal Response Research Center, who facilitated and managed the Arctic SONS project for NOAA, that a fundamental disconnect that hampers our abilities to interpret and extrapolate dispersant toxicity studies is that laboratory methods and conditions can be very dissimilar to in situ and field conditions. Notable examples include the lack of measured exposure concentrations in experimental work (important because assumed concentrations based on volumes in mixtures may not result in the intended exposures because oil and dispersants do not readily mix into water); and the use of exposure concentrations that far exceed any exposure scenario we could foresee during an actual dispersant application for a spill response.

  The National Academies of Science, Engineering, and Medicine report on dispersants (2019) recommended moving away from trying to either mimic field conditions in the lab or reconcile lab results with field conditions by instead focusing on generating toxicity test results that could be used as inputs into toxicity models that would be linked to fate and transport models.

…the Committee recommends focusing effort on methods that consistently produce toxicity test results required for calibration and validation of toxicity models at environmentally realistic concentrations. The toxicity models are then used together with environmental fate models…to evaluate the exposure and toxicity associated with various response options.

- Task Force members noted that the NASEM report stated that dispersants increase the aerosolization of oil at the air-sea interface. This suggests a potential increase in risk of inhalation exposure for air-breathing marine organisms as well as humans. NOAA is currently facilitating a collaboration between Johns Hopkins University and the National Aquarium I Baltimore to better understand the relationship between the physics of droplet size and the physiology of cetacean (bottlenose dolphin) breathing. In addition, recent studies by Afshar-Mohajer et al. (2018) and Nishida et al. (2019) reflect increased interest in studying how dispersant use may affect human inhalation exposure risk to oil compounds. The former study found that dispersant use decreased concentrations of volatile organic compounds by around 30 percent but increased fine particulate burden by a factor of 10. Nishida et al. presented results of ongoing work to examine the comparative effect of oil and dispersed oil on human bronchial tissue function, finding that dispersed oil but not oil only or dispersant only altered lung epithelial function in a transient manner. The implications with respect to operational or policy guidance for these ongoing studies remain to be determined.

  There are several vessel traffic risk management assessments (VTRAs) for different waters of Region 10, including multiple versions for the Salish Sea (2010, 2015, 2019), Grays Harbor (2018) and Columbia River (2017) areas. To provide a practical context for considering regional spill risk, the potential implications of dispersant use, and potential rationale for revisiting the current dispersant use policies of the Northwest Area Contingency Plan, members of the Task Force suggested reviewing the VTRAs to identify the current state of oil spill risk based on prevalent product mix and transport modes.

  In addition to risk forecasts such as those in the VTRA, the historical record of marine spills that have occurred in the region provide some insight into areas and resources impacted by coastal incidents. An abridged listing of larger spills in Washington and Oregon is included as Appendix A.

  Of interest is the fact that many of these spills indirectly or directly affected tribal communities and resources. Task Force members had expressed concerns about the implications of dispersant use for tribal fisheries and cultural resources and the potential for dispersant use off the Pacific coasts of Washington and Oregon suggests that coastal tribes may be faced with participating in and dealing with the consequences of dispersant tradeoff discussions.

  While these examples differed in the specifics of the accidents, the spilled oils, and affected resources, common themes included the remote shorelines with difficult access and less-developed infrastructure. For spills along much of the Washington and Oregon coasts, these kinds of challenges are likely to remain and may lead to operational responders to consider dispersant use to reduce potential shoreline impacts. This would suggest that an informed discussion about environmental tradeoffs would be imperative.

TASK FORCE RECOMMENDATIONS

As noted at the beginning of this white paper, several activities and products were initially identified for the RRT 10 Dispersant Task Force when chartered by the Executive Committee of the RRT. That list, and associated outcome or status, is repeated below.

1. **Review Arctic SONS findings**
   The Task Force completed its review of the findings from this project, including a direct briefing by Dr. Nancy Kinner of the University of New Hampshire Coastal Response Research Center.
2. **Review Biological Opinion**
   Reviews and responses from the National Marine Fisheries Service and the U.S. Fish and Wildlife Service had not been completed by August 2019, and thus were not available to this Task Force. However, similar efforts in other regions of the country were examined for comparison and context.
3. **Review National Academy study**
   The Task Force reviewed the pre-print draft of the National Academies of Science, Engineering, and Medicine report on dispersants.
4. **Review West Coast Response Plan**
   The Task Force learned that this effort by the National Marine Fisheries Service was an internal planning document and not intended for public release.
5. **Develop a white paper reviewing the most recent publications on dispersants and determine if changes are recommended for the NWACP**
   This paper and this section.
6. **Develop a fact sheet for public consumption**
   The Task Force determined that there are many fact sheets/"one-pagers" on dispersants that have been prepared over the years by a wide range of groups. A selection of these documents is attached to this white paper as appendices (Appendix D1-D6); the American Petroleum Institute has also created a series of informational fact sheets on dispersants that can be accessed at http://www.oilspillprevention.org/oil-spill-cleanup/oil-spill-cleanup-toolkit/dispersants; Appendix D-4 is an example of this series. One of the recommendations that this Task Force makes is to defer this activity to the subsequent working group in order to reflect relevant technical information on dispersants and a summary of regional dispersant use policy.

RECOMMENDATIONS: BACKGROUND

The Task Force found that much of the newer scientific research on dispersants undertaken after the 2010 *Deepwater Horizon* oil spill focused on deep-water behavior and impacts of dispersed oil injected into a leaking wellhead. Because there is presently no offshore oil exploration or production activity in our regional waters, these kinds of studies had limited relevance for Region 10. However, there was a great deal of pre-existing information about surface application of dispersants to floating oil slicks, and at least some of the recent effects studies could be extrapolated to spill and exposure scenarios and resources at risk in the waters of Washington and Oregon. The recent science does not radically alter our understanding of how dispersants work or the potential toxicological implications of their use; the science does support the notion that dispersant use can change processes and rates of environmental fate mechanisms, also changing the relative proportions of an oil spill distributed across environmental compartments like the sea surface, water column, and atmosphere. This, in turn, can affect exposure of organisms in those marine environmental compartments, including humans.

Modern formulations of dispersants have been shown to be of lower toxicity than both early (e.g., 1960s-1970s vintage) dispersant products and oil itself. However, the use of dispersants can increase short-term oil exposure, and thus the impact, of spilled oil to those organisms in the upper portion (≤ 10 m) of the water column. The potential and intentional alteration to the balance of where oil resides in the environment represents the basis for response decision making that would take place in the Environmental Unit of the Incident Command, or among representatives of the RRT who would be advising the FOSC and the Unified Command. This analysis of response options requires the comparison of environmental tradeoffs expected with each choice, including the choice of not mounting an active response. These choices are complicated by a highly variable environment with different combinations of species and species life stages that are present at different times of the year, in different marine habitats, e.g., estuaries, kelp forests, pelagic, rocky shores, sandy beaches and sea floor[3]. Understanding the seasonal changes of the system and the species it supports is important to properly evaluate trade-offs related to the application of dispersants, which dissipates oil from the ocean's surface to deeper portions of the water column, thereby preventing oiling of beaches and other sensitive coastal habitats, but potentially impacting a whole host of other species and pelagic habitats.

"MINIMUM REGRET" AND RESPONSE DECISION-MAKING TOOLS

The environmental implications of response decisions are superseded in importance only by the implications to human health and safety. If we accept that during a spill, something bad has already occurred, then the goal of response is to minimize additional harm. To put it another way: a past leader of NOAA's oil spill modeling and trajectory analysis group, Dr. Jerry Galt, published a paper (Galt et al, 1996) explaining an underlying "philosophy" for scientific support for oil spill response that was based on a concept from game theory called "minimum regret":

> In any game that is played with some unknown, or chance, factors the player can use available information to try to achieve a "maximum-win" result. An alternate strategy could begin with the same information (and uncertainty) and pursue a more conservative option to achieve a "minimum-regret" result. In general, the more valuable the resources that the player is using, the more preferable a minimum-regret strategy is. As an example, if you had a dollar and wanted to become rich it might make good sense to put it on the lottery with the chance of a maximum win. If, on the other hand, you were in control of your pension fund, a minimum-regret strategy based on bonds and blue-chip stocks would seem more appropriate. In emergency spill response, the inherent uncertainties in understanding the spill situation and its potential to unfold into the future, suggest that trajectory analysis should be aimed at supporting a minimum-regret rather than a maximum-win strategy. The argument becomes even more compelling when you consider the valuable resources that can be threatened by spills.

What does this mean for oil spill response decision making, evaluating the inevitable tradeoffs associated with those decisions, and then specifically, with dispersant use policy in Region 10? It suggests that in a situation where high-value, perhaps even irreplaceable assets (resources) are at risk, a conservative approach incorporating the available information but acknowledging uncertainty is preferable to an approach with a greater risk of loss, i.e., minimum regret.

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[3] The Washington State Marine Spatial Plan developed conceptual models of six habitat types in Washington State marine spatial planning waters (Andrews et al. 2015). In March 2010, the Washington State legislature enacted a new state law on marine spatial planning. One of the primary objectives of this law was to develop a comprehensive marine management plan for the state's marine waters. The law stipulated that the "plan must include an ecosystem assessment that analyzes the health and status of Washington marine waters including key social, economic, and ecological characteristics. This assessment should seek to identify key threats to plan goals, analyze risk and management scenarios, and develop key ecosystem indicators."

The path to making these decisions is frequently, and perhaps always, unclear. However, there are tools available to responders that can facilitate decision making—particularly when they are implemented outside of an actual spill incident, as a planning exercise. These formalize the informal and mostly unstructured process we call tradeoff analysis. The first use of a structured approach was termed Net Environmental Benefits Analysis (NEBA) and was used during the *Exxon Valdez* spill response to evaluate the potential use of a novel shoreline cleanup technique (NOAA, 1990; IPIECA and IOGP, 2015b). Net environmental benefits are defined as the gains in value of environmental services or other ecological properties attained by remediation or ecological restoration minus the value of adverse environmental effects caused by those actions. NEBA is a methodology for comparing and ranking net environmental benefits associated with multiple management alternatives, i.e., response actions. NEBA was also used during the *Deepwater Horizon* spill to evaluate whether established cleanup endpoints for sand beaches were protective for shoreline resources and human health. These two examples from actual spill responses involved relatively lengthy investigative and deliberative processes (i.e., weeks) and large numbers of technical experts. Because of this, NEBA is not well-suited for decisions, such as potential dispersant use, requiring rapid turnaround.

A retrospective NEBA-type approach was used by Lunel et al. (1997) to examine the tradeoffs, and what the authors described as the net environmental benefits, of dispersant use during a major oil spill in the UK, the *Sea Empress*. In that case study, an estimated 445 tons of several dispersants were applied to an estimated 72,000 tons (19 million gal.) of Forties Blend crude oil. Lunel et al. used empirical measurements of oil in the water and modeling to conclude that between 57,000 – 110,000 tons of emulsified oil were prevented from reaching the shoreline because of the use of dispersants. Their analysis concluded that impacts to sea birds, coastal waders, intertidal vertebrates and invertebrates, and amenity areas were substantially reduced, and that these benefits outweighed the potential disadvantages associated with elevated oil concentrations in the water column.

Similar evaluative frameworks have been used in spill response planning to compare and select preferred response alternatives. The U.S. Coast Guard supported Consensus Ecological Risk Assessment (CERA) workshops in many locations around the country (Mearns and Evans, 2008). A CERA workshop is an extended, multi-day spill drill in which participants—typically resource trustees, nongovernmental organizations, tribal and industry representatives, and other stakeholders—learn and practice a risk-based method for assessing the relative ecological benefits and impacts of alternative response actions, including no response ("natural recovery"), open-water mechanical cleanup, open-water dispersant application, in-situ burning, and mechanical shoreline cleanup. Extensive discussions of risks, tradeoffs, assumptions, and uncertainties within and among small groups is intended to enhance the opportunity for consensus among participants to develop.

Both NEBA and CERA focus exclusively on environmental tradeoffs. A more recent adaptation of comparative response alternatives evaluation created by the oil and gas industry is Spill Impacts Mitigation Analysis (SIMA) (IPIECA, API and IOGP, 2018). This variation on the NEBA theme compares impacts not only to ecological resources, but also to socio-economic and cultural resources as well.

The NEBA/CERA/SIMA approaches rely on discussions among a broad range of technical specialists and concerned communities, frameworks which do not lend themselves to supporting rapid decision-making. However, as planning tools, they can be scheduled and implemented outside of actual spill responses where the critical time constraints of, for example, oil dispersibility or combustibility do not burden or restrict in-depth discussions about response options and spill impacts. Conflicts and chokepoints can be identified in advance of an actual incident, and at a minimum, anticipated for consideration in an Environmental Unit or RRT. As is the case with other drill-type activities, relationships are also established prior to a spill incident and facilitate better communication in an oil spill response.

These kinds of tradeoff discussions may involve a diverse set of stakeholders, responders, tribal members, resource managers, and technical experts. In our region, we are fortunate to have informed and engaged stakeholders and tribal leaders, experienced responders, committed resource managers, and an elite set of so-called "world-class" scientists who could support NEBA/SIMA efforts. As specific examples of some of local expertise, we can cite the likes of the recently retired Alan A. Allen and Scott Knutson on the operational side of response; or Dr. John Incardona (NOAA), Dr. Jim West (WDFW), and Dr. Tracy Collier on the toxicological side. Recently retired NOAA response scientist Dr. Alan Mearns participated in many CERA workshops nationwide, and Dr. Ed Owens is known worldwide for his knowledge and experience related to Shoreline Cleanup Assessment Technique and shoreline cleanup methods. In short: there is an impressive abundance of expertise in this region that could be enlisted into assisting with facilitated tradeoff analyses.

RECOMMENDATION #1:
The Dispersant Science Task Force recommends the consideration of a NEBA/CERA/SIMA workshop approach for anticipating potential resource impacts of dispersant use and other response alternatives in our region. Regional subject matter experts, such as fisheries and wildlife scientists, should be recruited to help develop more sophisticated decision support tools and resources that would elucidate tradeoffs related to impacts of dispersant use on marine species during oil spill response, in advance of the next major oil spill.

UNCERTAINTIES REGARDING HUMAN HEALTH IMPACTS
The Task Force reviewed a number of recent articles in the scientific and popular literature regarding the potential and known human health impacts of both oil and dispersant exposure. Of all the subject matter categories related to oil and dispersed oil, this topic appears to be the least well-studied and understood and is burdened with the greatest degree of uncertainty. Nevertheless, a recent epidemiological study (Alexander et al., 2018) determined acute respiratory impacts in nearly 5,000 Coast Guard response personnel from the *Deepwater Horizon* who reported they had been exposed to oil (54.6%) and dispersants (22%). An important detail in this study was that the researcher was not able to distinguish between the effects of oil exposure alone vs. dispersed oil and dispersants. This led to misinterpretation in some media reporting the research results, such as a headline on NOLA.com: "Coast Guard responders harmed by chemicals used to clean up BP oil spill, research shows" (Baurick, 2018). This article in turn led to a letter written to the NOLA.com editor by Dana Tulis, Director of Incident Management and Preparedness for the Coast Guard, which in part stated:

> Your article, "Coast Guard responders harmed by chemicals used to clean up BP oil spill" (March 6, 2018), inaccurately claims the study found Coast Guard responders had greater health issues if they were exposed to dispersants. However, that is not what the study found. The authors specifically write that they couldn't differentiate between responders exposed to dispersants versus those exposed to both

> dispersants and crude oil. In fact, 91.1 percent of responders who self-reported dispersant exposure, also reported crude oil exposure…
>
> It's important to understand that – while a much-needed first step in the health monitoring process – this study has significant limitations. The study focuses on exposure to crude oil – not dispersants. And perhaps most importantly, the data was self-reported. If a responder wasn't directly involved with handling a dispersant, they can't know for sure whether they were exposed to a dispersant, much less what type of dispersant. In reality, with dispersant spraying operations occurring offshore, far fewer responders were exposed to dispersants compared to those who self-reported exposure in this data.

A companion study to Alexander et al. (2018) has just been made available online, with publication in October 2019. This paper, Krishnamurthy et al. (2019), also analyzed results from the Coast Guard cohort study but focused on neurological impacts. The authors concluded that increasing exposure to crude oil correlated to increasing incidence of neurological disorders, with apparently greater magnitude of impact in those respondents reporting exposure to both oil and dispersants. Because these analyses relied on the same reporting methods as the respiratory study, the same kinds of limitations identified by Tulis above would apply.

The Task Force also reviewed a 2019 article in the magazine Mother Jones (Kistner, 2019), which provided anecdotal accounts from Gulf coast residents of *Deepwater Horizon* dispersant exposure in 2010 and reports of acute and chronic health issues that followed. The account of being sprayed with dispersants on a vessel of opportunity, or the author's own story of being sprayed near a marina in Venice, LA, are completely at odds with what we as responders know from official policies and records of dispersant application sorties. Yet, a Task Force member related her own experience with local community members who had worked on the spill with similar stories. The discrepancies between these two realities, anecdotal and official, cannot be reconciled, especially at this point in time nearly ten years after the fact.

While we acknowledge the limitations and uncertainties associated with the human health-related research, and while it is not possible to reconcile the divergent realities of dispersant exposure experiences from the response, the Task Force recognizes the importance of protecting responders and the public from both oil and response chemicals and makes the following recommendation:

RECOMMENDATION #2:
The Task Force recommends working with response agencies, oil spill response organizations, and health professionals to improve the environmental and occupational "chain-of-custody" accounting for dispersants and other spill response chemicals. This might include:

- ***Review of record-keeping procedures and requirements related to handling and application of spill response chemicals like dispersants to document potential exposure hazard;***
- ***Review of personal protection equipment requirements and policies, to ensure that responders are adequately protected under all conditions;***
- ***Review of standard (chemistry-based) and novel approaches to determining presence or absence of dispersant residues in the environment to provide rapid assessment capabilities for information to concerned and affected communities during response.***

REGIONAL DISPERSANT POLICY
As we have stated elsewhere, the Task Force believes that our fundamental understanding of the physics and chemistry underlying dispersant function remains unchanged after the renewed scientific scrutiny over the last ten years. That is: application of chemical dispersants to surface

slicks of oil reduce interfacial tension between oil and seawater, facilitating the formation of smaller oil droplet sizes than would occur with natural dispersion (i.e., in the absence of dispersant). Dispersed oil is moved into the upper water column on a short-term and constantly diminishing basis. Dilution and an array of weathering processes degrade the oil. Dispersants are not without their own inherent toxicity, but the chemicals used in the mixtures are common in both other industrial and consumer-grade products, and modern dispersant formulations tend to be less toxic than oil itself.

Regional dispersant use policies summarized in this document reflect the regulatory translation of dispersant physics into practical guidelines. By specifying use restrictions based on depths from 10-20 m or distances from land varying from 0.5-3 nm, policymakers have intentionally reduced potential interactions with benthic organisms, shoreline habitats, and many nearshore life stages judged to be more sensitive to oil or chemical exposures. Some regions, including Region 10, have made modifications to the arbitrary restrictions to accommodate special areas such as marine sanctuaries or tribal U&A areas.

In the Salish Sea waters of Region 10, assignment of different areas to the three designated dispersant use zones (Pre-Authorized, Case-by-Case, and No-Use) is specified in the NWACP (as summarized above). However, a major exception to the rules exists: the designation of the waters south of Admiralty Inlet as a No-Use area. While this might seem to be both a practical and reasonable exception, given the concentration of population and proximity to many public use amenities in the southern Salish Sea, this has resulted in an elevated level of concern for residents of the San Juan Islands, in particular. It is not known why this area was not included in the No-Use exception made for the southern part of the Salish Sea, but this kind of apparent difference in our policy should be examined by a future policy task force to determine if changes are warranted.

In this case, and possibly in discussions of other potential revisions of the existing NWACP dispersant use policy, science is not necessarily the sole or even primary basis for making dispersant use zone designations. However, the last substantive examination of regional dispersant policy took place at least 14 years ago and possibly before; it is not an unreasonable time to revisit the existing policy designations to ensure they are consistent with current values and expectations. Moreover, the changing nature of oil transport (different oil types and transportation modes, availability of vessel traffic risk assessments for specific waters) and declining status of some regional marine resources (and potential policy changes resulting from biological consultations), and the availability of improved knowledge and monitoring capabilities of oceanographic conditions and features in Pacific Northwest waters, suggest that this is an appropriate time to examine the relevance of the existing policy. As we noted in the Introduction to this white paper, Chapter 4000 of the NWACP directs "As new information becomes available, these policies will be revisited, modified, and enhanced as appropriate." Therefore:

RECOMMENDATION #3:
The Task Force supports the chartering of a subsequent task force to examine the existing NWACP dispersant use policy to ensure consistency with current regional needs, values, uses, scientific knowledge, and treaty rights.

DISCUSSION AND CONCLUSIONS

The Dispersant Science Task Force of the NWAC/RRT10 was chartered on February 8, 2019. A total of 17 people signed up for the group, with one person withdrawing prior to its conclusion. Meetings were held by phone on 27 March, 20 May, 10 June, 24 June, 8 July, 15 July, 29 July, 5 August, 12 August, 19 August, and 26 August. On 13 May, Dr. Nancy Kinner presented an overview of the Arctic SONS project results to the Task Force at the Jackson Federal Building in Seattle. The Task Force facilitator briefed the NWAC and the Steering Committee on 29 May and 8 August, respectively.

Largely because of the group commitment, the Task Force adhered to its charge of reviewing the recent science to determine if those findings warranted subsequent review of regional policy. The volume of scientific study was overwhelming, given the amount of work that has taken place in the wake of the *Deepwater Horizon* spill. However, the Arctic SONS project and the NASEM review, both of which concluded this year, provided convenient entry points to, and syntheses of, the research. While a great deal of the recent science was specific to conditions from the *Deepwater Horizon* and waters of the Gulf of Mexico, a large amount of it was also more generic and more relevant to potential oil spill scenarios in the Pacific Northwest.

Our reading of the scientific reviews represented by the Arctic SONS project and the NASEM report, as well as examination of other journal articles that fell outside the purview of the syntheses, suggested that the broad structure of scientific understanding with respect to how dispersants work (or don't), inherent toxicity of modern dispersant mixtures, and differences across impacts from oil itself, chemically dispersed oil, and dispersants remained relatively consistent with pre-*Deepwater Horizon* knowledge. The two areas where recent research raises yellow cautionary flags, from the perspective of interpretation and extrapolation into policy considerations, fall under the categories of 1) dispersed oil and dispersant effects to exposed marine organisms like larval fish, and to air-breathing animals at the air-sea interface like marine mammals or seabirds; and 2) possible human health effects to response personnel and the broader public. In both cases, separating effects from oil alone (i.e., not using dispersants), and dispersed oil or dispersants, has been challenging. This is especially the case for human health studies, the largest of which unfortunately are not able to distinguish how surveyed participants were exposed.

The uncertainties related to these two considerations played roles in two of the recommendations of the Task Force: to engage in a more formal response tradeoff discussion under a NEBA/SIMA-type framework, in order to focus on specific resources of concern for our region; and to review response personnel/human health and safety guidelines in the NWACP to ensure the greatest degree of protection from possible exposure to both oil and dispersants.

The third recommendation of the Task Force, to charter a new task force to review existing NWACP policy on dispersant use, is likely the most significant of the lot because it potentially affects an important part of the NWACP. By all accounts, it has been a long time—at least 14 years—since the policy was reviewed/revised. While recent scientific findings may not in themselves prompt a policy review, it is possible that pending requirements on the action agencies resulting from the Biological Opinion process by the Services may result in changes to the policy. In addition, if opinions expressed by Task Force members are any indication, regional stakeholders, tribes, and resource managers are interested in reviewing dispersant use designations for portions of the Salish Sea. Finally, our review of the recent dispersant science does not *preclude* a new review of existing dispersant use policy. For these reasons, we believe it is an opportune time to take on this task.

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Appendix A. Significant larger spill incidents in Washington and Oregon waters

- *United Transportation Company barge* (1964), a barge loaded with refined products from the Ferndale (WA) refineries was making a delivery run down the outer coast to Coos Bay, OR when the tow line failed during a storm. Set adrift, the 200-foot barge, which was carrying 2,352,000 gallons of gasoline, diesel, and stove oil, grounded on a sandbar offshore between Moclips WA and Pacific Beach, just south of the Quinault Indian Reservation. Weather hampered removal efforts but eventually the barge was moved off the bar. However, 1.2 million gallons leaked from the barge. The spill fouled beaches from the Quinault Reservation south for 10 miles, killing untold numbers of seabirds. Wildlife researchers also reported massive shellfish deaths: 32,000 pounds of razor clams were killed by the spill, and officials immediately closed clam digging everywhere north of the Copalis River (de Place and Stroming, 2015).

- *General M.C. Meigs* (1972), a WWII troop transport carrier that had been mothballed near Olympia, WA, and was being towed to the Suisun Bay (CA) vessel layup area but broke loose in a storm and grounded near on Shi Shi Beach south of Neah Bay, where she eventually spilled 2.3 million gallons of residual heavy fuel. There was no attempt to remove the wrecked vessel from the shoreline. A die-off of purple sea urchins was documented, and petroleum residues were detected in intertidal organisms for a year (Clark et al., 1975).

- *Mobiloil* (1984), a tanker, was en route from Ferndale WA ten miles downstream from its destination of Portland OR when it experienced rudder failure. Unable to regain steering, the ship ran aground near Warrior Rock in the Columbia River, ripping a long gash through its starboard cargo tanks. A week later, salvors were able to refloat the vessel and escort it to a dry dock in Portland, but not before it leaked 165,000 gal. of heavy oils (residual oil, industrial fuel oil, and No. 6 fuel oil) into the Columbia River. Some of the oil sank or was suspended in the water, and the portion in and on the water was pushed downstream. In the ensuing weeks, beaches as far away as Cannon Beach OR, and Cape Flattery WA, were coated in oil, with the highest concentrations along the river's beaches and the swath of shoreline from Cape Disappointment north to Grays Harbor on the Washington Coast. The spill killed thousands of seabirds along the river and coast. Chemical sampling of sturgeon in the river detected heavy aromatic petroleum hydrocarbons. Shellfish beds of Willapa Bay and Grays Harbor were oiled (NOAA, 1992).

- *Arco Anchorage* (1985), a tanker carrying 34 million gal. of Alaska North Slope crude oil, ran aground in Port Angeles, WA while waiting to offload at the Cherry Point refinery in Anacortes, and lost 239,000 gal. into the harbor. Under the influence of wind and tides, oil was carried west to Neah Bay and east to Dungeness Spit. The oil spill killed over 4,000 seabirds, along with an untold numbers of harbor seals, otters, shellfish, and salmon. Dispersant use was discussed early in the response but was ruled out "due to the oil movement toward environmentally sensitive areas, weathering of the oil, uncommonly calm seas, and the fear that authorization for dispersant use would take too long" (NOAA, 1992).

- Barge *MCN-5* (1988). While being towed from the Texaco refinery in Anacortes to Seattle by the tug *James T. Quigg*, the tank barge *MCN-5* capsized and sank in Rosario Strait about

300 m off Shannon Point with nearly 415,000 gal. of heavy cycle gas oil on board. Salvage crews managed to pump much of the trapped oil out of the barge, but less than 105,000 gal. was estimated to have been released into the water; however, the high specific gravity of the product (1.086) meant that what was released did not surface. A smaller amount (nearly 12,000 gal.) of other, less dense intermediate fuel oil and marine diesel was also released, and these products did float and oiled kelp beds near Burrows Bay. The notable environmental threat of the sunken oil was to water intakes for the Shannon Point Marine Center, operated by Western Washington University. Heavy oil on the bottom was observed near a deep intake, necessitating special measures to prevent oil and contaminated sediments from being drawn into the water supply (NOAA, 1992; Yaroch and Reiter, 1989; de Place and Stroming, 2015).

- *Nestucca* barge (1988). En route from BP's Cherry Point refinery to Portland OR, with a delivery stop at Aberdeen WA along the way, the tugboat *Ocean Service* towing the barge *Nestucc*a attempted to cross the bar into Grays Harbor. While trying to shorten the length of the towline, the tug collided with the barge, causing a gash in its hull. The Nestucca was laden with nearly 3 million gal. of No. 6 bunker fuel, and in the 23 hours that the product leaked, a total of 231,000 gal. was released. The spilled product in the *Nestucca* was a heavy oil that likely would not have been amenable to dispersant application; Offshore oil was observed mainly in the form of light sheen with small patches and pancakes of oil. The bulk of the oil washed up around Ocean Shores WA. The oil killed or injured an estimated 56,000 seabirds, and cleanup workers sent 585 tons of oiled waste to landfills and had to burn 45,000 cubic yards of oiled driftwood (NOAA, 1992; de Place and Stroming, 2015).

- *Tenyo Maru* (1991) a fish processor which collided with the freighter *Tuo Hai* 25 mi. northwest of Cape Flattery in Canadian waters. The *Tenyo Maru* quickly sank, and one crewmember died in the incident. The *Tenyo Maru* carried 475,000 gal. of intermediate fuel oil and continued to leak after it sank. Around 361,000 gal. was released before the remainder was pumped from the wreck in an operation using a remotely operated vehicle (ROV). 800 live oiled birds and 3,700 dead oiled birds were recovered during the spill. Most were common murres, but a number of other species were also collected, including federally threatened marbled murrelets (NOAA, 1992).

- Crowley Barge *101* (1994). The Crowley Marine Services' Barge *101* leaked an estimated 27,000 gal. (of a cargo of nearly 2.7 million gal.) of diesel fuel into Rosario Strait and the waters north of Anacortes WA before the tugboat crew towing the barge noticed the spill. Several more hours passed before the flow of oil leaking from a 4' gash in the barge cargo tanks was secured. A subsequent investigation determined that the barge was ruptured after running aground on Clements Reef, north of Sucia Island. Oil impacted beaches on Guemes Island as well as on Blakely, Cypress, Sinclair, and Orcas Islands. A skimmer collected around 200 gallons of oil from around the barge, and oiled birds were taken to a wildlife rehabilitation center in Lynnwood. The Department of Ecology purchased 450 acres of tidelands in Fidalgo Bay with the damage settlement from the spill (de Place and Stroming, 2015).

- *New Carissa* (1999) was a bulk wood chip carrier that grounded outside the entrance to Coos Bay, OR in heavy weather and began to leak heavy fuel oil and diesel as the ship was battered by waves in the surf zone. Some of the fuel was intentionally burned by Navy demolition experts before the ship broke in two on the beach; the bow section was eventually towed out to sea with the intent of being sunk, but its towline broke and that section drifted back onto shore near Waldport. The bow was eventually refloated (again) and towed nearly 300 miles offshore, where it was sunk by Navy vessels. The stern section remained on the beach at Coos Bay until it was finally dismantled by late 2008.

- Foss barge *248-P2* (2003). Crews loading tank barge *248-P2* with heavy fuel oil at the Point Wells ChevronTexaco terminal near Shoreline WA miscalculated the flow rate and overfilled the barge's cargo tanks. The error spilled approximately 4,700 gal. into Puget Sound, most of which washed ashore between Point Jefferson and Indianola on the Kitsap Peninsula. A mile and a half of shoreline was impacted, as well as the critical forage fish habitat in Doe-Kag-Wats saltwater marsh, on Suquamish Tribe Reservation land on the northern shore of Port Madison. The oil killed seabirds and at least one harbor seal pup. Shellfish harvesting around Doe-Kag-Wats was disrupted for months (de Plae and Stroming, 2015).

- Dalco Passage/*Polar Texas* (2004). At 1:30 in the morning, a tugboat operator sailing through the Dalco Passage between Vashon Island WA and Point Defiance called the National Response Center to report encountering an oil spill. Darkness and heavy fog hindered the initial response; patches of oily sheen drifted as far south as the Tacoma Narrows and as far north as Eagle Harbor on Bainbridge Island. Officials closed parks on Vashon and Maury islands and suspended shellfish and seaweed harvesting as cleanup crews worked to recover an estimated 59 tons of oily debris from the shorelines and 6,842 gal. of oily water with skimming operations. The Coast Guard eventually tracked the spilled oil back to the *Polar Texas*, a tanker vessel owned by ConocoPhilips. ConocoPhilips denied that the *Polar Texas* was responsible for the spill, though the firm paid $588,000 to settle damage claims from federal and Washington state environmental agencies, which had spent around $2.23 million responding to the spill (de Place and Stroming, 2015).

Appendix B. Net Environmental Benefit Analysis (NEBA) and Spill Impact Mitigation Assessment (SIMA): Process and Considerations

Industry and government agencies make every effort to prevent spills of hydrocarbon into environment. In an unfortunate event of an oil spill decision-makers have to evaluate possible response strategies and select those that would be optimal for a specific scenario. While there are several ways to conduct this evaluation, they all are based on the same principles and aim to minimize impacts on people and the environment and facilitate fastest ecosystem recovery. Safety of public and responders is the foremost goal of the response and it is addressed first before any additional environmental or socio-economic analysis would take place. No response action that would put public or responders into harm's way would be taken. After required actions have been taken to protect human health and safety, response options can be evaluated for their ability to protect environmental and socio-economic resources. Depending on the nature of the event and timing of the decision (during contingency planning or response phase) this process may be applied at different levels of complexity, while maintaining the same "minimize the harm" goal:

- Without formal process:
    - Contingency planning or response strategies to stop the source of a spill and minimize oil spreading are examples of decisions based on "minimize harm" principle that don't require formal analysis to confirm its value as they are rooted in years of practical experience.
    - Ensuring that variety of tools are available in response toolbox to be effective under different spill scenarios and environmental conditions is also intuitive.
    - These principles are behind regulatory requirements and contingency plans, even though they may not have a visible description of underling drivers.
- With formal process:
    - **Consensus Ecological Risk Assessment (CERA) Workshops** have been conducted by Coast Guard in all districts since 1998. These workshops brought together a variety of technical experts and community members and used comparative risk methodology to conduct formal Net Environmental Benefit Analysis (NEBA) and evaluate oil spill response options for that region in a planning environment. Description of the methodology and examples of workshop reports are available online https://response.restoration.noaa.gov/oil-and-chemical-spills/oil-spills/resources/ecological-risk-assessment-era-workshops.html
    - The same **NEBA comparative risk methodology** (IPIECA and IOGP, 2015b) can be used for individual contingency plans and spill scenarios during response or planning phase.
    - The challenge of the CERA/NEBA method is the extent of scientific information and time required for the analysis. It may not be suitable for short responses or areas where no detailed information is available. To address this need, a **Spill Impact Mitigation Assessment (SIMA)** (IPIECA, API, and IOGP, 2017) method was developed. It emphasizes the importance of stakeholder engagement and reliance on practical experience, best available information and local knowledge and allows comparing response options in a shorter time frame and even with limited information. It also specifically addresses socio-economic resources as well as cultural and special value resources of local communities. In contingency planning phase this methodology could be used with the same complexity and rigor as NEBA comparative risk methodology.
    - Numerical modeling such as **Comparative Risk Assessment (CRA)** (Bock et al., 2018) could also be used to compare relative benefits of response options. This

approach combines predictions from an oil spill fate model on the surface areas and water volumes and days of exposure above threshold surface oil thickness or water column oil concentrations with the relative density distributions of Valuable Ecosystem Components (VECs) across environmental compartments to determine the fraction of the VECs exposed to oil above the threshold; the relative ability of the VECs to recover based on life expectancy; and a method of exploring different assumptions of the value of each VEC.
    - There are some other **numerical modeling** approaches used internationally, but typically not in US, where greater value is placed on stakeholder engagements and building consensus solution rather than relying solely on modeling results.
- <u>Practical application of conclusions from formal and informal processes and actual experience:</u>
    - It's not always possible or practical to conduct formal assessment process, yet there is a need to make timely response decisions based on best available information. In this case conclusions from earlier assessments, assessments conducted for similar scenarios in other areas, experiences from oil spill responses and restoration projects globally could be converted into policies, checklists and flow charts to facilitate timely, informed and transparent decision making. Some of the examples incorporating NEBA/SIMA principles and best available knowledge, including:
        - Pre-authorized dispersants use zones for offshore areas in all US coastal states have been established based on concussions from many previously conducted analysis and actual responses that dispersing surface slick offshore under appropriate conditions have greater overall benefit than allowing it to come into sensitive nearshore areas.
        - More detailed questioners and flow charts for "case-by-case" areas, which allows to gather more location-specific information to determine whether a response technique has benefit under a specific spill scenario.
        - Designated "no use" zones where based on previous experiences in similar situations or NEBA/SIMA analysis indicated that response technique would not be beneficial.
    - When a spill takes place in an area that has already conducted NEBA or SIMA analysis, the actual spill scenario can be compared to the one used in earlier formal analysis. If they are reasonably similar, some adjustments could be made to reflect specifics of the scenario and then significant portion of the earlier analysis and conclusions could be used for expedited decision-making.

Regardless whether conducted formally or informally, NEBA, SIMA, CRA and other methods offer structured approaches used by the response community and stakeholders during oil spill preparedness, planning and response, to compare the impact mitigation potential of candidate response options and develop a response strategy that will minimize the net impact of an oil spill on the environmental, socio-economic and cultural resources at risk. They are based on similar considerations:

- Safety of public and responders need to be addressed first.
- Key assumption is that oil is already in the environment and response options will change its presence in various environmental compartments. Impacts of untreated slick need to be considered along with slick treated with various response options.
- All feasible response options should be considered (Response Toolbox).
- There are no response methods that are completely effective or risk-free.

- Realistic effectiveness of response techniques under specific spill conditions need to be considered.
- Process considers all affected resources and uses ecosystem approach to evaluate impacts to populations and habitats, rather than impacts to individual organisms alone. It also considers socio-economic and cultural resources.
- It takes holistic view to evaluate long-term impacts on public and ecosystem and considers rates of recovery to return affected resources to pre-spill condition.
- Relies on best available science and location-specific information.
- Encourages stakeholder engagement and transparency of decision-making.

The assessment process is typically comprised of four stages:

1. Compile and evaluate data to identify an exposure scenario and potential response options, and to understand the potential impacts of that spill scenario.
2. Predict the outcomes for the given scenario, to determine which techniques are effective and feasible.
3. Balance trade-offs by weighing a range of ecological benefits and drawbacks resulting from each feasible response option. This will also include an evaluation of socio- economic benefits and costs resulting from each feasible response option.
4. Select the best response options for the given scenario, based on which combination of tools and techniques will minimize impacts.

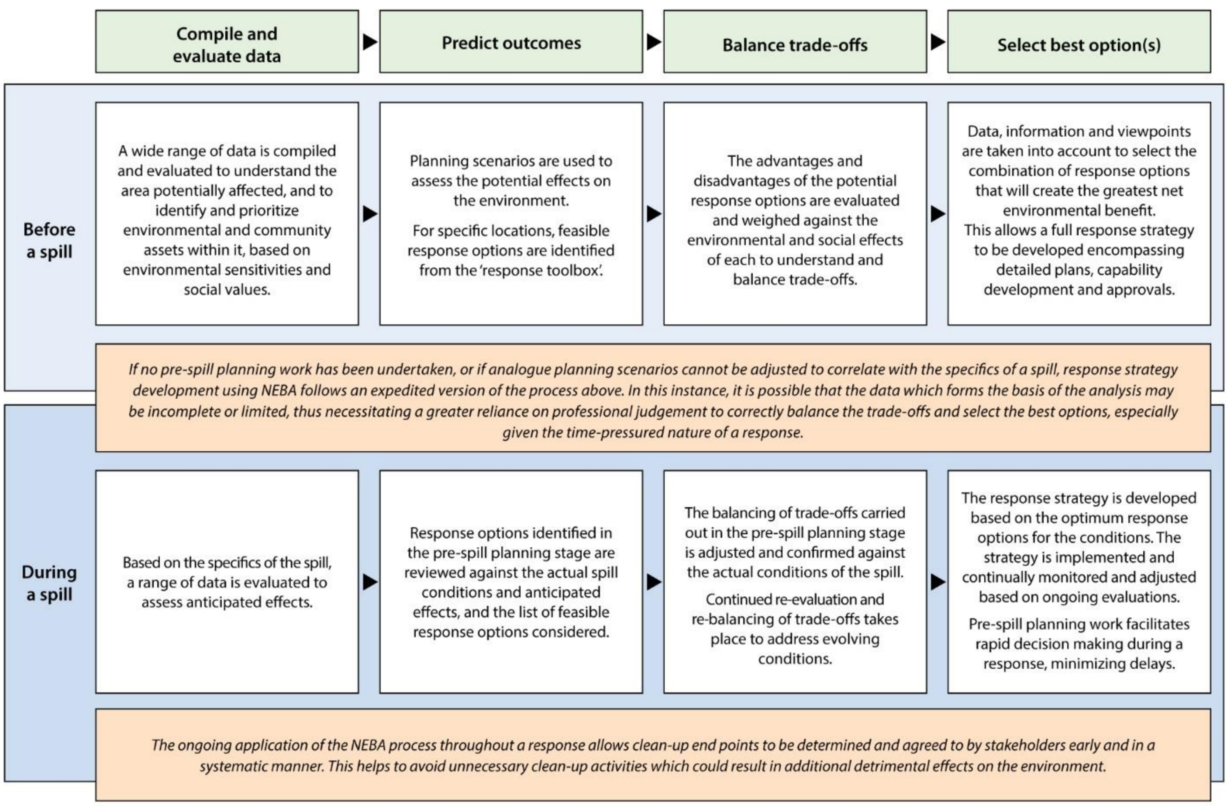

Figure A-1. Response strategy development using NEBA. Source: IPIECA and IOGP (2015b).

Depending on the scale and complexity of the spill scenario under consideration, the NEBA/SIMA processes may range from a brief review and straightforward ranking of a response options, to more a substantial analysis including advanced modeling as well as biological and socio-economic analysis. In formal analysis specific steps typically include:

1. Develop scenario(s)
    - Consider composition, properties, toxicity and weathering processes of petroleum product
    - Model base case (no response) oil fate and behavior (trajectory, area/volume affected, concentrations, exposure duration, etc.)
2. Define response options for consideration
    - Determine their requirements and realistic efficiency under a specific scenario
    - Evaluate/model changes to fate, behavior and persistence of oil for different response options or their combinations
    - Evaluate additional impacts of response techniques (e.g. direct impacts to human health and environment, noise, waste generation, aerial emissions, etc.)
2. Define Resources at Risk
    - Consider all compartments and habitats and representative populations that may be affected by oil under different response scenarios. Consider environmental, cultural and socio-economic resources.
    - Consider types, distribution, population density and dynamics, life cycle, overall health, etc.
    - Special emphasis is given to threatened and endangered species as well as high value resources and habitats.
    - Consider important relationships (e.g. population relationship with habitat, feeding base, etc.)
3. Define effects
    - Define risk assessment methodology (e.g. NEBA risk matrix vs SIMA coefficients)
    - Develop thresholds to estimate sensitivity of different communities and habitats to oil and impacts of response techniques
    - Estimate potential exposure (duration and concentration) for different response scenarios
    - Evaluate extent of the impact and recovery potential of organisms, populations, habitats and communities in base (no response) case. E.g. NEBA method specifically evaluates percent of affected population and number of years it would take to return to pre-spill conditions.
    - Evaluate the same for response scenarios under consideration.
4. Compare outcomes and select response option(s) resulting in higher degree of environmental and socio-economic protection.

Appendix C. Overview of Consultations Under the Endangered Species Act

Response actions undertaken to limit or prevent oil discharges and/or their effects on the environment, including the application of dispersants, have the potential to adversely affect listed species and critical habitat. In order to fully meet the goals of both the NCP and Endangered Species Act (ESA), spill response agencies and the Services have been encouraged to coordinate on spill planning and response efforts. The NCP requires OSCs to coordinate with natural resource trustees on spill response efforts. In addition, the NCP also states that the US Fish & Wildlife Service or National Marine Fisheries Service, collectively referred to as the Services, will provide technical expertise during planning and response. However, the NCP does not specify consulting with ESA specialists on spill response efforts. Therefore, efforts should be made on both sides to ensure that the Services provide input on spill response measures during the planning stages, and during actual responses. Response agency leads should request input from Service representatives during the planning and response processes. Likewise, Service representatives should be available for consultation (informal or otherwise) during planning and response processes.

The purpose of the ESA is to conserve listed species and the ecosystems on which listed species depend. Under section 4 of the ESA, certain species may be listed as either endangered or threatened according to assessments of their risk of extinction. Once listed, legal measures take effect to aid the conservation of the species. Two such measures are contained in Section 7 of the ESA. Section 7(a)(1) requires Federal agencies to use their authorities to further the purposes of the ESA by carrying out programs for the conservation of listed species. Section 7(a)(2) requires Federal agencies to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of designated critical habitat. These mandates are to be carried out in consultation with the Services.

In 2001, the United States Coast Guard; United States Environmental Protection Agency; Department of the Interior's Office of Environmental Policy and Compliance and Fish and Wildlife Service; and the National Oceanic and Atmospheric Administration's National Marine Fisheries Service and National Ocean Service developed and signed an *Inter-Agency Memorandum of Agreement(MOA) Regarding Oil Spill Planning and Response Activities Under the Federal Water Pollution Control Act's National Oil and Hazardous Substances Pollution Contingency Plan and the Endangered Species Act*. The purpose of this MOA is to increase cooperation and understanding among agencies involved in Endangered Species Act compliance at every stage in oil spill planning and response. The MOA outlines procedures to streamline the ESA compliance process before, during, and after an incident.

Federal agencies must consult with one or both of the Services when any activity carried out, funded or authorized by that agency may affect listed species or designated critical habitat. The Services conduct many types of consultations. Because the National Contingency Plan and ESA use "consultation" to mean different things, the MOA attempts to clarify this by suggesting procedures that meet the mandates of both. The language used in this section is from the ESA regulations, and the following consultation definitions pertain most directly to the MOA.

1) *Informal Consultations* may precede formal consultation. Informal consultation is an optional process that includes all discussions and correspondence be-tween the Service(s) and Federal action agency to determine whether a proposed Federal action may affect listed species or critical habitat. A written concurrence from the appropriate Service that the

action is not likely to adversely affect listed species or critical habitat concludes the informal consultation process. If specific sources of potential adverse effects are identified and removed, the Service(s) will provide a concurrence letter and Section 7(a)(2) requirements are met. The goal of the MOA is to use this form of the consultation process whenever possible so as to avoid or minimize impacts to listed species or critical habitat. The ACP planning process, which should include the Services, is considered informal consultation.

2) *Formal Consultation* is a process conducted between a Federal agency and the Service(s) to determine whether a proposed action is likely to jeopardize a listed species or destroy or adversely modify critical habitat. "Jeopardy" or "to jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers or distribution of that species. Formal consultation is required for actions that may affect listed species or critical habitat unless the Federal agency determines, with the written concurrence of the Service(s), that the proposed action is not likely to adversely affect listed species or critical habitat. The process concludes with a written Biological Opinion (BO), and may include an incidental take statement. In some cases, while using the MOA process, it may be necessary and even beneficial to engage in formal consultation following informal or emergency consultation. Formal consultation could be used in the planning process or following a spill.

3) *Conferenc*e is a process of early inter-agency cooperation involving informal or formal discussions between a Federal agency and the Service(s) regarding the likely impact of an action on proposed species or proposed critical habitat. Conferences are required for proposed Federal actions that are likely to jeopardize proposed species or destroy or adversely modify proposed critical habitat. For the purposes of the MOA, "conferencing" on proposed species is achieved through the ACP planning process and can be included in informal consultation. Biological Assessments and subsequent Biological Opinions are not required.

4) *Emergency Consultations* occur during disasters, casualties, national defense or security emergencies, or as addressed in the MOA, during response to an oil spill. The emergency consultation is initiated informally. The action agency contacts the Service(s) as soon as possible about the situation for advice on measures that would minimize effects of the response. This contact need not be in writing. Generally, under the MOA, the FOSC contacts the DOC and DOI representatives who then follow up with the NOAA SSC and RRC respectively. The Service(s) will follow the initial contact with a written summary of the conversation. If the initial review indicates that the action may result in jeopardy or adverse modification, and no means of reducing or avoiding this effect are apparent, the agency should be so advised, and the Service(s) conclusions documented. The action agency then initiates formal consultation after the emergency situation is over if listed species or critical habitat have been adversely affected. At this time, the consulting parties assess impacts to listed species and critical habitat as well as the effects of any recommendations provided by the Service(s) during the response. The Service(s) provide a BO that documents the effects of the emergency response on listed species and/or designated critical habitat. As per the MOA, if a spill response activity may affect listed species and/or critical habitat, emergency consultation is used until the case is closed. This

should result in open communication between the action agency and the Services. Recommendations as well as actions taken should be recorded.

Each agency is responsible for coordinating not only internally, but also with other agencies, to ensure proper documentation at each stage in the ESA compliance process. Some of the more important materials are presented below, including Biological Assessments, Biological Opinions, Incidental Take Statements, and letters of concurrence. Note that these are general terms taken from the regulations.

Biological Assessment /Biological Evaluation

A Biological Assessment (BA) can be a part of the Section 7(a)(2) consultation process. A BA is required for major construction project. For Federal actions that are not construction projects the term Biological Evaluation (BE) is commonly used. The BE content conforms to the ESA regulations of initiation packages. The content is required whereas the regulations related to BA outline recommended content. Bas/BEs contain an evaluation of the potential impacts of a proposed Federal activity on listed species, proposed species, or designated or proposed critical habitat. This information is provided by, or under the direction of, the Federal action agency. The conclusion(s) of the BA determine whether a formal consultation is required. If the conclusion is that the action is not likely to adversely affect (NLAA) listed species or critical habitat, then the agency sends a request for concurrence to the Service(s). The Service(s) may agree or disagree with the determination. If the conclusion is that the action is likely to adversely affect (LAA) listed species or critical habitat, then the action must undergo a formal consultation. The Federal agency submits an initiation package to the appropriate Service to begin consultation. The outcome of a formal consultation, when the action is LAA, is a biological opinion issued by the Service(s).

Letters of Concurrence

If a Federal agency determines that its proposed action is not likely to adversely affect listed species or designated critical habitat, it may request concurrence from the Service(s) of their determination. This is part of informal consultation. Once the Service(s) have the opportunity to review the action and agree that no adverse effects are likely, they provide a letter of concurrence. If, however, the assessment of the proposed action reveals potential adverse effects, then the action agency has two alternatives. The action agency can implement modifications to its proposed action that would eliminate the potential adverse impacts; otherwise, the action agency can initiate a formal consultation. Note that in the MOA, it is expected that the Services are part of these conversations, i.e., that they are not "reviewing" it after the fact. The letter of concurrence provides documentation both for the Service(s) and the action agency that this coordination has taken place.

Initiation Package

Formal consultation starts when the Federal agency taking an action submits a written request to initiate the process. As noted above, the term biological evaluation is generally used to describe the initiation package. The initiation package includes a written request to the Service(s) to initiate formal consultation and contains:

1) A description of the action to be considered;
2) A description of the specific area that may be affected by the action;
3) A description of any listed species or critical habitat that may be affected by the action;
4) A description of the manner in which the action may affect any listed species or critical habitat and an analysis of any cumulative effects;
5) Relevant reports, including any environmental impact statement, environ-mental assessment, or biological assessment prepared; and

6) Any other relevant available information on the action, the affected listed species, or critical habitat.

If the Service(s) find the package complete, then consultation begins. If the package is deemed incomplete, additional information may be requested. Once the package is accepted, the Service(s) can begin formal consultation and the preparation of a BO. Note that in the MOA, the Services can often assist in the development of information needed in the BE on response activities through the planning process and before initiating consultation.

Biological Opinion

A Biological Opinion (BO) is prepared by the Service(s) in response to receipt of an initiation package from a Federal agency. The BO includes:

1) The opinion of the Service(s), stating whether a Federal action is likely to jeopardize the continued existence of listed species, or result in destruction or adverse modification of designated critical habitat,
2) A summary of the information on which the opinion is based, and
3) A detailed discussion of the effects of the action on listed species or designated critical habitat.
4) An estimate of the anticipated level of take (the incidental take statement) and non-discretionary actions the Federal agency must follow in order for the take to be lawful.
5) Triggers for re-initiation of consultation. These are standard and include when/if new species or critical habitats are listed, if new information becomes available that suggests an impact from the action that wasn't evaluated in the BE or BO, or the level of incidental take is exceeded,

If the Service(s) determine an action is likely to jeopardize the continued existence of listed species, or destroy or adversely modify designated critical habitat, the BO will contain available Reasonable and Prudent Alternatives that are within the agency's authority and do not result in jeopardizing listed species or adverse modification of critical habitat. If a Service issues a jeopardy BO, the Federal agency must notify the Service of its intent to proceed or not proceed with the action. If the Federal agency cannot avoid jeopardy (i.e., the project must proceed, but taking of listed species or critical habitat is likely), then the Federal agency and Service(s) should meet to discuss how to resolve the issue. As described in the MOA, communications throughout the ACP planning process can help avoid this jeopardy determination. The Services may generate a BO as a result of the ACP planning process or after a spill response. A BO prepared after a spill has occurred may contain slightly different information, as the spill response actions have already been taken.

The USCG and EPA may engage in ESA section 7 consultation either before a specific incident, thus consulting on the actions in the area contingency plan, the regional contingency plan, both or specific elements of either. More commonly, USCG and EPA consult on specific incidents using the emergency consultation process, which allows the response to continue but engages the Services to help advice the response on ESA listed species and critical habitats and means to reduce the likelihood of impacts.

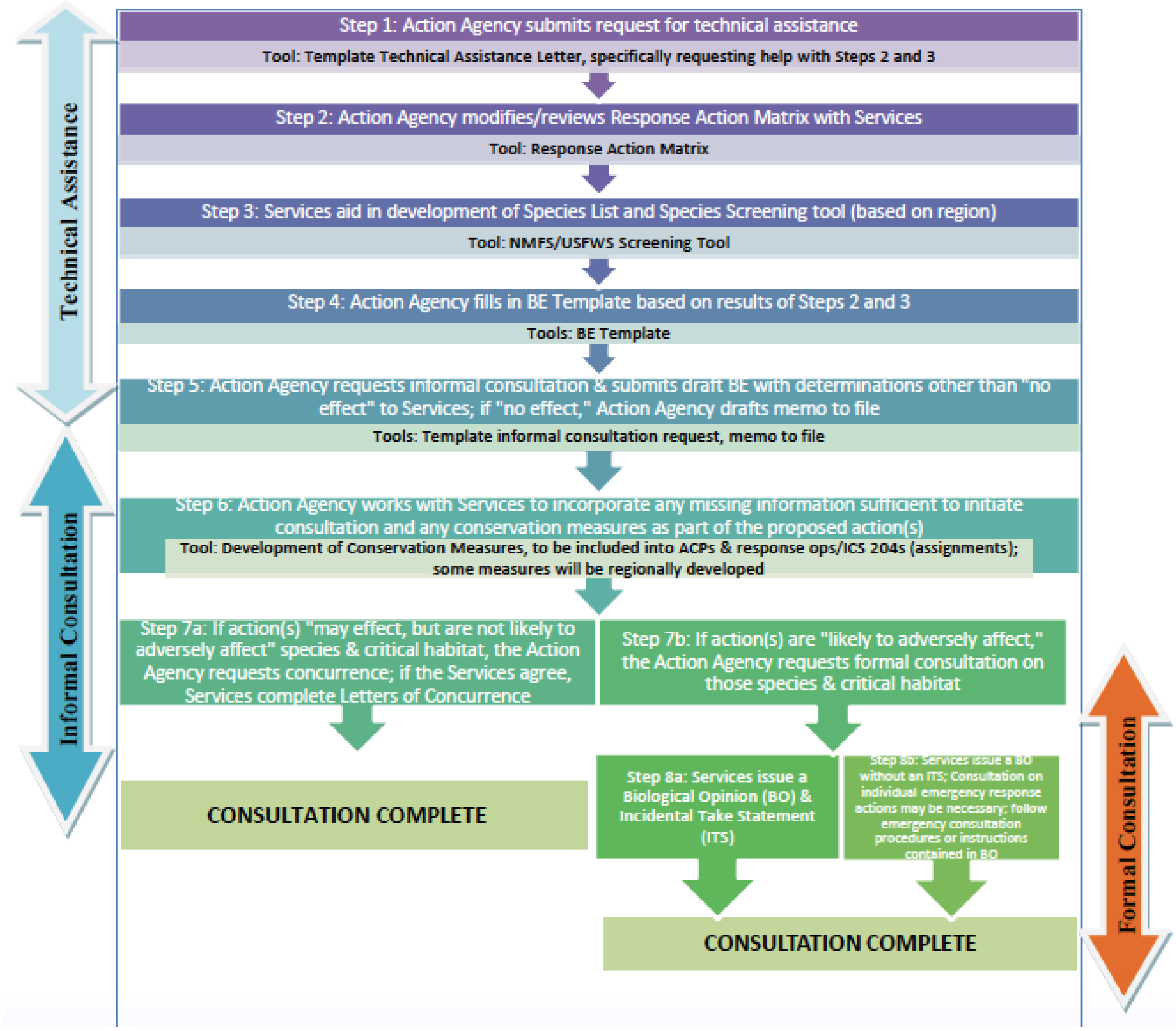

Figure 5. Flow chart of biological consultation process under Section 7 of the Endangered Species Act. Source: National Response Team.

Appendix D-1. Dispersant Fact Sheet, Gulf of Mexico Sea Grant Programs (2019)

temperature regulation, loss of habitat, and death.[6] Dispersants protect sea life and their habitats from being oiled by reducing large oil slicks to small droplets.[1] Lab studies show that high levels of dispersants can lower the survival rate of aquatic life who encounter them.[7,8] However, scientists found that the levels of dispersant that can harm animals or people are not found in the environment, even after incidents like the Deepwater Horizon oil spill.[4] Dispersants alone are unlikely to pose risk for sea life.

While dispersant prevents some sea life from being oiled, it may increase exposure for others tens to hundreds of times by moving oil compounds into the water.[7,9,10] In lab studies, oil-dispersant mixtures cause a variety of negative impacts to marine life, including problems with egg hatching, heart health, growth, and early development.[9] These studies in the laboratory show that impacts can vary depending on the species, age at time of exposure, oil and dispersant concentrations, and environmental factors like water temperature and salinity.[9] While oil-dispersant mixtures can be problematic to sea life in lab studies, scientists see population declines in some wild animal populations but not others.[4,6,9] Scientists continue investigating the differences between studies done in the lab and the ever-changing conditions in the wild.

WHAT ARE EXISTING POLICIES?

The National Contingency Plan, as mandated by the Clean Water Act, describes which dispersants may be considered for oil spill clean-up, the types of waters where they may be used, and how much may be applied in those waters.[11,12] Only products that have undergone effectiveness and toxicity testing may be listed.[11,12]

HOW WERE DISPERSANTS USED DURING DEEPWATER HORIZON?

After receiving federal authorization, emergency responders applied 1.8 million gallons of dispersants Corexit 9500A and 9527A to the water's surface and underwater at the point of the blowout.[3,5] Airplanes sprayed dispersants only in daylight. Application could not occur in areas less than 33 feet deep, within 2.3 miles of any vessel, or within 3.45 miles of shoreline or visible marine life.[3,5]

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SUGGESTED CITATION

Maung-Douglass, E., Graham, L., Hale, C., Sempier, S., Skelton, T., Swann, L., and Wilson, M. (2019). Frequently asked questions: Dispersants edition. GOMSG-G-19-001.

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gulfseagrant.org/oilspilloutreach

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Appendix D-2. Dispersant Fact Sheet, Prince William Sound Regional Citizens Advisory Council (2007)

Dispersants

January 2007

FACT SHEET

Position Statement
After years of observing dispersant trials, dispersant effectiveness monitoring, advising and sponsoring independent research regarding chemical dispersant use, it is the position of the Prince William Sound Regional Citizens' Advisory Council (the Council) that dispersants should not be used on Alaska North Slope crude oil spills in the waters of our region. Until such time as chemical dispersant effectiveness is demonstrated in our region and shown to minimize adverse effects on the environment, the Council does not support dispersant use as an oil spill response option. Mechanical recovery and containment of crude oil spilled at sea should remain the primary methodology employed in our region.

What Are Dispersants?

Chemical dispersants are substances with an active ingredient called surfactants. Surfactants are composed of both hydrophilic (water-liking) and oleophilic (oil-liking) compounds.

In theory, chemical dispersants do as their name implies: they disperse surface oil into the water column, thereby diluting it, preventing it from fouling shorelines, and speeding up the process by which bacterial action renders it harmless.

But years of research have failed to bear out the claims of dispersant proponents. Unlike dispersant use, mechanical recovery with booms and skimmers removes oil from the water. Current state and federal laws and regulations hold that dispersants should be used only if it is clear that mechanical cleanup methods such as booming and skimming won't work.

Council Concerns

Reliable scientific data about the efficiency, toxicity, and persistence of dispersants and dispersed oil in Prince William Sound/Gulf of Alaska conditions is scarce. There has not been a conclusive demonstration that chemical dispersants work in the extremely cold waters of the Exxon Valdez oil spill region. Although effort has been put into evaluating chemical dispersant use over the last 30 years, much of this research was conducted by the formulators of dispersants and not by independently funded surfactant scientists.

An Airborne Dispersant Delivery System (ADDS) unit is loaded into a cargo plane during a drill.

Testing the behavior of oil in water at a wave tank in Halifax.

Helicopter dropping simulated dispersants during a drill.

see also:
www.pwsrcac.org/projects/EnvMonitor/dispers.html

Prince William Sound Regional Citizens' Advisory Council ~ *Citizens promoting environmentally safe operation of the Alyeska terminal and associated tankers.*

VALDEZ: PO Box 3089 / 130 S. Meals, Ste. 202, Valdez AK 99686 ~ toll-free: 877.478.7221 ph: 907.834.5000 fax: 907.835.5926
ANCHORAGE: 3709 Spenard Rd., Ste. 100, Anchorage, AK 99503 ~ toll-free: 800.478.7221 ph: 907.277.7222 fax: 907.277.4523

www.pwsrcac.org ~ see other PWSRCAC fact sheets at www.pwsrcac.org/resources/factsheet.html

Appendix D-3. Dispersant Fact Sheet, Alaska Department of Environmental Conservation (2016)

Alaska Department of Environmental Conservation

Oil Spill Dispersant Fact Sheet

What are Dispersants?

Dispersants are oil spill response tools that may be considered for use when mechanical equipment, such as containment boom, sorbents, and skimmers are unable to effectively remove free oil from water surfaces in a timely manner. These chemical mixtures break slicks into tiny droplets that entrain and diffuse into the water column, using wave, wind, and/or tidal energy. These tiny droplets have increased surface-to-volume ratios and can be dissolved, digested, or broken down by natural processes such as biodegradation, photodegradation, and reduction/oxidation to form less stable compounds. Therefore, dispersants do not immediately reduce the amount of oil in the environment, but change its distribution, persistence, and potential effects. Droplets less than 70 microns in diameter stay suspended, whereas larger droplets may resurface. This reduces the risk of oil stranding upon environmentally sensitive areas, such as estuaries, shorelines, haul-outs, rookeries, nearshore and intertidal areas.

Why are they used?

Dispersants are not considered to be a primary response tool because the primary goal is to recover and remove oil from the environment. When this becomes unfeasible, dispersants are one of many non-mechanical response options that may be considered. They redistribute the location of toxic compounds from the surface to subsurface and produce a short-term toxicity spike, but significantly reduce the persistence of toxic compounds. Since mechanical recovery has many limitations, it is not always practical or effective. In fact, less than 20% of crude oil is typically recovered from large, marine spills by mechanical recovery methods. Therefore, other response tools are considered when mechanical recovery becomes impractical or insufficient.

Environmental trade-offs are analyzed when dispersant use is considered. If favored, small-scale pilot testing must show that dispersants are having the desired effect in prevailing environmental conditions before large-scale use is approved. Approval for large-scale use must be renewed during each operational period (typically 24 hours). Approval is only granted after spill response managers have coordinated with natural resource trustees and a narrow set of conditions exist.

Test of aircraft dispersant application equipment during CANUSDIX drill. (ADEC Photo)

Appendix D-4. Dispersant Fact Sheet, SpillPrevention.org (API)

SpillPrevention.org

INTRODUCTION TO **DISPERSANTS**

Things You **Should Know**

Mechanical recovery will always be the most widely used response option, because most spills are small and nearshore.

Dispersants remove oil from the water surface thereby protecting birds, mammals, and sensitive shorelines.

Dispersants can be used under a broad range of environmental conditions. For large offshore spills, the limitations of other response options may make dispersants the most effective response tool.

Modern dispersants are biodegradable and contain ingredients which are similar to, and in some cases less toxic than those found in many common household soaps, cosmetics, shampoos and even food (Fact Sheet 2).

All environments contain naturally occurring microbes that feed on and break down crude oil.

Dispersants are designed to break a slick up into tiny oil droplets, which enhances the rate of microbial degradation and ultimately removes the oil from the environment.

Dispersant use is always based on a net environmental benefit analysis (Fact Sheet 6).

Scientists have been studying the effects of dispersants on the marine environment for over 30 years, and are still actively engaged in dispersant research, development and innovation.

Overview

Dispersants are products used in oil spill response to enhance natural microbial degradation, a naturally occurring process where microorganisms remove oil from the environment. All environments contain naturally occurring microbes that feed on and break down crude oil. Dispersants aid the microbial degradation by forming tiny oil droplets, typically less than the size of a period on this page (<100 microns), making them more available for microbial degradation. Wind, current, wave action, or other forms of turbulence help both this process and the rapid dilution of the dispersed oil. The increased surface area of these tiny oil droplets in relation to their volume makes the oil much easier for the petroleum-degrading microorganisms to consume (**Figure 3**).

Dispersants can be used under a wide variety of conditions since they are generally not subject to the same operational and sea state limitations as the other two main response tools — mechanical recovery and burning in place (also known as in-situ burning). While mechanical recovery may be the best option for small, near-shore spills, which are by far the majority, it has only recovered a small fraction of large offshore spills in the past and requires calm sea state conditions that are not needed for dispersant application. When used appropriately, dispersants have low environmental and human health risk and contain ingredients that are used safely in a variety of consumer products, such as skin creams, cosmetics, and mouthwash (Fingas et al., 1991; 1995).

This fact sheet summarizes what dispersants are, how they work, when their use is considered, and any associated environmental trade-offs and potential human health effects.

Fact Sheet Series

- **Introduction to Dispersants**
- Dispersants — Human Health and Safety
- Fate of Oil and Weathering
- Toxicity and Dispersants
- Dispersant Use Approvals in the United States
- Assessing Dispersant Use Trade-offs
- Aerial and Vessel Dispersant Operations
- Subsea and Point Source Dispersant Operations
- Dispersants Use and Regulation Timeline
- Dispersant Use in the Arctic Environment

Introduction

Unfortunately, when an oil spill occurs adverse impacts will occur. The goal of oil spill responders is to rapidly determine which options will reduce these impacts as much as possible given the conditions of the specific incident. The main categories of response options available for marine spills include:

- On-water (surface) mechanical recovery (boats, boom, skimmers, etc.).
- Surface or subsea applications of dispersants to enhance natural microbial degradation.
- Controlled burning, known as in-situ burning (burning in place on the water surface).
- Monitor and evaluate — allowing natural processes to take place with monitoring.

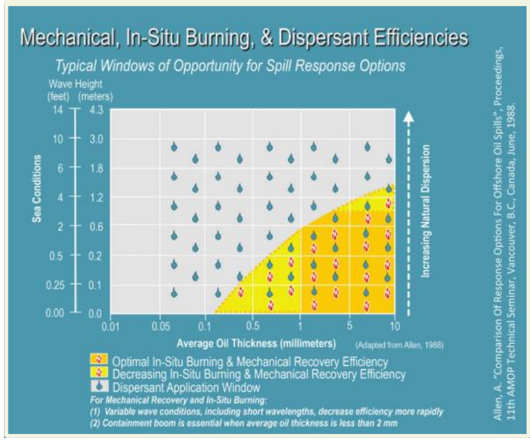
All of these options have their place in oil spill response because of the extreme variability of marine spill conditions. Mechanical recovery will generally be the most important and widely used oil spill response option because most spills are relatively small, close to shore, and often near locations where boats, boom, skimmers, and trained responders are available.

Dispersants become a critical response tool for larger spills far from shore, spills more distant from stockpiles of recovery and containment equipment, when weather and ocean conditions preclude the use of other options, or when weather conditions are predicted to become more severe. This is because in addition to vessel-based operations, dispersants can be rapidly applied from aircraft as well; they are efficient when wind and waves prevent vessel-based mechanical recovery or in-situ burning operations, and they are the only effective option when slicks have spread very thin (< 0.1 mm) (**Figure 1**).

Additionally, dispersant aircraft can typically travel to spill locations at speeds over 150 knots (170 mph; 275 kph) compared to 7 knots (8 mph; 13 kph) which is the typical speed of a response vessel transiting to a spill location. Arriving at the spill location quicker allows an effective response to start before slicks have spread, moved, or broken apart into smaller surface slicks. Additionally, aircraft are also able to travel between slicks located only a few miles apart in a matter of minutes, while vessel-based response options may require many hours to haul in the equipment, move to a new location, and redeploy the equipment.

Seas with breaking waves greater than 3-5 feet (approximately 1 to 1.5 meter) reduce the efficiency of both mechanical recovery and in-situ burning. This is because both options require containment boom to corral and contain slicks in an effort to thicken slicks for efficient operations. However, booms begin to lose the ability to contain oil in those conditions and become less efficient as wave heights increase, causing slicks to wash over or under booms. As depicted in **Figure 1**, potential wave-height and average oil thickness have an effect on the operating windows for the three main offshore response options.

FIGURE 1. Effectiveness limits of response options due to sea conditions and average oil thickness (Source: Coolbaugh, 2011, Modified with permission from A. Allen/Spiltec)



Dispersants, however, retain their effectiveness when mixing energy in the form of waves increases, since the greater the mixing energy, the smaller the resulting dispersed oil droplets. This both reduces the potential for resurfacing of droplets (small droplets rise much more slowly) and creates additional surface for microbial degradation—tiny droplets have a greater surface area to volume ratio than larger droplets. In addition to this, larger waves cause greater mixing that helps to reduce the concentration of dispersed oil in the water column even more rapidly.

Containment boom also has limitations when attempting to collect thin oil slicks. As mentioned, oil slicks rapidly spread and become extremely thin within hours of a spill. Low-viscosity oils will eventually become as thin as 0.1 mm on average (Lehr et al., 1984) with sheen being even thinner (NOAA, 2007). Slicks and sheen this thin simply cannot be collected efficiently in boom because only a small volume of oil is encountered and collected within the boom at any time. For example, a boom with a 330 foot (100 m) opening (also known as "swath") width collects a 0.1 mm thick slick at approximately 19 m^3 per hour (120 barrels or about 5,000 gallons/hour) because vessels can only move forward at about 1 knot (1.2 mph; 2 kph) for most types of boom systems to keep the oil contained. There are boom systems that can move faster, but they do not rapidly spread within the top 30 feet (~10 meters) of the water column and provide an easy target for microbial degradation. Oil-degrading bacteria are present everywhere in the marine environment, from the Arctic to the equator, from the sea surface to the seafloor and at all water depths in between. Thus, as mentioned above, dispersants enhance removal of oil from the environment through microbial degradation.

Dispersants work best on fresh oil that has not weathered significantly (e.g., become thicker) and are generally considered to be most effective on oils that have been on the water for less than 72-96 hours (NRC, 2005). Therefore, decision-makers must decide quickly whether to use dispersants during a spill in order for dispersant use to be the most effective. A batch (everything spilled at once) or a continuous (oil continues spilling over time) spill is also an important consideration because a continuous spill may require continuous dispersant applications.

Oils also vary in viscosity/thickness and composition and dispersants may work differently on different types. In general, the less viscous or lighter the oil is, the more easily it is dispersed. **Fact Sheet #3 – Fate of Oil and Weathering** provides more information on the types of oil and the changes oil undergoes after being spilled into the environment.

Research and experience has shown that dispersants work best on light oils and medium to heavy weight crude oils (**Table 1, Groups II and III**) (Nedwed and Coolbaugh, 2008). Dispersants can effectively disperse light products; however, these materials such as gasoline and diesel tend to rapidly evaporate and biodegrade when spilled, so the use of dispersants is not recommended. Conversely, due to the composition of very heavy oils like bunkers or asphalt-like products (**Table 1, Groups IV and V**), their components limit the dispersion action. However, research has shown that dispersants can be effective on more viscous oils and that dispersants should not be ruled out before being tested in the field with the understanding that thicker or heavier oils may disperse more slowly than light oils.

Initial elevated concentrations of tiny dispersed oil droplets will rapidly dilute and their impact will be very short-lived and localized. Field trials and wave-basin tests show that dispersed oil dilutes to concentrations below 1 ppm within hours after application of dispersants. These concentrations are below most toxicity thresholds for marine organisms that have undergone testing with constant exposures to dispersed crude oil for 48 to 96 hours. This rapid dilution explains why fish kills have never been observed in areas where there is significant water depth (10 meters or greater) after dispersants have been properly used.

The dispersed oil droplets will continue to dilute and are expected to have concentrations less than a few ppb within 2 days (Nedwed, 2011). Research indicates that microbes colonize dispersed oil droplets within 1 – 2 days (MacNaughton et al., 2003) at which point the microbial degradation process becomes rapid. By this time, the dispersed oil concentrations are too dilute to exhaust the available nutrients (primarily nitrogen and phosphorus) or available dissolved oxygen. As a result, aerobic microbial degradation proceeds much more efficiently than it would on a shoreline or in near shore sediments. In general, the components of oils that are of the most concern are typically the smaller, most soluble and volatile compounds that will tend to rapidly evaporate and dissolve. These also tend to be biodegraded first because they are easier for microbes to consume. As the oil droplets are biodegraded, they become less toxic over time.

Dispersants make it more difficult for oil droplets to stick back together or to other objects, like sediment, sand, wildlife, vegetation, rocks, or other hard surfaces in the nearshore environment. Because dispersed oil droplets do not reform

TABLE 1. Oil Type and dispersants effectivness

Group	Common Products	Specific Gravity	API	Natural Dispersion	Chemical Dispersion
I	Gasoline, Ker	< 0.8	> 45	Rapid	Not Recommended[1]
II	Diesel, Heating Oil	0.8—0.85	35—45	Moderate–Rapid	Rapid
III	Alaskan Crude Oil, Gulf of Mexico Crude Oil	0.85—0.95	17.5—35	Moderate–Slow	Rapid
IV	Heavy Fuel Oil, Venezuelan Crude Oil	0.95—1.0	10—17.5	Slow	Moderate
V	Oil Sand, Bitumen, Asphalt	> 1.0	< 10	Little or None	Not Applicable[2]

[1] As Group I oils, such as finished product gasoline evaporate rapidly, the use of dispersants is not recommended
[2] As the specific gravity of Group V products is heavier than fresh water, these oils may sink and the use of dispersants may not be applicable
Source: Nedwed and Coolbaugh, 2008

Appendix D-5. Media Fact Sheet for Oil Spill Dispersant Use (Florida DEP, 2018)

Home » Divisions » Office of Emergency Response » Office of Emergency Response (General) »
Media Fact Sheet for Oil Spill Dispersant Use

Dispersants are chemicals that are applied directly to an oil slick. The key components of chemical dispersants are surface active agents called surfactants (also known as detergents). Chemical dispersants assist with breaking up the slick into small droplets ranging in size from a few micrometers to a few millimeters.

Chemical dispersants can do this because they contain molecules that are both water compatible and oil compatible. The molecules align themselves around the oil droplets as the droplets break away from the slick. This action prevents the coalescence (reforming or joining) of oil droplets so the oil can no longer form a slick on the water surface, and it reduces the adherence of the oil to solid particles (sand) and hard surfaces (seawalls and boat hulls).

Chemical dispersants remove the oil from the surface of the water and into the water column. Once in the water column, the oil is diluted to less harmful levels, and eventually is used as a food by bacteria. Birds, marine mammals, turtles and Florida's sensitive coast are protected when oil is removed from the water surface. Chemical dispersants do not cause the oil to sink but remain in suspension in the water column.

Not any chemical dispersant may be used. Only chemical dispersants that are listed on the National Product Schedule (NCP) may be used to treat oil spills. Manufacturers who want to list their chemical dispersants on the NCP must complete specific tests demonstrating effectiveness of at least 45 percent, aquatic toxicity, and identify ingredients. The results of these tests are sent to the U.S. Environmental Protection Agency for evaluation.

Are chemical dispersants toxic? Yes, but the dispersants used today are generally not as toxic as the oil itself and, with adequate dilution, will not harm aquatic life. As an added precaution, chemical dispersants are not applied to shallow nearshore waters, mangrove areas, marshes, or waters over coral reefs and seagrass beds.

Specific Information

Name of Chemical Dispersant Used:

Method of Application:

Area to be Treated:

Date and Time of Application:

Florida Department of Environmental Protection
Office of Emergency Response 850-245-2010

Last Modified: March 8, 2018 - 8:19am

Appendix D-6. Technical Information Sheet, Corexit® 9500A (Oil Spill Response Ltd., 2017)

TECHNICAL INFORMATION SHEET | DISPERSANTS

Corexit™ EC 9500A Effectiveness, toxicity and biodegradability

This datasheet provides a summary of key facts about Corexit EC9500A.

Name	Corexit EC9500A
Supplying company	Nalco Environmental Solutions LLC

Dispersant product approval

Development of dispersant regulations by competent national authorities or appropriate government regulators forms a critical part of national oil spill contingency planning processes, in alignment with the International Convention on Oil Pollution Preparedness, Response and Cooperation, 1990 (OPRC Convention).

Dispersant product approval requirements outline which dispersants are approved for use and how dispersants can be added to a list of approved dispersants by meeting the requirements of specific laboratory-based tests.

The tests are designed to screen out least effective or more toxic dispersants and as such can only be used for comparative purposes and not for assessment of actual impacts or efficiency at sea where mixing and especially exposure conditions (as well as organisms types and life stages) would be very different.

During a response, field efficiency may be evaluated by a test application of dispersant.


IPIECA IOGP

Regulatory approval of dispersant products and authorization for their use

Further information on regulatory approval and authorisation can be found in the IPIECA-IOGP report on the subject: bit.ly/DispersantAA

Effectiveness

A dispersant should meet or exceed a threshold for effectiveness (or 'efficacy'). It is necessary for a dispersant to possess a minimum level of effectiveness to enhance the rate of natural dispersion when applied at sea.

A range of laboratory based tests are used globally that have been designed to allow for the assessment of good vs poor performance: IFP (>60%) in France, WSL (LR448, >60%) in UK and SFT in USA/Canada (>45%).

These tests are designed to assess dispersant efficacy under specific conditions described in national regulations. None of the laboratory test methods can simulate the complex mixing scenarios and energies encountered in the marine environment. Therefore, results from laboratory tests typically expressed as 'percentage effectiveness', should not be extrapolated to the amount of oil likely to be dispersed in real world incidents. The tests will, however, provide data on the relative effectiveness of different dispersants under the parameters of that test.

	UK	USA	FRANCE
Efficacy pass level	>60% Dispersants must achieve a minimum efficiency of 60%	≥45% A dispersant must attain an effectiveness value of 45% or greater (compared to the control) in order to be added to the US EPA NCP Schedule	>60% Dispersants must achieve a minimum efficiency of 60%
Efficacy achieved	Pass Corexit EC9500A passed the LR448 approval test, i.e. has a minimum efficacy of 60%	Pass Corexit EC9500A is 50% effective (Average of two crude oils, Prudhoe 45.3%; South Louisiana 54.7%)[1] Effectiveness of ~72% in temperatures as low as 0˚C[2]	Pass Corexit EC9500A passed the IFP approval test i.e. has a minimum efficacy of 60%

[1] *Regulatory approval using the Swirling Flask Test*
www.epa.gov/emergency-response/national-contingency-plan-product-schedule-toxicity-and-effectiveness-summaries

[2] *Data from BSEE (2015). The test procedure was adapted from the Ohmsett dispersant effectiveness test protocol developed between 2000 and 2003 and documented in "Dispersant Effectiveness Testing on Alaskan Oils in Cold Water" (SL Ross Environmental Research & MAR Incorporated, 2003).*

Oil Spill Response

Toxicity

Toxicity testing

A dispersant should not exceed a maximum toxicity threshold to marine life. Care needs to be taken when considering dispersant toxicity versus the toxicity of the dispersed oil (dispersant plus oil) since it is the toxicity of the oil that accounts for the largest contribution. When evaluating toxicity for inclusion onto a list of approved products the maximum toxicity threshold of a candidate dispersant is usually set at either:

a) a level where the oil and dispersant mixture is no more toxic than the oil alone at the same exposure levels; or

b) if the dispersant is tested alone, at a level which is significantly less toxic than a reference oil.

This testing can only evaluate the relative toxicity of different candidate dispersants under artificial laboratory conditions and is not intended to predict actual environmental impacts in the field where the exposure regime experienced by marine organisms will be much different.

UK	USA	FRANCE
Pass	Slight to moderate = Pass	Pass
Sea Test passed[3]	Corexit EC9500A alone = Slightly toxic No.2 Fuel Oil alone = Slightly toxic 9500A + No.2 Fuel Oil = Moderately toxic Reference toxicant = Moderately toxic[4]	Corexit EC9500A is approved for France using the standard NF.T.z90-349 method which requires the toxicity of 9500A to shrimp to be at least 10 times lower than the toxicity of a reference toxicant (Noramium DA50)[5]

[3]Test procedure exposes shrimps to a mixture of oil (i.e. a lightly weathered Kuwait crude oil) and dispersant. The mixture is 1 part of dispersant to 10 parts of oil. The dispersant will be approved based on nominal concentrations if the dispersant and oil mixture causes no more mortality than that caused by mechanically dispersed oil alone. Results are shown as a pass or fail. Kuwait Crude is used as the reference oil for toxicity testing.

[4]Current toxicity test involves testing with two US EPA standard species—inland silverside fish (Menidia beryllina) and mysid shrimp (Americamysis bahia)—five concentrations of the test product and No. 2 fuel oil alone, and in a 1:10 mixture of dispersant to oil. To aid comparisons of test results from assays performed by different laboratories, reference toxicity tests are conducted using sodium dodecyl sulphate (SDS) as a reference toxicant. The test length is 96 hours for Menidia and 48 hours for Americamysis. LC50 values are calculated. The exposure regime used in an LC50 test procedure is that required to kill 50% of the test organisms. Toxicity threshold descriptors are set as: 1 to 10ppm = moderately toxic; 10 to 100ppm = slightly toxic

[5]Corexit EC9500A is at least 10 times lower than the toxicity of a reference toxicant (Noramium DA50).

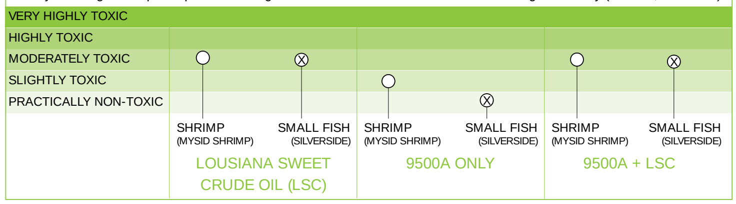
The EPA (August, 2010) conducted independent studies to assess the relative acute toxicity of eight dispersants including Corexit EC9500A. Corexit EC9500A fell into the slightly toxic category for mysid shrimp and the practically non-toxic category for inland silverside fish. Corexit EC9500A proved to be the least toxic to small fish among tested dispersants. Oil alone was found to be more toxic to mysid shrimp than the eight dispersants.

Endocrine disruption and cytotoxicity tests were also performed (EPA, June 2010[7]) to assess the degree to which eight types of oil spill dispersants were toxic to various types of cells. Corexit EC9500A did not display endocrine disruption activity. In cytotoxicity tests cell death was observed in some tests at concentrations above 10ppm. The endocrine and the cytotoxicity screening were conducted at dispersant concentrations from 0.001 parts per million up to 10,000 parts per million. None of the dispersants triggered cell death at the likely concentrations of dispersants expected in open water.

Corexit EC9500A toxicity versus the toxicity of dispersed Louisiana Sweet Crude oil

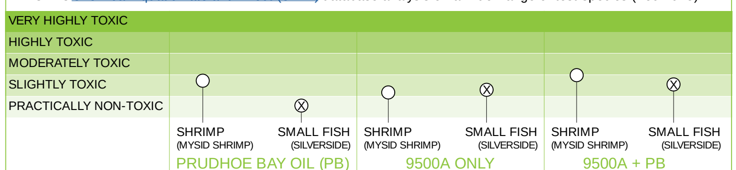
[6]Comparative Toxicity of Eight Oil Dispersant Products on Two Gulf of Mexico Aquatic Test Species (US EPA, Aug 2010)

[7]Analysis of Eight Oil Spill Dispersants Using In Vitro Tests for Endocrine and Other Biological Activity (US EPA, Jun 2010)



Corexit EC9500A toxicity versus the toxicity of dispersed Prudhoe Bay oil[8]

[8]NOAA's Chemical Aquatic Fate and Effect (CAFE) database analysis on a wider range of test species (Dec 2015)



Using the CAFE system, the toxicity for Corexit EC9500A alone, Prudhoe Bay alone and a combination of both to the widest range of test species in the database can be compared to ensure rigour. Essentially, Corexit EC9500A and Prudhoe oil is comparable in its toxicity to Prudhoe oil alone. Corexit EC9500A alone is less toxic.

Biodegradability

A dispersant should be readily biodegradable and not contain persistent harmful constituents. This may require additional information to be provided as part of the product approval process.

UK	USA	FRANCE
No requirement for testing	No requirement for testing	>50% = Pass[8]

[8]For France, biodegradeability of the dispersant should be at least 50%. Tests are performed by INERIS, using the NF T90 346 test method.

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Oil Spill Response

Appendix E. Alaska RRT FAQs About Dispersants

Alaska Outreach Dispersant
(agency that drafted answer)

1. Why did you have to establish preauthorization?

(USCG) Establishing preauthorization is important because it will trigger requirements for tank vessel response plan holders to ensure dispersant is stockpiled in Alaska. These requirements come from the Vessel and Facility Response Plans for Oil: 2003 Removal Equipment Requirements and Alternative Technology Revisions, better known as the "CAPS" rule, 33 CFR 154 and 155. This will complement existing oil spill response capability, ensure dispersant availability as ONE possible response option, and may reduce environmental damage from an oil spill.

2. Why didn't you just re-establish it back in the pre-SEP 2008 zones (aka Zone 1) in Cook Inlet and Prince William Sound?

(USCG) Based on discussions with Federal and State agencies, including the Natural Resource Trustees, those locations would be best served by incident-specific consultation, given the dynamic characteristics of many factors, including their hydrology, flora and fauna.

The relative risk of a tanker-based crude oil spill (and their transit profiles) and actual response data (e.g., M/V SELENDANG AYU, RO/RO COUGAR ACE, M/V GOLDEN SEAS) served as the principal driver of the decision to demarcate the proposed preauthorization zone.

3. How do you know that dispersants are effective in Alaska's waters?

(NOAA) Like all response alternatives, dispersant effectiveness will depend on the oil properties as well as operational and oceanographic factors. At some oil spills, dispersant use can be of great benefit, while at other spills their use would be inappropriate based on oil type, weathering, and other factors.

We know from laboratory and field studies that most crude oils and some fuel oil can be dispersed if dispersants are applied promptly, even in cold water, but the effectiveness of dispersants declines over time as the oil weathers.

Alaskan waters do contain cold-adapted, oil-eating microbes. However, they operate at slower metabolic rates than warm water species. The cold temperatures also affect the nature of the oil, making it thicker and more viscous, which is harder for the bacteria to break down. Applying a dispersant to oil under these kinds of conditions may help break down the oil into smaller particles that are easier to digest for the oil-eating bacteria.

Because the circumstances of a particular spill (adequacy of mechanical response, oil type, proximity to oil-sensitive resources, weather, etc.) are critical, the decision to use dispersants on an actual spill will be made on a case-by-case basis. Prior to full-scale application, one or more field tests will be conducted to determine the effectiveness of oil dispersion under existing site-specific environmental conditions (Kind of like testing a stain remover on your clothes before spraying the whole garment). We all want to make sure it works.

The monitoring of dispersant effectiveness will be performed according to the Special Monitoring of Applied Response Technologies (SMART) protocols, a methodology that uses three tiers of monitoring.

• Tier I — Visual observations by trained observers, i.e. Did the oil slick disappear, forming cloudy water?)

• Tier II — On-water visual observations and using a special oceanographic tool (fluorescence spectrometry) at a single depth to measure oil concentrations under treated slicks; and

• Tier III — On-water visual observations, fluorescence spectrometry at multiple depths, and water chemistry sample collection to monitor horizontal and vertical spreading of the dispersed oil.

4. What are the safe limits of dispersant use?

(NOAA, EPA) If used properly, dispersants are less toxic than most common household cleaners, since dispersants have been designed and tested for use in the ocean. But we know that dispersants can cause harm to animals in the water

The proposed preauthorization plan includes various provisions to limit the potential adverse effects of dispersants. This includes the 24 mile nearshore boundary for operations, 60 foot minimum depth, the 96 hour operational limit, and stringent monitoring of marine mammals, etc.

5. Are there limits on the amounts that can be applied during a spill?

(NOAA, EPA) There are no gallons limits to the amount of dispersants that can be applied, but dispersant operations typically plan on a 1:20 dispersant to oil ratio. The preapproval is only effective for 96 hours (4 days) so there are practical limits on the amounts of dispersants that could be applied.

The recommended application rate of 5 gallons per acre of sea surface is itself a limit. This application rate results in a maximum short-term concentration of 5 parts per million (ppm) of dispersant in the upper meter of water. This concentration of dispersant is at the lower of the range of concentrations (mainly 10 to over 100 ppm) known to be toxic to sensitive marine water column organism over longer term exposures (96 hours).

6. What is the long-term monitoring of the environment going to be if dispersants are used?

(NOAA) Under the proposed preauthorization plan the US Coast Guard officer in charge of the response is required to monitor all dispersant operations and prepare a summary report within 30 days of completion of the dispersant operation(s) that includes the results of the monitoring and a description of any adverse environmental effects associated with the dispersant application, such as impacts to fish and/or wildlife (e.g. disturbance, unintentional over-spray). In addition, any spill large enough to entail significant dispersant operations would also trigger the Natural Resource Damage Assessment (NRDA) provisions under the Oil Pollution Act of 1990 (OPA 90). The NRDA process includes a detailed evaluation of injuries resulting from a spill (including any adverse effects of response actions, which would include impacts from dispersants use) and development of a restoration plan to address those impacts.

7. What have we learned about the short and long impacts of the large scale use of dispersant in the Gulf of Mexico?

(NOAA) The Deepwater Horizon oil spill involved extensive use of surface and subsurface dispersants. Dispersant and oil spill effects information continues to be reported in the scientific literature, including studies and reports illustrating both positive and negative consequences of dispersant usage. Using dispersants, like any other spill response measure, has trade-offs. Peer-reviewed scientific studies have shown that using dispersants may increase the short term impacts to organisms like plankton/etc. that live in the water column where the oil will be dispersed into, while also showing that their use reduces the impacts to shorelines, birds, fish, marine mammals, and other marine life that frequent the water's surface or the shoreline, where undispersed oil would remain. Studies after Exxon Valdez have shown how disruptive shoreline clean-up can be, and how long oil can persist on Alaska's shorelines. The federal and state agencies involved with dispersant decisions in Alaska will continue to analyze and use new information to make the best decisions for Alaska on a case-by-case basis.

8. How/When will the new dispersant stockpiling requirement under the 2009 CAPS rule start to be enforced? By whom?

(USCG) When the pre-authorization plan is signed, the Coast Guard will post the document on the Vessel Response Plan (VRP) Web site and publish a notice in the **Federal Register**. Plan holders within newly established pre-authorized areas will have **24 months** from the date of publication to achieve compliance and will be enforced by the Coast Guard as other VRP requirements are enforced. [Source: Federal Register / Vol. 74, No. 167 / Monday, August 31, 2009 / Rules and Regulations, page 45009-12]

9. How will Alternative Planning Criteria (APC) requests be reviewed and adjudicated in the preauthorization zone?

(USCG) As with any APC request, the Coast Guard will carefully examine all the factors surrounding any APC request, should any be submitted. The Coast Guard has invested significant time and effort to develop pre-authorization, partly to ensure industry provides dispersant capability as required by the CAPS rules. The Coast Guard stands with its RRT partners in desiring to see the required dispersant capability developed for Alaska, to ensure the FOSC has broadest range of tools in the response toolbox, and thus the best chance of success to effectively respond to a spill, protect the marine environment, and address tribal, stakeholder, and public interests.

10. What about environmentally sensitive areas (e.g., critical habitat, fisheries, subsistence areas, presence of threatened & endangered species) inside the preauthorization zone?

(USCG) {Also need to mention requirement to establish avoidance areas with 24 months within the preauth zone [or preauth is rescinded for that subarea]. FOSCs may desire to establish avoidance areas outside the preauth zone in the process.}

Pre-authorization does not automatically mean that dispersants will be selected as the preferred response option. Mechanical removal will remain the primary method for cleanup when feasible. Even in the preauthorization area, the FOSC will notify Federal, State, Tribal and other stakeholders, including consultation with Natural Resource Trustees. Additionally, the Environmental Unit of the Unified Command response structure will provide the FOSC with a broad range of information regarding environmentally sensitive areas. All these resources will inform the FOSC's decision on whether to use dispersants or not.

11. Does this apply to subsea use?

(USCG) No. Subsea dispersant use is considered atypical and is not addressed in the pre-authorization plan. FOSCs and the Alaska RRT will be guided by the NCP and NRT Guidance on Atypical Dispersant use.

In 2010, during the response to the Deepwater Horizon release in the Gulf of Mexico, large volumes of dispersants were injected into the wellhead at the seafloor. Although subsea injection of dispersants is being considered in the other coastal regions of the US, the proposed preauthorization in Alaska only applies to surface and aerial application of dispersants.

12. Will there be a public comment period?
(ADEC) There will be a 90-day comment period from November 13, 2013 to February 14, 2014. Individuals who wish to provide comments on the plan may do so by contacting LTJG James Nunez at james.d.nunez@uscg.mil or (907)463-2806. Comments collected during the public comment period will be reviewed by the Alaska Regional Response Team to further enhance the proposed plan.

13. When will this new preauthorization zone go into effect?
(USCG) After conducting Government-to-Government consultation with affected tribes, and outreach to other Alaskan stakeholders, the Alaska RRT will review input, make appropriate changes, sign the plan and publish in the Federal Register. This is anticipated to occur by early summer 2014.

14. What kinds of checks or limitation will there be on the policy?
(USCG) The policy itself contains a broad variety of means to ensure that even in pre-authorization areas, the FOSC will have a broad range of information and perspectives available when making the decision on whether to use dispersants or not.

15. What will happen to my family and my community if crude oil or dispersant taints our subsistence food supplies?
(DEC) Our goal is focused as much on protecting the Alaskan culture and way of life as it is on protecting our shorelines, so large oil spills are addressed by a consortium of responding agencies to address the whole gamut of oil spill issues. These include impacts to subsistence resources, economies, public and mental health, as well as environmental impacts. This is done first and foremost by removing as much product as possible before it reaches the shoreline. The consortium works with the responsible party to determine the degree to which residents, subsistence species, and their habitats (onshore, offshore, and in the intertidal zone) have been affected, and addresses both immediate and on a long-term effects.

The Alaska Department of Health and Social Services (DHSS) monitors and evaluates contaminant bioaccumulation trends in subsistence species and provides advisories about risks, or lack thereof, associated with consuming these resources. Biomonitoring typically focuses on subsistence species with a limited home range that reveal contaminant concentrations in local areas. These species, known as indicator species, typically include mussels, clams, sea cucumbers, and so on. Salmon and other highly mobile species are sampled when present and available. When/if contaminant concentrations exceed risk-based screening levels, the DHSS issues advisories to limit the consumption of subsistence species. The Unified Command may even close certain areas to subsistence harvest, if necessary.

The Unified Command also works with responsible parties to ensure that "claims lines" are established. Claims lines represent one of many avenues to access funds to protect and restore the environment and traditional ways of life. They also serve to document and compensate individuals and communities for hardships that arise when contamination negatively affects them. Although there is no formal mechanism to broker resource sharing agreements, the Unified Command typically works with affected and neighboring communities to see if one community can help another in times of need. Effects from large oil spills may linger for years, so it becomes essential for community representatives to remain engaged throughout the evaluation and remediation process in order to ensure that your concerns and observations are addressed until the environment is restored.

(NOAA) One of the greatest concerns during an oil spill response is ensuring the health and safety of the response workers and the public from the effects of the spilled oil, the response options, and cleanup efforts. Seafood tainting from a spill is possible, especially if oil reaches shores and coastal areas. But state and federal agencies will be monitoring seafood for oil tainting and will take the appropriate measures to notify the communities that may be affected by this.

However, when dispersants are properly applied, the general public will not come in direct contact with dispersants. Consuming seafood tainted by dispersants is also very unlikely. The ingredients in most dispersants are not persistent in the environment because they biodegrade (break down), and therefore do not move up the food chain. If crude oil or dispersants threaten to contaminate subsistence seafood, the federal and state agencies may institute advisories and/or closures.

16. Who was involved in the creation of this policy?
(USCG) A pre-authorization plan for dispersant use is an agreement, adopted by a regional response team in coordination with area committees, which authorizes the use of dispersants at the discretion of the Federal On-Scene Coordinator without the further approval of other Federal or State authorities. These preauthorization areas are generally limited to particular geographic areas within each region (33 CFR 155.1020). In this case, the members of the Alaska RRT required to approve a pre-authorization plan under Subpart J of the NCP worked together to develop a draft.

As prescribed in the NCP, the signatories are representatives of the EPA, DOI, DOC, USCG, and the State of Alaska DEC.

17. Since the 1989 ARRT Oil Dispersant Guidelines, how often have dispersants been used in Alaska? Where did these applications take place?
I believe there were test applications during Exxon Valdez, but a full-scale application never happened due to weather and equipment issues. To my knowledge this is the only case that dispersants were applied but we should check with others who have been doing this a lot longer than I have.

18. Will this change the mechanical oil recovery requirements that companies currently have to meet?
No, under Alaska Statute 46.04.030 and regulations 18 AAC 75.430 - 18 AAC 75.442 companies are still required to have sufficient oil cleanup equipment, personnel and resources to meet response planning standards. Furthermore, per 33 CFR Parts 154, 155, 156 tank vessels and transfer facilities will still be required to meet current requirements.

19. What are dispersants?
Dispersants are mixtures of solvents, surfactants and other additives that break up the surface tension of an oil slick or sheen and make oil more soluble in water, similar to the way detergent breaks up grease when washing dishes. Dispersants do not remove oil from the water but break up the oil slick into tiny droplets. These droplets spread out into the water column, where they may break down further in the environment. Tiny oil droplets have a greater surface area-to-volume ratio than larger droplets, which provides additional surface area for microbial degradation (think

about taking smaller bites vs. bigger bites of food, it will take longer for you to break down the bigger bites of food).

Longer Answer
Dispersants are products used in oil spill response to increase natural microbial degradation, a naturally occurring process where microorganisms remove oil from the environment. All environments contain naturally occurring microbes that feed on and break down crude oil. Dispersants aid the microbial degradation by forming tiny oil droplets, making them more available for microbial degradation. Wind, current, wave action, or other forms of turbulence help both this process and the rapid dilution of the dispersed oil. The increased surface area of these tiny oil droplets in relation to their volume makes the oil much easier for the petroleum-degrading microorganisms to consume.

Dispersants generally contain surface active agents (surfactants) and solvents. Surfactants are the active ingredients in many common household products including soaps, cosmetics, detergents, shampoos, and even food. Dispersants work because surfactant molecules have one end that is attracted to oil while the other end is attracted to water. When mixing energy is applied (e.g., wind, waves, currents), the dispersant-treated oil slick will break up into many tiny droplets that are less than 100 microns in diameter (smaller than the size of a period on this page). Solvents are used to dissolve the surfactants (some surfactants are solids) and to reduce the liquid's viscosity or resistance to flow (many surfactants are high viscosity liquids) so that the dispersant may be sprayed onto the spilled oil.

20. Do they really work? Why is there so much controversy!
Correct, there is a lot of controversy. A lot of that is from dispersant use years ago during the Torrey Canyon spill in England and Amoco Cadiz spill in France. Those involved much more toxic dispersants. Modern formulations are much better.

Here is what we know: Dispersants actually do break up oil slicks, causing oil droplets that mix down into the water. Some products work better than others. Most testing has been done in laboratories, some in big tanks. Only a few full-scale tests in really cold water. Less testing has been done in the ocean (because you can't get permits to spill oil). Their effectiveness depends on many things. Some oils and fuels are easily dispersed with dispersants, others not. They are generally are more effective in warmer water than colder. They are more effective in saltwater rather than estuaries. You have to have waves (to mix the droplets into the water).

In real spills the effectiveness of dispersant operations has been mixed. When they work, they work fast (seconds, minutes). Dispersant applications cover a much larger area and faster than do mechanical operations.

What we don't know: There are a lot of past international spills where dispersants were used but no one reported their effectiveness. We don't really know the extent to which dispersed oil might re-surface in calm waters. We don't know much about the effects of dispersants on mechanical recovery, when both are in use. Most of the hundreds of dispersant and dispersed oil toxicity studies have been done with Corexit 9500 and Corexit 9527 and a handful of oils and fuels. More studies are needed on other dispersant products and on other kinds of oils, and on both weathered and fresh oils.

21. Why do we use dispersants if the oil can be recovered mechanically?
Mechanical recovery will always be the most widely used response option, because most spills are small, close to shore, and often near locations where boats, boom, skimmers, and trained responders are available. But dispersants can be used under a wide variety of conditions since they are generally not subject to the same operational and sea state limitations as the other two main response tools — mechanical recovery and burning in place (also known as in-situ burning). Mechanical containment and recovery is only effective in relatively calm seas and good weather, and it works best during daylight. Dispersants are an essential part of the response in other weather conditions. It is important to carefully assess the effectiveness of each method, and to use each where it is most effective and needed.

Dispersants become a critical response tool for larger spills far from shore, spills more distant from stockpiles of recovery and containment equipment, when weather and ocean conditions preclude the use of other options, or when weather conditions are predicted to become more severe. This is because in addition to vessel-based operations, dispersants can be rapidly applied from aircraft as well; they are efficient when wind and waves prevent vessel-based mechanical recovery or in-situ burning operations

In remote areas including much of Alaska, response times can be a critical factor. Rapid response is critical as both mechanical response and dispersants can become less effective as the oil weathers. Oil slicks rapidly spread, and, depending on the oil type, can become extremely thin within hours of a spill. Dispersant aircraft can typically travel to spill locations at speeds over 150 knots compared to 7-8 knots which is the typical speed of a response vessel transiting to a spill location. Aircraft can reach the spill location quicker to begin responding before slicks have spread, moved, or broken apart into smaller surface slicks.

Furthermore, mechanical recovery becomes even more inefficient as the oil spreads and becomes very thin and becomes difficult to locate. Aerially applied dispersants can be used on these thin and widely spread patches of oil, while vessel-based response options may require many hours to haul in the equipment, move to a new location, and redeploy the equipment.

Rough seas and strong currents can also be a significant challenge for mechanical recovery. In seas greater than 3-5 *feet*, and currents over 1 knot, booms begin to lose the ability to contain oil causing slicks to wash over or under booms. Dispersants, however, retain their effectiveness when mixing energy in the form of waves increases, since the greater the mixing energy, the smaller the resulting dispersed oil droplets

22. How often will dispersants be used?
Hopefully never. Dispersants would only be used if there is a big spill that can't be effectively or safely responded to with mechanical equipment. Big spills like that happen really infrequently-

23. So why is a preapproval plan needed?
Because we don't want to wait until a big spill happens, because then it will be too late to get the equipment and supplies and training necessary. Dispersants are most effective on fresh oil. Waiting even a few days could result in an even bigger mess if the oil spreads and come ashore.

If you are relay worried about safe and thoughtful dispersant use, then you want a strong plan that has lots of checks and balances and requires extensive monitoring. The day of a big spill it is too late to establish all of those requirements.

24. How do dispersants help in the event of an oil spill?
The use of dispersants helps reduce the amount of surface oil that might reach sensitive shoreline habitats and help reduce the amount of oil that sea birds and other wildlife may encounter floating on the water surface.

25. What are the trade-offs that are typically considered?
In essence, the choice is discriminating between the "lesser of two evils." A decision to use dispersant involves balancing the risks to certain animals and plants at the water surface and in shoreline habitats against the potential risk to other organisms in the water column and the seafloor. Dispersants can cause real impacts to fish and plankton, which will also have temporary impacts to the organisms that eat them, but that they are more likely to recover more quickly than some of the top-of-food-chain organisms at the water's surface or shoreline.

26. What is the fate of dispersants and dispersed oil after dispersant applications?
When dispersants are applied, the oil is broken up into tiny droplets that are quickly dispersed by currents, mixed and diluted within the top few 30 feet of the water column, and where they can be degraded by microorganisms within days to weeks. Harmful effects are likely localized to the areas close to application. While the half-life of the dispersant is approximately in the days-to-weeks range, some elements in crude oil would degrade more slowly, especially if the oil strands on sheltered shorelines.

27. Doesn't dispersed oil just sink out of sight?
Dispersants do not make the oil sink. There are several natural processes that can lead to oil sinking, including being driven into shallow nearshore areas where it can pick up sand and sediments and then sink. Dispersing the oil offshore can reduce this potential for sinking. Dispersed oil typically stays in the top layers of the ocean. Most of these droplets are so small that they remain suspended in the sea water and travel and continue to mix with ocean currents. In calm conditions larger droplets may rise back to the surface, but with any wave energy these will essentially stay neutrally buoyant.

28. What about natural dispersion? Isn't that enough?
After oil is spilled in the environment, it immediately begins to undergo a wide variety of physical, chemical, and biological processes that begin to transform the oil. Some fraction of the oil will disperse naturally regardless of whether chemical dispersants are used. The extent to which this occurs depends on the type of oil spilled and the mixing energy. Natural dispersion takes place when the mixing energy provided by the waves and wind is sufficient to overcome surface tension at the oil/water interface and break the oil slick into droplets of variable sizes. In rough seas, light oils may even be completely dispersed by this process.

29. Which dispersants are preapproved?
All dispersant products and other chemical countermeasures used in the US must be listed on the US EPA National Oil and Hazardous Substances Pollution Contingency Plan (NCP) Schedule. Approved dispersants must meet minimum effectiveness requirements and the manufacturer must report toxicity test results. Currently there are 19 dispersants included on the schedule (http://www.epa.gov/oem/docs/oil/ncp/schedule.pdf)

30. Why was Corexit used during the Deepwater Horizon oil spill? And, are there less toxic dispersants available?

Yes, there were some dispersants that were slightly less toxic, but they were also much less effective, which means responders would have had to apply a lot more to the environment for them to work. Corexit was used because it was possible to obtain a large enough supply to meet the anticipated need for dispersant in the days immediately after the spill. Recent studies by the USEPA found that Corexit 9500A had generally similar toxicity to other available dispersants but was generally less toxic when mixed with South Louisiana sweet crude oil.

31. What do we know about the fate and behavior of Corexit 9500A?

This dispersant is readily biodegradable and does not bioaccumulate. In biodegradation studies showed a 78% biodegradation of Corexit in 28 days, while other studies estimated the half-life of 4.2 days. Half-life is the length of time that it takes half of the material to disappear or change to something else. For Corexit 9500 components, the bioaccumulation factors are in the range of 2.6-208, well below the regulatory bioaccumulation threshold for concern value of 1000. For comparison purposes, the bioaccumulation factor for a known infamous pesticide DDT ranges from 12,000 to 80,000 depending on the species.

32. Why is the use of dispersants so controversial? Is it because they are toxic?

Dispersant use has been controversial for years because initial formulations caused more environmental damage than the oil itself. Today's oil spill dispersants are the product of several decades of development, to improve effectiveness and reduce toxicity. The industrial detergents used at the Torrey Canyon oil spill would not be allowed to be used today because they would not meet the toxicity or effectiveness criteria of the EPA. Current formulations are relatively benign and most of the offshore environmental impacts associated with dispersant use are from the oil that has been dispersed rather than from the dispersant itself. When dispersants are properly applied, the overall risk to wildlife from the chemicals in the dispersants is substantially less than the risks from the oil. At the standard application rates directed by the U.S. Coast, and under the mixing conditions of the ocean, dispersants are not expected –in most circumstances– to cause significant harm to most marine organisms.

33. Given reports of dispersant toxicity, why would you allow any application of dispersants?

Dispersants are generally less harmful than crude oil and biodegrade in a much shorter time span. The toxicity of dispersants and dispersed oil has been studied in great detail and it was concluded that the main toxicity effect of dispersed oil droplets comes from the oil itself and not from the dispersant.

34. Why is dispersed oil more toxic than the oil itself, is this a factor of bio-availability?

Dispersants decrease the surface area of an oil slick and increase the surface-to-volume ratio of oil droplets thereby facilitating oil weathering and degradation (photolysis and microbial biodegradation). This process also results in an increased dissolution and partitioning of toxic oil constituents into the water column, increasing oil bioavailability. Although the use of dispersants does not increase the toxicity of oil, the increased bioavailability of oil constituents implies that more oil is available for uptake by aquatic organisms, which results in a much higher exposure dose compared to oil exposures in the absence of dispersants.

35. Dispersants redistribute oil instead of removing it from the environment. How does this strategy help the environment?

Dispersants do transfer oil from the surface into the water column. Organisms, including fish that come into immediate contact with oil or a concentrated dispersed oil cloud (immediately after dispersant application) are likely to be affected. One of the considerations for dispersant use is to identify conditions and locations that will allow for rapid dispersion and dissolution of the oil to low concentrations to minimize harm to marine life. When used properly, dispersants reduce the risk of environmental harm. If oil is not treated, it may remain on the surface for a long time, increasing the probability it could affect birds and marine life and/or reach the shoreline. Surface oil poses known risks to birds, marine mammals, and the shoreline environment.

36. Doesn't the addition of dispersants just add toxic chemicals to an already polluted environment?

Dispersants or some of their ingredients may be toxic to certain aquatic species when tested in isolation. However, when dispersants are used on an oil spill, they are applied to the water surfaces in small amounts over large areas, generally at a rate of 5 gallons per surface acre, in deep ocean water. The dispersant quickly mixes with the water, and the resulting dispersant/oil particles are rapidly diluted and dispersed to low concentrations that fall–within minutes to hours– below acute toxicity thresholds.

37. What about weathered oil and dispersants?

Oil weathering can have a significant impact on the properties of a slick and affect dispersant effectiveness. Studies of Alaskan North Slope Crude have shown that dispersants work best on fresh oil, and effectiveness declines as the oil weathers.

38. Why is this limited to crude oil only?

Research and experience have shown that dispersants work best on light oils and medium to heavy weight crude oils. Dispersants can effectively disperse light products; however, these materials such as gasoline and diesel tend to rapidly evaporate and biodegrade when spilled, so the use of dispersants is not recommended. Conversely, the composition of very heavy oils like bunkers or asphalts limits the effectiveness of dispersants**.**

39. Aren't these dispersants banned in Europe?

Dispersant policies vary among countries, but dispersant policies in Europe are generally similar or more liberal than in the US, and dispersants are often considered a first response option in a number of countries around the world, including close to shore.

40. Do dispersants bio-accumulate?

These substances have low bioaccumulation potential. Although the Material Data Safety Sheets for one dispersant being used states that certain of its components have a potential to "bioaccumulate," the known components of this dispersant are not expected to have a significant bioaccumulation risk, particularly given the rate at which dispersants are typically applied (approx. 5 gallons/surface acre).

41. Is the 24 mile limit and minimum water depth because of their toxicity?

Dispersants are generally used in deep ocean waters as a precautionary measure to minimize any potential exposure of sea floor and nearshore organisms. One of the potential concerns about dispersant use is the potential negative effect that they may have if they are used in shallow or confined waters. There is concern that in these shallow areas dispersed oil droplets may not dilute as rapidly and could affect water column and bottom dwelling plant and animal communities.

Keeping dispersant operations offshore provides space and time for the dispersed oil to dilute to non-toxic levels.

Most state preapproval zones elsewhere in the US are in waters more than 3 miles offshore and water depths of 30-60 feet or more. The proposed Alaska preapproval zone is far more cautious that other states. The 24 mile limit means that most of the water depths are far deeper than prescribed elsewhere in the US.

42. Why is the preapproval limited to central and western Alaska?
The marine approaches to Prince William Sound, Cook Inlet, and the Aleutian passes are the primary routes for the vessels carrying crude oil. The USCG conducted a vessel track analysis that confirmed that these regions were the highest traffic areas.

43. What are the potential effects on marine life?
When evaluating the potential effects on marine life from dispersant use, it is important to weigh those potential effects in comparison to the benefits from dispersant use. As EPA has said, "we know dispersants are generally less toxic than the oils they breakdown," but the use of dispersants is an "environmental trade-off." The EPA, NOAA, USCG, and the University of New Hampshire (UNH) Coastal Response Research Center recently convened a panel of more than 50 scientific experts to evaluate Dispersant Use and Ecosystem Impacts of Dispersed Oil in the Gulf of Mexico. These experts also concluded that: "…use of dispersants and the effects of dispersing oil into the water column has generally been less environmentally harmful than allowing the oil to migrate on the surface into the sensitive wetlands and near shore coastal habitats."

44. What are the potential effects on humans?
Potential effects on humans theoretically could occur through inhalation of dispersants at or near the site where they are applied, or through consumption of seafood that is tainted with oil and dispersants. For both of these potential exposure pathways, measures are being taken to ensure that human health impacts are minimized. Workers applying dispersants at sea, and those working with them and near them, have the personal protective equipment recommended by the dispersant maker. In addition, air monitors on offshore response boats are used to measure and maintain exposure levels within safe occupational exposure limits.

45. Didn't a recent study show that dispersants are 52 times more toxic than oil?
Dispersants put more oil into the water, which is what dispersants are designed to do. The more oil you put in the water, the more toxic the water is. This is not news. Many other researchers have already shown that dispersants don't make oil more toxic, they just make it more available to marine organisms in the water and less available to animals on the surface. Many other competent studies show that dispersants are substantially less toxic that the oils they are designed to disperse.

46. I heard that enzyme-based bioremediation products are a lot less toxic to marine life than dispersants. So why don't we replace the dispersants with these?
You have a point, but not all the information.
What we know:
There are hundreds of oil spill bioremediation products out there, dozens listed by EPA.

Some contain enzymes and/or bacteria which when applied to oil on water in laboratory jars, can degrade oil compounds.

The degradation is not fast, takes days to weeks.

Most products are designed to be applied to oiled beaches or soil at hazardous waste sites, and the help degrade oil over periods of weeks to months.

Some of these products are indeed less toxic to marine animals than some dispersant products.

Unlike the situation with dispersants, there are literally no peer-reviewed scientific studies on the effectiveness and effects of enzyme-based bioremediation products under reasonable field conditions.

This applies to Oil Spill Eater II. The vendor has provided numerous letters from "satisfied" customers, but no reliable scientific data.

EPA did studies in aquaria with this product. The product did not degrade oil any faster than untreated oil. The results have not been published.

What we don't know

When an enzyme based bioremediation, product is sprayed on oil slicks on the water, we don't know how to keep it in contact with the oil long enough to let it help degrade the oil (days).

We know of no bioremediation products specifically designed for application in open ocean conditions.

An effective bioremediation event requires monitoring the chemical composition of the oil and water samples. There are no protocols for this at this time.

Before adopting enzyme-based bioremediation products, we recommend that studies be conducted in large tanks in Alaska, under Alaska conditions.

It is not an either or situation- we need both tools in the toolbox.

Appendix F. Friends of the Earth and Friends of the San Juans "Minority Report"

FRIENDS OF THE EARTH and FRIENDS OF THE SAN JUANS

Minority Report for the 2019 Dispersant Science Task Force of the RRT 10/Northwest Area Committee's Dispersant White Paper

Friends of the Earth and Friends of the San Juans are deeply disappointed by how few new insights were elucidated as a result of the review of the extensive literature that has been published over the past 14 years since the NW Area Committee dispersant policy was last reviewed and revised.

Rather than recommending the adoption of a precautionary approach for dispersant use while there remains a paucity of information on its efficacy and toxicity, the report provides little to no guidance other than suggesting that a policy review should occur at some indefinite time in the future. It is important to acknowledge that we have sought this policy update of the NW Area Plan for over 5 years. This in effect supports the status quo which resulted in one of us limiting the time spent towards the development of the White Paper and the other removing their affiliation from the report given the white paper's implied effectiveness of dispersant use in other than offshore, open ocean environments.

However, we do support the finding in the White Paper that states:

> The two areas where recent research raises yellow cautionary flags, from the perspective of interpretation and extrapolation into policy considerations, fall under the categories of 1) dispersed oil and dispersant effects to exposed marine organisms like larval fish, and to air-breathing animals at the air-sea interface like marine mammals or seabirds; and 2) possible human health effects to response personnel and the broader public. In both cases, separating effects from oil alone (i.e., not using dispersants), and dispersed oil or dispersants, was challenging and frequently not possible.

Interestingly, the FAQs about dispersants developed by the State of Alaska's RRT found in Appendix E of the White Paper states, "The proposed preauthorization plan includes various provisions to limit the potential adverse effects of dispersants. This includes the 24-mile nearshore boundary for operations, 60-foot minimum depth, the 96-hour operational limit, and stringent monitoring of marine mammals, etc." (#4) This is in contrast with the NWACP policy for dispersant use on a case-by-case basis within three miles of shore.

Rather than being able to review the current West Coast Response Plan, we were told it is a "planning document under development by the Office of Protected Resources within NOAA/NMFS, and is intended to provide response guidance to NOAA personnel along the west coast; however, it is an internal agency project and the plan is not currently available to the public, although it may be released in the future. As such, it was not reviewed by the task force."

Despite the little information that is known, the current NWAC Dispersant Policy Map includes the narrowest waterways of the Salish Sea (< 1 mile) for potential dispersant application on a case by case basis (see https://waecy.maps.arcgis.com/apps/webappviewer/index.html?id=ff1d0cd00e6641209e25b9ee56df46fc).

The narrow, glacially carved straits in the northern portions of the US waters in the Salish Sea are very deep nearshore, regularly exceeding 100 feet within 100 yards of shore. The current policy of the NWAC considers such close proximity to shore as potentially suitable for dispersant use because of depths exceeding 60 feet. This policy fails to recognize that the oil would likely to strand on shore well before the dispersant would have time to have any potential impact on the oil.

These nearshore waters are also of high biological richness and in close proximity to residential homes and businesses. Furthermore, while these sheltered, inshore waters can exhibit short, choppy waves, they rarely exhibit the large waves typically used to model dispersant mixing which is critical to their hypothesized benefit. The Salish Sea's narrow straits and wide tidal range also result in swift currents, further reducing the likelihood that the dispersants would have any time to break down the oil before beaching. Finally, dispersants, to the degree they are effective, work best on medium crude oils. However, ships will be increasingly likely to be running on lighter grades of fuel to comply with the Emissions Control Area (ECA) and there is a concerted effort to expand the export tar sand derived crude, neither of which are suitable for dispersant deployment.

In addition to the concerns we have associated with the liberalization of potential dispersant use in the absence of data as evidenced by the recently identified Dispersant Case-by-Case Authorization Zones on the NWACP dispersant policy map, is the impact such expanded for dispersant use support is used to dissuade more stringent requirements for mechanical recovery.

The State of Alaska's RRT FAQs (Appendix E) asks, "How will Alternative Planning Criteria (APC) requests be reviewed and adjudicated in the preauthorization zone? As with any APC request, the Coast Guard will carefully examine all the factors surrounding any APC request, should any be submitted. The Coast Guard has invested significant time and effort to develop pre-authorization, partly to ensure industry provides dispersant capability as required by the CAPS rules." (#9). We are currently experiencing this similar potential tradeoff at the state level as the Department of Ecology is refusing to update its oil spill response standards during its current legislatively mandated 5-year update of it contingency plan rule.

In addition, though it does recognize it is common practice to incorporate tribal input to the incident command decision-making, the white paper does not explicitly recognize the need for consultation with all Treaty Tribes regarding dispersant use and dispersant use policies in their Usual & Accustomed (U&A) marine area or waters.

In conclusion, we do support the White Paper's findings calling for the development of a Net Environmental Benefits Analysis to elucidate tradeoffs related to impacts of dispersant use on marine species during oil spill response. Unfortunately, this has been the case for two decades and the failure of the RRT to require that the incident command be informed with real time marine biological information (e.g., upwelling index, satellite-derived sea surface temperature and plankton density) has kept the tradeoff analysis to be one sided. We also support the review of personal protection equipment requirements and policies, to ensure that responders are adequately protected under all conditions.

However, until the existing NWACP dispersant use policy is updated we believe it is irresponsible to envision supporting the deployment of dispersants within the Salish Sea with the potential exception of areas in the eastern Juan de Fuca Strait and southern Georgia Strait where dispersant application can take place at least three nautical miles from any US shore. This is the maximum extent such an inclusion of inshore waters should be considered and the maps should be modified accordingly ASAP.

We appreciate the Dispersants Task Force's efforts to advance our current understanding of relative merits of dispersant use in different environmental conditions. We believe that the data that has been assembled requires the adoption of a precautionary approach that removes the Dispersant Case-by-Case Authorization Zones from the vast majority of inland waters of the Salish Sea.