PWSRCAC Dispersant Use Position Supporting Materials

Background

In September 2022, the Prince William Sound Regional Citizens' Advisory Council (PWSRCAC) adopted an updated position on the use of dispersants in Prince William Sound (PWS) and the Exxon Valdez oil spill (EVOS) affected region. This paper summarizes key evidence from scientific literature, technical reports, and policy documents in support of the Council's position.

Contents

Mechanical Recovery is the Preferred Response Method

PWSRCAC supports mechanical recovery as the preferred response method in PWS and the EVOS affected region because it is the only response option that removes oil from the marine environment. Dispersants do not remove the oil from the sea; they move it from the surface to the water column and sea floor (Ventikos, 2004).

The Dispersant Use Plan for Alaska (ARRT, 2016) affirms this preference by stating:

> "The primary method for cleaning up oil will be mechanical removal" (page F-15).
>
> "The use of dispersants may provide an alternative response tool when mechanical recovery and/or in-situ burning, alone or in combination, are infeasible, ineffective, or insufficient" (page F-15).
>
> "Dispersant delivery in a mechanical recovery area will not displace or interfere with mechanical or other response operations" (page F-15).

The Dispersant Use Plan for Alaska affirms the preference for mechanical recovery as the "primary method for cleaning up oil."

Operating conditions in PWS limit the feasibility of effective dispersant application compared to mechanical recovery. Historical weather data shows that wind, sea state, air temperature, and visibility in central PWS favor mechanical recovery 87% of the time year-round and 96% in summer. Conditions favor dispersants only 25% of the time year-round, with lower feasibility in summer (Nuka Research, 2007; Nuka Research, 2008).

When dispersants are applied to an oil slick, the dispersant will only treat the portion of the slick where they are accurately applied in the right dosage. Only a fraction of the treated oil will be effectively dispersed and the oil slick may still wash ashore. Despite the heavy application of dispersants during BP's Deepwater Horizon spill response, over 1,300 miles of shoreline was still oiled (Wilson et al., 2021).

Oil that has been chemically dispersed from the surface to the water column may eventually resurface over time (Loh et al., 2019). Applying dispersants to an oil slick causes physical and chemical changes to the oil that can make it more difficult to recover the remaining oil using skimmers (National Research Council, 2005).

There is a substantial stockpile of mechanical recovery equipment in PWS and the EVOS affected region, including boom, skimmers, storage barges, and oil spill response vessels with trained crew and responders. This capacity is supported by strong oil spill response plans based on response planning standards that promote timely and effective on-water containment and recovery (DeCola and Robertson, 2018). Treating an oil slick with dispersants may undermine the effectiveness of this robust mechanical recovery system.

Dispersants Have Not Been Demonstrated to be Effective in Conditions Found in EVOS Region

Application of chemical dispersants to Alaska North Slope (ANS) crude oil spills in regions with similar temperatures and salinity profiles as those found in PWS and the EVOS affected region has never been demonstrated to be effective in the laboratory or in the real world. During EVOS, dispersants were applied to the slick and declared ineffective due to insufficient light and lack of wave action. The dispersants did not break up the slick, but instead herded the oil (Gilson, 2006).

> "The long term effects (of dispersants) on aquatic life are unknown."
> U.S. Environmental Protection Agency Administrator

Tank trials conducted in the past have failed to demonstrate dispersant effectiveness on ANS crude oil under environmentally reasonable conditions. A series of cold water dispersant trials that attempted to demonstrate the dispersibility of ANS crude oil were determined to be inaccurate because the oil was warmed to reduce its viscosity. Dispersant effectiveness may have been overestimated because it was done visually without measurement or calculations. Some of the observed dispersion was temporary, as the oil eventually resurfaced once mixing energy was turned off (DeCola & Fingas, 2006; Belore et al., 2009; S.L Ross, 2007).

Even in regions with higher water temperatures and higher salinity, which are more favorable for dispersant application, the dispersant does not remove the oil from the environment. Dispersed oil moves into the water column, where the hydrocarbons are known to be toxic to fish, plankton, and other marine life (National Research Council, 2005; Mearns et al., 2020).

Potential Benefits of Chemically Dispersing Spilled Oil Do Not Outweigh the Known Harms and Potential Risks

PWSRCAC opposes dispersant application in PWS and the EVOS affected region because of the risks – known and unknown – of causing harm to ecological resources and human health. Dispersants have been shown to disrupt respiratory, nervous, immune, and endocrine system functions, increase toxin exposure levels to larvae and developing organisms, and cause higher mortality rates when animals on multiple trophic levels are exposed (Arnberg et al., 2019; Couillard et al., 2005; Dussauze et al., 2014; White et al., 2017).

> "There remains a paucity of information on the long-term consequences of dispersants in the marine environment."
> "A Decade of GOMRI Dispersant Science: Lessons Learned and Recommendations for the Future" (Quigg et al., 2021)

As chemically dispersed oil increases in the water column, there is a greater chance for marine organisms to come into contact with oil droplets, which readily adhere to the eggs of pelagic fish species, allowing for the transfer of toxic components through the egg surface to the embryo during development (Hansen et al., 2018; Mearns et al., 2020).

Past oil spill incidents where dispersants were applied have resulted in adverse human health impacts. Personnel who participated in dispersant application in response to the Deepwater Horizon oil spill experienced acute respiratory symptoms such as coughing, shortness of breath, and wheezing (Alexander et al., 2018). Workers also reported skin irritation and swelling to areas that came into contact with dispersants; studies confirmed that components of the dispersant Corexit 9500A cause eye irritation and "allergic hypersensitivity" of the skin (Anderson et al, 2011). Deepwater Horizon responders were exposed to toxic aerosols, where a portion of the crude oil and dispersants evaporated and increased concentrations of particulate matter, sulfur and nitrogen dioxide, and carbon monoxide in the surrounding air (Beland & Oloomi, 2019). Coastal communities can also face adverse effects of dispersant use, with higher occurrences of infants being born prematurely and underweight (Beland & Oloomi, 2019).

While dispersant application increases the amount of oil droplets in the water column, there is disagreement in the scientific literature regarding whether dispersants increase or reduce oil biodegradation. In cold water regions like Prince William Sound, "the lowered temperatures significantly reduce the effect of dispersant on the biodegradation of oil under simulated marine conditions" (Davies et al., 2001).

While dispersants may inhibit biodegradation of oil in coastal and pelagic waters, there is strong evidence that dispersants enhance the transfer of oil to benthos through the formation of marine snow and sedimentation (Brakstad et al. 2018; Tao et al., 2018).

The long-term impacts of dispersant application are poorly understood. While an oil spill on any scale will have adverse impacts, the addition of dispersants may exacerbate them in known and unknown ways. Research from the Gulf of Mexico has yielded mixed results and there is a lack of scientific consensus regarding the safety or effectiveness of dispersant application. PWSRCAC is not willing to risk the organisms, ecosystems, or communities in PWS without concrete scientific evidence proving dispersants are safe and their use on spilled oil benefits people and the environment more than other response methods.

The Dispersant Use Approval Process Outlined in the Federal On-Scene Coordinator (FOSC) Dispersant Authorization Checklist Will Preclude Dispersant Application in PWS and the EVOS Affected Region

Various requirements on the Dispersant Authorization Checklist used during an oil spill response cannot be met due to the unique conditions found in Prince William Sound. Dispersants are primarily created to be utilized in seawater with a salinity that falls between 30 and 35 parts per thousand (ppt) (ITOPF, 2011). Some areas within the EVOS affected region have a salinity that falls below 15 ppt during certain seasons (Musgrave et al., 2013).

For dispersant application to be successful, there must be adequate mixing energy in the water. This is uncommon in the semi-protected waters of PWS where there may not be enough turbulence in the upper water column to mix oil and dispersant (Musgrave et al., 2011).

One of the criteria in the Dispersant Use Plan for Alaska decision-making checklist requires that dispersant application be a minimum of 1,640 feet away from swimming fish, rafting seabirds, swimming marine mammals, or marine mammal haul outs. Prince William Sound has rich ecological resources and there is no time of year during which fish, seabirds, or marine mammals are not potentially present. There is no way to assure that these organisms will remain at least 1,640 feet from dispersant operations.

> "Chemically-dispersed oil exerts more remarkable sublethal effects in oysters in comparison to mechanically-dispersed oil…dispersant provokes some sublethal toxicity, at least transiently, as reported for other biological effects endpoints in other marine animals."
>
> Luna-Acosta et al., 2017

PWSRCAC also believes that the Alaska dispersant decision-making checklist does not adequately incorporate feedback from key stakeholders who may be adversely impacted by chemically dispersed oil. Chemically dispersed oil threatens food safety and security within Alaska Native Tribes and coastal communities that rely on subsistence foods for cultural and nutritional value. Important finfish and shellfish species have been shown to experience adverse impacts when exposed to dispersants and chemically-dispersed oil (Luna-Acosta et al., 2017; Keitel Gröner et al., 2020).

Supporting Literature

The PWSRCAC maintains an extensive database of peer-reviewed literature on oil spill dispersants research and commissions periodic literature reviews. The database is available on our website, https://www.pwsrcac.org/programs/environmental-monitoring/dispersants/dispersant-literature-reviews/.

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