

# Role of Dispersants in Oil Spill Response

Oil spill prevention remains a major focus for industry and government alike, yet despite best efforts spills remain a constant threat. We must therefore maintain our preparedness to readily respond at all times.

Among various response options, dispersants are now recognised as one of the most effective at-sea response technique for many major open water spills, making them a primary response tool rather than an alternative strategy. This widespread acceptance stems from a growing awareness that:

- ◆ Traditional on-water mechanical response encounters only a small part of a large slick and can be severely limited by rough weather and seas, often resulting in recovery of not more than 10 percent of spilled oil.
- ◆ Advances in dispersant formulations have dramatically reduced their toxicity and improved their effectiveness. Today's dispersants do not add to the toxicity of dispersed oil. Recent tests have shown the latest dispersant formulations to be effective for a wider range of oils and at lower concentrations.
- ◆ Dispersed oil droplets dilute rapidly in open water and has not shown significant toxic effects on marine or benthic life. Where minor effects have occurred, biological recovery has been rapid.

A definitive body of evidence encompassing over 30 years' worth of studies and practical experience continues to indicate the positive benefits of dispersant use, including:

- ◆ A potentially lower overall environmental impact than when relying on other countermeasures alone



- ◆ Vastly reduced hazardous waste generation
- ◆ Reduced shoreline impact
- ◆ Reduced exposure of birds and mammals to excessive oil

This conclusion is supported by numerous international agencies, including the U.S. National Research Council (NRC), the U.K. National Environmental Technology Centre (NETCEN), the International Maritime Organization (IMO), the International Tanker Owners Pollution Federation (ITOPF), CEDRE and the U.S. Coast Guard. Useful references are included in the electronic document for further research.

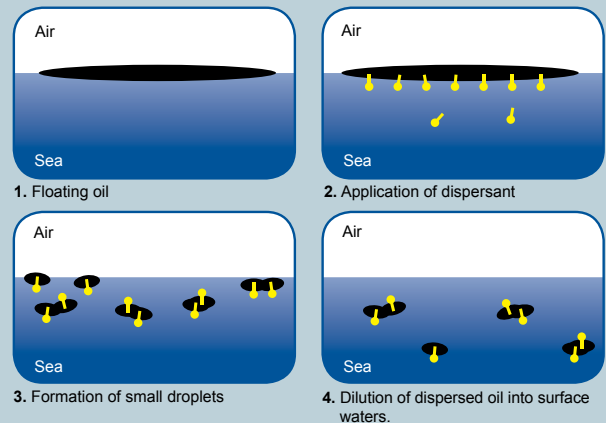
## How Dispersants Work

Modern dispersant is a solution made of two compounds: a solvent and a surfactant. The surfactant, or surface active agent, is the active ingredient which reduces the interfacial tension between oil and water, allowing the oil to be broken up into tiny droplets that are entrained into the water column by wave energy.

These droplets are so small (1-70 microns) that they are effectively neutrally buoyant and so remain suspended in the top 5 -10 metres of the water column. Tidal flows and currents quickly distribute the oil droplets to very low (less than 1 part per million) concentrations, thereby reducing the possible harm to sea life.

The formation of these droplets greatly increases the surface area exposed to hydrocarbon-degrading bacteria already present in the water which break

## Mechanism of Chemical Dispersion



the oil down into simpler, less harmful compounds in a natural process called biodegradation. Natural dispersion and degradation processes have been used by nature to remove oil which has been seeping into the sea for millions of years.

## Importance of Dispersants

Spills with significant biological impacts have often resulted from un-dispersed oil accumulating in the near shore or intertidal zones. Dispersants remove oil from the water surface into the water column thereby reducing possible impacts on birds, wildlife, sensitive shorelines, amenity and tourist beaches, and intertidal marine species.

By distributing the oil into the water column where it can be diluted to safe levels dispersants prevent, or at least mitigate, the consequences of shoreline impact. The goal is to maximise the net environmental benefit of the response technique.

## How Dispersants Are Applied

Dispersants can be applied using boats, helicopters and fixed-wing aircraft. A single large aircraft can treat a spill up to 40 times faster than even the largest skimmer, which must operate slowly to be effective. In addition, aerial application allows dispersants to be applied in rough seas where use of mechanical equipment is not feasible.



## Considerations for Dispersants Use

Dispersants should not be applied to oil upstream of or directly over sensitive marine areas, such as coral, fish farms or mariculture unless it is obvious that by doing so they would be more protected than more than by not doing so.

For maximum effectiveness, dispersants need to be applied to oil before it becomes viscous through weathering or emulsification. Dispersants should not be used on very viscous oils as they tend to be less amenable to dispersion. Oils with a viscosity of more than 5000 cSt should be treated with a test spray to evaluate effectiveness before commencing wide spread spraying operations.

Care should also be taken to ensure that oil is not dispersed in zones of low water circulation where it could remain suspended at high levels for extended periods. Oil should not be chemically dispersed near open water intakes.

## Environmental Impact

The prudent use of dispersants can reduce the overall impact of an oil spill on environmental and economic resources. Nonetheless, the decision to use dispersant should always be a careful one based on sound analysis of the overall environmental benefit. The use of Net Environmental Benefit Analysis (NEBA) is advocated to evaluate proposed environmental actions and comparing the tradeoffs of those actions.

At the contingency planning stage, this goes towards identifying the relative risk to potentially sensitive resources in different parts of the marine environment and resolving conflicting priorities (e.g. between seabirds at risk from floating oil and shellfish at risk from dispersed oil), thus laying justifiable grounds for dispersant use.

## Health Impact

Dispersants are generally not hazardous to humans but it is prudent to take reasonable protective measures. In the few cases where there have been health effects, proper safety procedures had not been followed. Workers involved in the handling of dispersants should wear protective equipment to minimise inhalation and contact with eyes and skin.

## Regulatory Issues

In almost all instances, regulatory approval is required for dispersants application. Dispersants are usually first evaluated and then placed on a government-sanctioned product list. To use dispersants in a particular incident,

their use must be approved by officials during the incident.

It is essential that this approval is quickly obtained as dispersant effectiveness diminishes as the spilled oil weathers. Unfortunately reality has often shown this to be a considerable bottleneck which delays response times and compromises effectiveness. The following steps can help speed the approval process:

- ◆ Zones where dispersant use is acceptable should be identified in the pre-planning phase
- ◆ The decision to authorise dispersant use at the time of the spill should be delegated to as few participants as possible. If many agencies are involved in the decision (currently up to 16 in some countries), it can take a long time to reach agreement.

## Where Dispersants Are Approved

Dispersants are approved and used in many countries of the world. They are the first line of defence in countries such as the U.K. and South Korea, where recurring rough seas make dispersants the most practical option. In the U.S., many coastal states have pre-authorised dispersant use. Dispersants are also approved in Australia, Egypt, France, Greece, Indonesia, Italy, Japan, Malaysia, Norway, Singapore, Spain, Thailand, and most of the coastal African, South American, and Middle Eastern countries.

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## Dispersant effectiveness: Sea Empress spill, 1996



Dispersants have been successfully applied in more than 80 spills over the past 30 years. Frequency of use has steadily increased during the 1990s till the present.

In the 1996 Sea Empress spill in Wales, dispersants were used in open water while mechanical recovery was used near shore. Over 80 percent of the oil (about 35,000 tonnes) which did not evaporate was kept from impacting shorelines by natural and chemical dispersion processes. Subsequent studies showed that there was a net positive environmental benefit for seabirds, coastal waters, intertidal habitats, and tourist beaches.

\*Information adapted from the Sea Empress Environmental Evaluation Committee report, *The Environmental Impact of the Sea Empress Oil Spill*.

## Further Reading

IPIECA, *Dispersants and their role in oil spill response*

IPIECA, *Choosing spill response options to minimise damage - Net Environmental Benefit Analysis*

API, *Effects of oil and chemically dispersed oil in the environment*

API, *Fate of spilled oil in marine waters*

API, *A decision maker's guide to dispersants*

EMSA, *Applicability of oil spill dispersants*

EMSA, *Inventory of national policies regarding the use of oil spill dispersants in the EU member states*

NOAA, *Open water oil identification job aid for aerial observation*

CEDRE, *Using dispersant to treat oil slicks at sea*

ExxonMobil, *Oil spill dispersant guidelines*

USCG, *Developing consensus ecological risk assessments: environmental protection in oil spill response planning*

NOAA, *Dispersant application observer job aid*

ITAC, *The use of chemical dispersants to treat oil spills*

ITAC, *Dispersant application from vessels*

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