

Basic information on oil dispersant use following the Deepwater Horizon Incident.

OIL AND DISPERSANTS:

Untreated oil:

Crude oil tends to disperse into a wide, thin layer at the surface of the ocean. Much of the surface oil (20-50%) is lost to evaporation within the first two days. Ideally, all oil should be collected and removed from the surface at this time and U.S. Coast Guard documents state that, "Mechanical recovery is the preferred method as it provides for the removal of the oil from the environment..." However, because it is extremely difficult to find and remove the oil on the surface quickly, the remainder of the oil that does not evaporate continues to "weather" and becomes entrained in the water column over time. Some of this oil sinks to the bottom and becomes a plume of benthic oil but much of the oil stays close to the surface and moves with the fast-moving water currents; this is the oil that poses the greatest risk for severe negative impacts on shorelines and shallow water areas (especially mangroves, sea grass beds and salt marshes). This thick layer of surface and subsurface oil is also extremely harmful to large marine air-breathing animals (cetaceans, turtles, manatees and birds) that inhale and ingest toxins and become coated in the oil itself. Plankton and the larvae of animals that feed on plankton are also particularly vulnerable to this oil. This oil is very slow to degrade due to its composition and viscosity and this is what we see reaching shore as "mousse," "streamers," or "tar balls" depending on the distance it travels and how much surface turbulence it encounters.

Chemically-dispersed surface oil:

If oil is treated with dispersants while it is at the surface, the oil is broken up into very tiny particles that dissolve in the water column. This is a preferred method of mitigation for several reasons but it also has many drawbacks.

Pros:

First, it's cheap; the cost of dispersants and dispersant deployment are far less than those of capture and disposal of the oil.

Second, it's effective; the longer oil remains near the surface the more broadly it spreads across the surface and the deeper it gets into the water column. Both of these things make it very difficult to gather, contain and remove the oil. Therefore, when oil cannot be captured quickly, dispersant use is an effective means of limiting the amount of oil that will reach shorelines and shallow water.

Third, the rate of natural oil degradation is increased by about 50%. By decreasing the size of the oil droplets, more surface area is provided for bacteria to access and degrade the oil.

Fourth, by removing oil from the surface and distributing it downward through slower currents and along the ocean bottom, the movement of the oil is slowed substantially. This

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increases the time over which natural processes can degrade the oil before it reaches the most critical shallow water habitats.

Cons:

First, removing oil from the surface reduces the amount of further "weathering" the oil may do naturally and eliminates any possibility of collecting it.

Second, because more of the oil is dissolved through the water column, many pelagic organisms that live entirely below the surface (fish, mollusks, crustaceans) may be exposed to dilute concentrations of oil. While the food sources (phytoplankton and zooplankton) and the larvae of these animals have a higher chance of being impacted by untreated surface oil, the adults and juveniles would generally escape direct effects of surface oil. Furthermore, the amount of benthic oil is likely to be increased by this method.

Third, the solvents that are included in dispersants to break-up the oil so that the surfactants can dissolve the oil can be toxic (this was particularly true of the 2-butoxy-ethyl found in Corexit 9527). Even without direct toxic effects, the combination of solvents and surfactants increase the transport of chemicals across cell membrane - especially in gametes and tiny larvae. Tests have shown that even relatively "non-toxic" dispersants (such as Corexit 9500) in combination with oil can be extremely lethal to larvae and can prevent gamete fertilization via this mechanism.

Fourth, some components of the dispersants may persist and bio-accumulate in the environment. This hazard varies by product. Corexit 9500 reaches maximum degradation in 28 days in seawater.

Case Study:

An interesting case study in the natural environment compared the effects of exposure for 24 hours to oil vs. oil+dispersant on an island shoreline off the coast of Panama. The results of the experiment demonstrate the kind of the tradeoffs involved. In summary, the untreated oil resulted in an initial mangrove mortality of 17% with continuing effects resulting in 46% mangrove mortality over 10 years. The coral reefs, however, were largely unaffected (note that this does not mean that the oil itself is not harmful to corals; other studies have demonstrated severe lethality of oil alone.) In contrast, dispersed oil had no noticeable effect on mangroves but resulted in 10-30% decrease in some coral coverage in the first 2 years. However, the corals fully recovered (equal to pre-spill and oil-treated area) within 10 years.

Chemically-dispersed deep-water oil:

Because the time window for successfully applying dispersant to oil is short (1-48 hours depending on the chemicals used), and the vast distance over which oil coming from a mile

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below the surface is spread out once it reaches that surface, the EPA has allowed BP to attempt the novel approach of deploying dispersant directly into the oil at depth to increase its effectiveness. All evidence suggests that this is working: less oil is reaching the surface than would be expected without dispersant use. This should decrease the amount of oil that could potentially impact the shoreline or shallow water and should allow more time for natural degradation. However, because the oil is not reaching the surface it cannot evaporate nor can much of it be collected and removed. The result is that much more oil has to be degraded by natural processes in the ocean. Furthermore, due to harmful effects of the combination of oil and dispersant on marine life, there is an increased risk to new generations of deep water pelagic and benthic organisms that may be spawning at this time.

There has also been wide speculation that deep water (1 km) "plumes" of oil may be the result of deep-water dispersant deployment. The downside is that oil in these plumes is apparently not rising to the surface for evaporation or collection but the good news is that the plumes are deep and slow moving and the toxins within them are very dilute.

Dispersants:

Recent independent testing has confirmed that Corexit 9500 is one of the least toxic dispersants available. Another product, JD-2000, appears to be equally effective as a dispersant but is far less toxic to marine life. However, it is produced slowly by a small company with limited on-hand stock. Therefore BP has chosen to continue to rely on its enormous stockpile of Corexit 9500.

CONCLUSIONS:

Given the above information, most environmental experts agree that we are left with an untenable decision that involves a trade-off: should we protect the critical shallow water and shoreline habitats from a near-certain threat by increasing the risk to deepwater habitats? Based on these factors, the EPA and Coast Guard have chosen to allow the limited use of dispersants.

What does this mean to the Florida Keys?

1) The decision to use surface dispersants (given the limited ability of surface ships to collect the oil) may have saved the Keys from seeing a great deal of surface and subsurface oil. The use of dispersants may also have saved countless large air breathing marine animals. The effects of dispersants and oil in the water vs. the effects of surface oil itself on marine plankton are likely similar in scope.

2) The use of deep-water dispersants may have prevented some of the oil from reaching us in the short term but may ultimately lead to an increased amount of sub-surface and benthic oil reaching us in the future (we may not know which for months or years). Additionally, deep-

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water pelagic and benthic organisms may suffer increased negative impacts due to the combination of oil and dispersants.

3) The use of Corexit 9527 and other products containing more toxic chemicals that were used before the use of Corexit 9500 was mandated may have led to unprecedented amounts of hazardous chemicals entering the food web.

Based on this information, what are the recommendations of the Florida Keys Environmental Coalition regarding dispersant use?

1) Due to the danger of toxic chemicals entering our habitats and food web, the FKEC recommends that only Corexit 9500 (and, if possible, the far less hazardous JD-2000) be used as a dispersant and only in the quantities necessary at the surface to disperse oil that cannot be collected and is thus threatening the shoreline.

2) To assure that a minimum amount of oil reach our shores, the FKEC recommends that increased assets be deployed to collect and remove surface and subsurface oil. This is the most environmentally safe way to deal with the oil and will reduce the amount of oil in the environment and reduce the need for the use of dispersants.

3) To reduce the impact on spawning fish and other organisms in the Gulf of Mexico and to guard against the possibility that deep-water plumes of oil might reach our area, the FKEC requests that the practice of deploying dispersants in deep-water be discontinued immediately and prohibited until sufficient research is conducted following the Deepwater Horizon incident to determine whether or not this practice is more ecologically damaging than allowing the oil to reach the surface. More oil reaching the surface will lead to increased loss due to evaporation and removal thus reducing the load on the environment and decreasing the potential for long-term negative impacts on our ecosystem. Sufficient assets should be deployed downstream of the oil source to collect the majority of surface oil and prevent shoreline fouling.

4) To protect the fragile near-shore breeding and nursery habitats near and within the Florida Keys, the FKEC requests that no dispersants of any kind be deployed within range to reach the Florida Keys within 28 days (the time required for maximum degradation of Corexit 9500) and further recommends that only JD-2000 or a comparable minimally-toxic dispersant be used within that range if the Coast Guard determines that dispersant use is necessary. The geographic line delineating the no-use zone will vary depending on current environmental conditions. The FKEC further recommends that local federal, state, county and city authorities requisition and maintain appropriate stocks of JD-2000 dispersant so that it can be accessed quickly in time of need to protect the critical habitats of the Florida Keys.

5) To assure that a minimum amount of oil reaches the habitats of the Florida Keys and to prepare for rapid, effective remediation of that which does, the FKEC requests that local and state governments immediately allocate and release funding for research on and provisioning for least-destructive protection and remediation techniques including air-curtain entrainment

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or exclusionary systems, microbe bioremediation deployment options for all Florida Keys habitats (i.e. coral reefs, mangrove hammocks, sea grass beds, pelagic spawning areas and beaches), bridge tidal flow filtration systems, effective durable stationary boom systems, and high volume skimmer systems with water/oil separation and bioremediation capabilities.