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## Lasting Menace

Gulf oil-spill disaster likely to exert environmental harm for decades

By David Biello

More than 20 years after the Exxon Valdez foundered off the coast of Alaska, sea otters still dig up oil in their hunt for clams in Prince William Sound. Nearly 25 years after an oil storage tank ruptured near mangrove swamps and coral reefs of Bahia Las Minas in Panama, oil slicks still form in the water. And some 40 years after the fuel-oil barge *Florida* ran aground off Cape Cod, the muck beneath the marsh grasses makes the area smell like a gas station.

Similar damage may be in store for the U.S. Gulf coast, given that millions of gallons of light sweet crude spewed from BP's broken well 1,500 meters down and approximately 65 kilometers off the Louisiana coast. Its oil-drilling rig Deepwater Horizon exploded on April 20, and efforts to cap the flow—estimated to be 200,000 to a few million gallons a day during the weeks right after the accident—suffered setbacks and delays. All the oil released, which could ultimately exceed the *Valdez* spill several times over, could compromise wildlife and local livelihoods for years.

The toxic compounds in oil vary, but the most worrisome are polycyclic aromatic hydrocarbons (PAHs), such as naphthalenes, benzene, toluene and xylenes. All can sicken humans, animals and plants. "These hydrocarbons are particularly relevant if inhaled or ingested," says environmental toxicologist Ronald J. Kendall of Texas Tech University. "In the bodies of organisms such as mammals or birds, these aromatic hydrocarbons can be transformed into even more toxic products, which can affect DNA." The mutations that might result could lead to reduced fertility, cancer and other problems.

Not all the PAHs become an environmental threat, though. Thanks to evaporation, oil that reaches the surface loses at least 20 to 40 percent of the original hydrocarbons. "Evaporation is good; it selectively removes a lot of compounds we'd rather not have in the water," says marine chemist Christopher M. Reddy of the Woods Hole Oceanographic Institution. The oil also emulsifies, forming mousse—a frothy mix of hydrocarbons and water—or clumps into so-called tar balls.

But to scientists' surprise, plumes of oil extending several kilometers were floating roughly 1,000 meters beneath the surface, where the toxic compounds are literally washing off the oil and contaminating the water. Those components "can be more pervasive in finding ways to infiltrate a salt marsh" and impact wildlife, Reddy says. And there's a lot of wildlife to impact: some 16,000 species of plants and animals live in the Gulf of Mexico, according to marine biologist Thomas Shirley of Texas A&M University. Many of their habitats "are at risk of being affected, but we don't have any direct way to know which ones or in what amount," remarked marine biologist Jane Lubchenco, director of the National Oceanic and Atmospheric Administration, at a May 12 press conference on the spill.

In the area by the spill itself, "anything that's in the upper water column is going to be exposed" to oil chemicals, Shirley says. That's bad news for the millions of zooplankton out there, and the contamination could ultimately end up having cascading effects up the food chain. "If you start removing pieces of this big food web out there, what's going to happen?" Shirley asks. "We don't really know, but probably not good things."

In regard to long-term damage, researchers worry most about landfall. "Once the oil, because of high tides or high winds, gets into the coastal wetland, it gets trapped in the sediment," notes Héctor M. Guzmán of the Smithsonian Tropical Research Institute in Panama, who studied the effects of the 1986 spill off Panama. "Then for decades you continue to see oil coming back out." Particularly critical are marshes, which are nurseries for wildlife ranging from fish to birds; contamination there could damage embryos and affect a species for generations.

Whether the oil can be kept out of the wetlands comes down to one thing: the weather. Rough seas would swamp the booms keeping oil off the coast. "A hurricane or even just a tropical depression could be catastrophic," Kendall emphasizes. "It will push oil into places that it's difficult to clean up."

Of course, everyone hopes that the oil can be removed or dissipated before that happens. Certainly the warmer conditions of the Gulf of Mexico will help bacteria and other natural forces more quickly degrade the oil than in the spill at Prince William Sound. And early on workers used hundreds of thousands of gallons of chemical dispersants to help break up the slick. The dispersants themselves carry their own risks and toxicity, which have many environmentalists concerned about their potential impact. Given the choices, NOAA's Lubchenco probably summed it up best: "When an oil spill occurs, there are no good outcomes."

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