Sunshine is making Deepwater Horizon oil stick around

Nearly a decade after the spill, oxygen-rich by-products don't seem to be going anywhere

BY **LAUREL HAMERS** 7:00AM, JUNE 12, 2018

JUST ADD SUNLIGHT Oil swirls at the water's surface after the 2010 Deepwater Horizon oil spill. Sunlight transformed the oil molecules on the surface into new molecules that are still sticking around.

Sunlight shapes oil spills' long-term legacies.

In the days and weeks after the 2010 Deepwater Horizon oil spill in the Gulf of Mexico, sunlight hit the oil slicks on the surface of the water. That triggered chemical reactions that added oxygen to oil molecules that once were just chains of carbon and hydrogen atoms. These oxygenated hydrocarbons are still sticking around eight years later with little evidence of degradation, researchers report May 29 in *Environmental Science and Technology*.

Chemist Christopher Reddy of Woods Hole Oceanographic Institution in Massachusetts and colleagues analyzed the oily soup of molecules floating in the Gulf post-disaster. (The Deepwater Horizon spill was the largest marine oil spill in U.S. history, leaking more than 3 million barrels.) While investigating how the leaked hydrocarbons broke down over time, the team got a surprise: More than half of the degrading oil by-products found in oil slicks from the spill were these oxygenated hydrocarbons, the researchers reported in 2012. The by-products had gone relatively unnoticed after previous oil spills, and so were mostly unstudied in that context.

Now the team has evidence that these oxygenated hydrocarbons aren't just a major by-product of the Deepwater Horizon oil spill, but a particularly persistent one. The scientists analyzed more hydrocarbon samples collected from the water surface and from sandy beaches in the area in the years since the spill to see how the molecules have fared. All of the sand samples had roughly the same proportion of oxygenated hydrocarbons between years, suggesting that in the eight years since the disaster, these molecules still haven't broken down.

"A natural process took what was released from the [spill] and made something either as tough or tougher," Reddy says.

The team did identify one relatively small category of oxygenated hydrocarbons that appear to be more soluble in water, though, suggesting that some of the molecules aren't entirely resistant to breaking down.

One big, unanswered question is just how toxic this stuff is, says Zhanfei Liu, an organic geochemist at the University of Texas at Austin who wasn't part of the study.

But pinpointing toxicity is challenging, Reddy says. The oil residue is a complex mixture of different molecules that varies from place to place, not a single compound that one could order from a chemical company and test in a controlled study.

It's also too soon to say what the finding means for wildlife, Reddy says. The persistence of the oil by-products means that they're still hanging out in the environment, able to coat birds' feathers and otters' fur. But since most of these molecules seem relatively reluctant to dissolve into the water, it's unclear whether aquatic organisms are taking the pollution in at a level that could impact their health.

Sunlight probably affects the chemistry of how other oil spills break down in the environment, too, Liu says, but perhaps less dramatically. That's because Deepwater Horizon may have had the perfect combination of factors for sunlight to star: The hydrocarbon molecules that leaked tended to be smaller in size than in some other oil spills, meaning the oil spread over a larger

surface area and had more exposure to the sun's rays. Plus, the Gulf of Mexico receives brighter, more direct light than more temperate regions.

Citations

C. Aeppli *et al.* How persistent and bioavailable are oxygenated Deepwater Horizon oil transformation products? *Environmental Science and Technology*. Published online May 29, 2018. doi: 10.1021/acs.est.8601001.

C. Aeppli *et al.* Oil weathering after the *Deepwater Horizon*disaster led to the formation of oxygenated residues. *Environmental Science and Technology*. Vol. 46, July 18, 2012, p. 8799. doi: 10.1021/es3015138.