Now that the gusher that spewed oil for 85 days into the Gulf of Mexico has stopped, scientists are wondering where it all went. A federal report released last week should have begun to answer that question. Instead, political spin and media hype transformed the scientists’ message even before it was released. According to one CNN reporter, the interagency report led by the Department of the Interior and the National Oceanic and Atmospheric Administration (NOAA) said that of the 4.9 million barrels of oil spilled, “75% has been cleaned up by Man or Mother Nature.”

Nothing in the report supports that interpretation. But there are multiple ways to read the report’s iconic pie chart while remaining grounded in fact. One is that responders have—with herculean effort—intercepted 25% of the oil, leaving 75% to have its way with the environment. Under this interpretation, “raising the flag and declaring victory is premature,” says biogeochemist Samantha Joye of the University of Georgia, Athens.

Another take on the report finds that three-quarters of the oil is gone from the gulf or is dispersed in the water in its most easily degraded form. This remaining oil “is degrading quickly right now,” says marine geochemist Edward Overton of Louisiana State University, Baton Rouge.

Overton and other optimists note that today official maps from NOAA no longer show any surface oil in the gulf. And the “massive” deep oil plumes of media fame now appear to have been faint shadows of their public images. Resolving the inevitable uncertainties and filling in the gaps of such an early report will no doubt take many months.

The report’s most certain conclusion was that responders managed to collect or remove about 25% of the oil released from the damaged well. Seventeen percent was collected at the wellhead in an unprecedented technological feat. About 5% was burned at the surface, an exceptionally large proportion for a U.S. spill, experts say. But skimmers captured only 3% of the total, despite the high-profile effort. Such meager results are to be expected in the open ocean, says William Lehr of NOAA’s emergency response division in Seattle, Washington, who worked on the report. Less than 0.1% had been recovered from beaches and marshes.

That leaves 75% of the spill that remained in the environment, but just how it entered it—as oily scum on the surface, as more readily degraded microscopic droplets at depth, or as vapors into the atmosphere—is far less certain. That’s because these flows were calculated, not measured. Despite the seeming precision of the pie chart, “there’s a large degree of uncertainty,” says Lehr. Uncertainties crop up, for example, in calculations of “natural dispersion” involving the physics of oil and gas jetting into seawater from the wellhead. These calculations yield an estimate of how much oil ends up dispersing as droplets smaller than 100 micrometers in diameter. That’s the size range that can drift away in a horizontal plume the way dust can float in the air.

Add up all the uncertainties and they can be considerable. There are uncertainties in calculating the natural and chemical dispersion that produces deep plumes as well as dissolution in seawater or evaporation from the surface. Then there is the ±10% uncertainty in the total volume of the spill. All told, the “residual oil”—what could not be measured or estimated but is left to float as tarballs or be washed ashore—could be as high as 39% of the total or as low as 13%, by a simple accounting from charts in the report’s supplement.

Perhaps the most muddled calculation involves the fraction of oil that went into the dreaded subsurface plumes. The media “created an image of an underwater river of oil,” says Steven Murawski, NOAA’s chief scientist for fisheries in Silver Spring, Maryland, who is overseeing spill science for NOAA. “In a glass, [plume water] looks like clear seawater.” He says that measurements of oil reveal a principal plume confined to depths of 1000 meters to 1300 meters that in spots...
How BP came to spray 1.1 million gallons of chemical dispersants a mile beneath the ocean surface is a story of scientists turning to desperate measures during desperate times. And the government’s decision to let BP do so, among the most gutsy calls of the entire Deepwater Horizon saga, was a classic case of pitting the devil you know against the devil you don’t.

Roughly a week after the magnitude of the gusher became clear in late April, former Exxon-Mobil scientist Gerard Canevari suggested that BP might try spraying chemicals called dispersants right at the billowing wellhead. Dispersants are usually used in small quantities on the surface of the ocean to break up slicks. Canevari’s idea would mean releasing giant amounts of the fairly nasty chemicals in the cold and high-pressure world of the ocean floor, something that had never before been tried. “At first we were going, ‘Yeah, right,’” recalls Charlie Henry, a top scientist on Gulf of Mexico issues for the National Oceanic and Atmospheric Administration (NOAA). “It was out of the norm”—a massive proposed undersea experiment.

But, he says, the unprecedented nature of the problem meant nothing was off the table. While outlining the pros and cons on white boards in NOAA’s New Orleans office, says Henry, the basic tradeoff seemed clear. Every drop of oil that made it to the surface was a potential threat to coastal ecosystems, fish, and marine mammals. Dispersants, which are mostly detergents, break up globs of crude into microscopic droplets that are more readily devoured by microbes. So keeping as much oil as possible below the surface would give microbes a leg up in eating the oil. And injecting dispersants into the hot, vigorously mixing oil of the busted riser would presumably mean they would work especially effectively. Smaller quantities would then presumably be needed at the ocean surface.

Some drawbacks emerged during a conference call with 25 industry and academic scientists arranged by NOAA in early May: The risks to undersea marine life—eggs, larvae, fish, coral, and other bottom dwellers—were largely unknown. One possibility was particularly frightening: Giving microbes a feast of hydrocarbons might massively increase their numbers, starving the water column of oxygen and creating dead zones.

So government scientists proposed a three-tiered plan to try the undersea injection as safely as possible. First, teams across the country began adapting existing undersea models of oil plumes to predict how they might move, referencing data on nearby sea life from the Department of the Interior. Second, they required that BP conduct aggressive monitoring, including ocean surface-to-floor water sampling, toxicity tests using zooplankton, and tests with fluorometers, which would continuously track the oil droplets. And if the dispersant injection created unexpected effects during tests, an “adaptive management” plan would enable the feds to halt the procedure immediately.

The Environmental Protection Agency (EPA) and the Coast Guard agreed to the procedure on 15 May. “I don’t think I’ve had to make a harder decision,” EPA Administrator Lisa Jackson told reporters at the time. BP deployed a specially built tube with tiny

Desperate measures. Spraying chemical dispersants at the undersea wellhead seems to have spared coastal ecosystems, but at what cost?