WRITTEN TESTIMONY OF
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HEARING ON

"The BP Oil Spill: Human Exposure and Environmental Fate"

SUBCOMMITTEE ON ENERGY AND THE ENVIRONMENT
COMMITTEE ON ENERGY AND COMMERCE
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Introduction

Good afternoon Chairman Markey, Ranking Member Upton, and members of the Subcommittee. Thank you for the opportunity to speak today about the British Petroleum (BP) Oil Spill. My name is Christopher Reddy, and I am a scientist at the Woods Hole Oceanographic Institution in Woods Hole, MA, principally investigating marine pollution. I have published >85 peer-reviewed scientific journal articles and several book chapters on this and related subjects. I have studied or am currently studying the aftermaths of oil spills that occurred in 1969, 1974, 1996, 2003, 2007, and 2007 as well as natural oil seeps off the coast of Santa Barbara, CA and more recently the BP spill. I am leaving for a 12-day research cruise on June 17, 2010 to quantify and characterize oil below the sea surface in the Gulf of Mexico.

For today's hearing, I will provide a brief overview on the environmental chemistry of oil spills and then some comments on dispersants used by BP.

Petroleum composition and environmental chemistry

Petroleum or crude oil is a complex mixture of compounds formed from organic debris acted on by geologic processes over millions of years[1]. Refineries convert crude oil into different products, such as gasoline, jet fuel, diesel fuel, etc.

The thousands of molecules that compose a crude oil or a refined product can have widely different properties, which dictate their fate in the environment. Each compound has it own tendency or likelihood to evaporate, dissolve in water, be eaten by microbes, or degraded by sunlight. These processes, collectively called weathering, can act on oil immediately, changing its composition dramatically. For example, I collected and analyzed oiled grasses approximately 50 miles away from the Gulf spill zone several weeks ago and found that evaporation and/or dissolution had already acted on the oil.

* The views expressed here are my own.

All oil spills are different, and comparisons from one to another should be done carefully[2]. Just as a particular compound can be weathered differently, so can it have its own toxic effects, at its own schedule of toxicity. Recovery from oil spills in the environment can also vary temporally, spatially, and at the individual- and community-wide level.

For example, I have studied two diesel fuel spills that occurred in 1969[3] and 1996[4] in Southern New England. Both spills resulted in devastating short-term impacts. For example, the 1996 spill led to the deaths of 10 million lobsters, two thousand birds, and 20 million surf clams and the closure of 200 square miles of shell fishing beds for as long as five months. Today, however, there are no detectable remnants of oil in or near the oiled region from this 1996 spill. Surprisingly, the effects of the 1969 spill persist, as crabs, grasses, and mussels are significantly impaired by trace amounts of weathered diesel at this site.

Our best knowledge about oil spills is from the National Research Council's *Oil in the Sea III*[2].This book and its predecessors have represented the state of our knowledge about oil's inputs and fates as well as effects on the ocean. Another book published by the National Research Council entitled, *Oil Spill Dispersents: Efficacy and Effects*[4] is an excellent resource on dispersants.

Comments on dispersents used by BP

When responding to an oil spill, the main goal is to reduce damages. Numerous tools, such as dispersants and skimming, can be used.

Dispersants are deployed to "break-up" large pieces of oil into small droplets. Traditionally, the goal of dispersants has been to move oil from the surface of the ocean to below the surface. This approach attempts to reduce oil exposure or contamination from surface oil that could affect wildlife or coastal areas. Ideally, the dispersed oil droplets under the sea surface are then diluted and eventually weathered.

However, dispersants can carry their own risks. If not deployed in a proper, effective, and accurate manner, adding more chemicals to an oil spill may increase damages in the area. If they do work, the dispersants can increase the oil concentrations below the sea surface, exposing undersea wildlife to greater risk.

Hence, there are significant trade-offs to using dispersants. Historically in the Gulf of Mexico region, they have been used numerous times and considered a success. Quantifying the extent of success relative to not using them is challenging. Oil spill responders are not always afforded the luxury of a true control situation, where they could compare the effects of the two scenarios, as one might have in the calmer setting of a laboratory.

I believe two dispersants, Corexit 9500 and 9527, have been used in the Gulf. As of June 8, 2010, 790,000 gallons have been used on the surface and 331,000 gallons have been injected below the surface since the spill occurred. While the amount of oil released has not been fully constrained, if an estimated 50 million gallons has leaked, then dispersants are only 2% of the volume compared to the oil released.

However, considering that the United States has not had an oil spill greater than one million gallons in almost 20 years, one million gallons of dispersant is nevertheless a sizeable amount—perhaps qualifying this as an unprecedented response to an oil spill.

To communicate my views on dispersants, I would like to comment on the executive summary of the recently released "*Deepwater Horizon Dispersant Use Meeting Report*," which was the result of a two-day meeting on May 26 and 27, 2010 of over 50 experts from academia, the Federal government, Environment Canada, industry, and non-governmental organizations[5]. Among their conclusions were:

> *"It is the consensus of this group that up to this point, use of dispersants and the effects of dispersing oil into the water column has generally been less environmentally harmful than allowing the oil to migrate on the surface into the sensitive wetlands and near shore coastal habitats".*

After reviewing this report, I tend to agree with this finding. I am considerably more comfortable about the usage of dispersants on the surface, where 700,000 gallons have been used and it is easier to monitor. I reserve a more confident judgment on the efficacy and potential damages of using the dispersants in the subsurface until more data becomes available. Due to the novelty of injecting dispersants in the subsurface, it may be necessary to use laboratory and computer-based models to grasp fully this aspect of the oil spill response. It is noteworthy that the usage of dispersants in deepwater was not discussed, nor research recommended, in the executive summary of *Oil Spill Dispersents: Efficacy and Effects (2005)*[3]. The recent availability of the formulations of Corexit 9500 and 9527 will be useful in designing methods to analyze for these components in samples as well as testing and evaluating biological effects.

After the *Deepwater Horizon Dispersant Use Meeting Report* was released, the chief technology officer of Nalco, which manufactures the Corexit dispersants, stated:

> *"The use of COREXIT dispersants to break up the oil in the Gulf of Mexico has been widely acknowledged by government officials as a safe, effective and proven response. Its ingredients rapidly biodegrade, do not bio-accumulate and are commonly found in popular household products".*

This statement is true but carries some caveats: The safety of Corexit dispersants depends on how, where, and in what amounts it is used; biodegradation of these products may occur but not necessarily rapidly; some ingredients may be found in household products, but they are in considerably smaller concentrations. Regarding bioaccumulation, I picked one of the major compounds (30 to 60%) in Corexit 9527, butoxyethanol, and compared its bioaccumulation factor to that of the pesticide DDT. While there are other variables that must be considered when estimating bioaccumulation, DDT is about 40,000 times more likely to bioaccumulate in an organism that butuxyethanol[6].

In summary, the response and release of dispersants in the BP oil spill is unprecedented. Experts have recently concluded that the usage of them has been worthwhile. However, detailed studies from samples collected near and around areas that have been have been sprayed or injected with dispersants should be considered in the full context of all available data. Environmental monitoring should continue for months and years to understand the fate of the spilled oil.

Select references

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